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THÈSE

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PATENT QUALITY AND CORPORATE TAKEOVERS

JURY

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« Je crois qu'avoir ENVIE de réaliser un rêve …

c'est le TALENT ! »

Jacques BREL

A mes Parents,

Allal Alain DIFADI et Mona KHERBIBI.

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Positivement vôtre,

M.D.

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INTRODUCTION GENERALE

Après l'acquisition d'entreprises de services comme Doubleclik et Youtube en 2006, Google s'offre Motorola, une entreprise d'équipements disposant d'un portefeuille de 17 000 brevets dont 15 200 concernent la téléphonie mobile[1]. « Nous pensons qu'il s'agit d'une transaction concurrentielle », a déclaré David Drummond, responsable juridique de la société. « Il ne s'agit pas d'une transaction horizontale. Google n'a pas été réellement actif dans le secteur des combinés ». Le 15 Août 2011, le géant de l'internet et du software acquiert pour 12.5 milliards de dollars une société de Hardware en perte de vitesse, ce qui a suscité de nombreuses interrogations du marché et a généré une véritable angoisse chez les rivaux (Microsoft, Apple, Nokia) mais également chez les partenaires (Samsung, LG, HTC). D'ailleurs, le 16 Août 2011, le NYSE affiche une baisse de 6.54% du titre de Google et une hausse de la valeur des titres de Microsoft et Nokia. Pour autant, le plus surprenant arrive en 2014 lorsque Google vend Motorola pour seulement 2.91 milliards de dollars au premier fabricant mondial de PC, Lenovo.

En réalité, Google ne cède que l'activité de conception et de fabrication de Motorola à Lenovo mais conserve 15 000 brevets sur les 17 000. Au fond, « l'arnaque » que l'on peut penser de l'achat et de la vente de Motorola, dissimule en fait une protection juridique infaillible, des gains potentiels de synergies, et surtout un avantage concurrentiel de taille. Acquérir Motorola, c'est « booster l'écosystème Android en créant un vaste portefeuille de brevets », a affirmé Larry Page.

Notre travail de recherche s'inscrit dans cette logique de stratégies d'entreprises et de restructuration du paysage économique, et se focalise sur l'étude d'un « actif immatériel » en particulier : le Brevet ! L'objet de cette thèse de doctorat a donc pour visée d'enrichir le lien qui pourrait exister entre les opérations de fusions/acquisitions et la qualité[2] des brevets perçus comme un moyen de diversifier et/ou perfectionner les compétences technologiques en place. Hypothétiquement, un portefeuille de brevets diversifié pourrait être un gage de qualité technologique, ouvrant la voie à plusieurs connections possibles, reflétant une entreprise qui vit avec

[1] Source : dealbook.nytimes.com

[2] Nous définirons la « qualité » des brevets dans les sections suivantes.

son temps et annonçant l'émulation qui en découle. Fondamentalement, cette thèse se veut être une réflexion sur le choix de la société cible – ou Target –, et dans lequel nous considérons que l'acquéreur va davantage s'intéresser à des informations « concrètes » et visionnaires, rendant mieux compte de la richesse économique que le simple montant figurant dans le poste comptable « Recherche & Développement (R&D) ». Ces informations seraient donc axées sur la qualité des brevets au sens de la valeur ajoutée des opportunités qui découle du potentiel de diversification et de complémentarité technologiques. Ainsi, cette thèse de doctorat se situe à cheval entre la comptabilité financière et la finance d'entreprise, et introduit également des notions de l'économie de la connaissance.

1 - **Cadre conceptuel de la recherche**

1981, « La guerre du feu » ! Un long métrage époustouflant retraçant une quête éperdue du feu, un joyau vénéré par toutes les tribus du Paléolithique inférieur Acheuléen[3], que certaines ont déjà appris à domestiquer et que d'autres ne savent toujours pas produire. Le réalisateur Jean-Jacques Annaud nous plonge dans un univers ancestral, il y a environ 400 000 ans avant aujourd'hui (AA), où le feu apparaît comme une avancée majeure et sans égal pour ces tribus, leur permettant ainsi de se protéger contre le froid et les bêtes hostiles, de cuire les aliments, et de cesser le cannibalisme. Outre le voyage vers des sensations primitives élémentaires, cette œuvre cinématographique dresse un portrait représentatif de l'état d'avancement du monde à l'époque de Néandertal. Si 99.99 % de ce que nous connaissons aujourd'hui n'existait pas pour ces tribus préhistoriques ; leur intuition, leur sensibilité, leur créativité, leur instinct de survie et leur osmose avec l'environnement ont fait de ces hominidés les premiers couturiers (peaux de bêtes), architectes (cabanes), artistes (peintures rupestres), et bien sûr professeurs (enseignement des techniques du feu et autres) … Ils sont les pionniers des inventions et innovations de l'être humain.

Pour autant, la première invention de l'ère humaine est probablement celle qui remonte au Paléolithique inférieur Oldowayen[4], marquant la transformation de pierres en outils et armes taillés nécessaires au cassage des os ou aux simples

[3] Il y a environ 1 million d'années
[4] Il y a 2 à 3 millions d'années

premiers besoins rudimentaires. Ces méthodes de taillage et de percussions auraient, par conséquent, donné lieu aux premières innovations techniques tels que le Galet aménagé, l'Eclat ou encore le Biface, constituant ainsi l'industrie lithique caractéristique de la Première période de la Préhistoire[5].

Cet exemple préhistorique fait apparaître de manière explicite la distinction subtile qui existe entre les notions d'invention et d'innovation. L'invention répond à un problème pratique donné, en apportant une solution nouvelle, une méthode ou une technique qui n'existait guère jusqu'à ce jour[6]. L'innovation quant à elle, repose sur une invention pour donner naissance à un nouveau produit, à un nouveau processus ou à un nouveau service s'introduisant dans une industrie et palliant des besoins spécifiques. Fondamentalement, c'est de l'invention que naît l'innovation ! « L'invention est la concrétisation isolée d'une idée créative. L'innovation est un nouveau produit implémenté avec succès sur un marché. »

L'élaboration en 1679 par Denis Papin de l'autocuiseur permettant de cuire les aliments sous haute pression, appelé Digesteur ou « marmite de Papin », constitue une invention technique. A distinguo, la commercialisation en 1953 de la « Super-Cocotte » par la société SEB constitue, elle, une innovation construite sur l'invention autocuiseur.

L'autre différence majeure, entre ces deux notions, réside dans la protection de la nouveauté par un brevet [nous définirons plus loin ce concept central à cette thèse de doctorat afin de respecter la chronologie, le cheminement de la réflexion, et le cadre conceptuel complexe qui encadre notre étude]. Aucune demande de brevet ne peut être déposée pour une innovation, c'est bien l'invention en amont et source de l'innovation qui est protégée par un brevet - on parle d'ailleurs de brevet d'invention -.

Cela étant, encore faut-il le déposer ce brevet !

Si l'invention de la lampe à incandescence est attribuée à l'américain Thomas Edison, ce dernier a plutôt contribué à l'amélioration de l'invention du britannique Joseph Swan et ses travaux sur la prolongation de l'incandescence sans détruire le filament [7]. L'année 1879 voit la présentation d'une lampe à incandescence fonctionnelle par J. Swan, et d'une ampoule dont le filament est une fibre de coton carbonisée par T. Edison. Ironie du sort, la preuve d'antériorité est reconnue pour J.

[5] Source : wikipédia.org/wiki/Histoire_des_techniques
[6] Traité de Genève, 1978
[7] De 1860 à 1875

Swan mais la mise en application industrielle à T. Edison[8], menant ainsi la justice en place à contraindre les deux hommes à fabriquer leurs ampoules dans une entreprise commune. Et pourtant, la ruse de l'histoire véhiculée nous apprend plus tard, que le véritable inventeur de l'ampoule électrique à incandescence est l'Ecossais James Bowman Lindsay ayant mis au point et présenté une lampe électrique à lumière constante en 1835 … mais il n'avait pas déposé de brevet !
Outre ce récit sur les protagonistes de cette invention, l'ampoule électrique vient fermement contredire cette croyance usuelle qu'une invention naît d'une illumination soudaine d'un homme considéré comme à part ou communément appelé génie – non, non, il existe bien en chaque homme sur terre quelque chose qui est de l'ordre du génie ! –.

2 - Le processus cumulatif de l'innovation

En réalité, les inventions sont le fruit de plusieurs horizons, et d'un long travail d'accumulation de connaissances, issues de divers pays. Conjointement, l'innovation, elle aussi, est un long processus que l'on qualifierait de cumulatif. Certes, celle-ci prend en compte le contexte historique et les besoins actuels d'une époque, mais elle découle principalement de l'agrégation des inventions, des innovations et des connaissances développées par les civilisations précédentes. Nous ne faisons pas simplement référence, ici, à des innovations incrémentales consistant en une amélioration d'un produit existant, mais aussi à des innovations dites de ruptures marquant une véritable révolution technique. Clairement, c'est à partir d'innovations antérieurement révolutionnaires, que naissent les innovations drastiques qui révolutionnent les époques futures. Si la Ford T de 1917 a révolutionné le XX^{ème} siècle en étant l'ancêtre des véhicules que nous connaissons aujourd'hui, on ne peut contredire le fait qu'elle découle des idées mêmes de transports et de la volonté de se déplacer plus vite et plus confortablement, développées par les civilisations antérieures. Il faut bien rappeler que la toute première automobile, en fait un jouet, est attribuée à un Flamand, Ferdinand Verbiest, qui a fabriqué en 1668 un véhicule constitué d'une bouilloire, d'un petit four et de petites roues à engrenages. Les chars, les calèches et les carrosses ne sont

[8] Brian Clegg, *Light Years*, Wiley, 2001, p. 205-207

que des exemples parmi tant d'autres ; d'ailleurs, la puissance des voitures de nos jours n'est autrement mesurée qu'en chevaux ou cheval-vapeur[9] (cv). La réalisation de la voiture n'aurait pas vu le jour sans les recherches fondamentales de James Watt sur la machine à vapeur (1765), de Rudolf Diesel et son moteur à huile (1985), et bien d'autres travaux sur la mécanique et autres techniques d'assemblage.

Schématiquement, le processus d'innovation passe par trois étapes indispensables : Imiter (Imitation), Apprendre (Apprentissage), Innover (Innovation)[10]. En remontant à l'étymologie latine, l'origine du mot innovation découle du verbe « INNOVARE » signifiant revenir à, renouveler. Le préfixe « IN » désignant un mouvement vers l'intérieur éclaire justement la nécessité d'imiter pour apprendre ; et le radical « NOVARE » faisant allusion au changement et au nouveau, souligne bien ce passage de l'apprentissage à l'innovation.

D'ailleurs, dans Ethique à Nicomaque VI, Aristote établit une typologie des savoirs en associant les Arts et Métiers aux « sciences poétiques », désignant les producteurs et les esclaves – troisième catégorie de la hiérarchie sociale –. L'idée qui découle de cette identification est que le véritable innovateur technique n'est pas l'homme menant une vie de science, et appartenant à la première catégorie appelée « sciences théoriques », mais bien l'artisan et le maître dans son métier. Ce qui est vrai des arts, c'est la nécessaire spécialisation si on veut exceller, maîtriser, pour pouvoir davantage perfectionner. Et cela implique une disposition, qu'Aristote définit comme un processus cumulatif, comme une incorporation de la pensée (où le corps se spiritualise), comme une soumission de l'homme à des habitudes. Concrètement, Aristote énumère quatre étapes essentielles à la disposition :

1) Voir Faire
2) Faire
3) Refaire
4) Parfaire

En substance, on reconnaît bien encore une fois ce caractère d'imitation indispensable à l'apprentissage de toute technique, qui une fois devenue maitrisée (habitude facilement reproductible), peut donner naissance à une amélioration et éventuellement à une nouvelle invention ou une nouvelle innovation.

[9] 1 cheval = 736 Watts
[10] David Laroche – Wake up calls

Sur le plan entrepreneurial, le processus d'innovation peut aussi se décliner en trois étapes : la création, la conversion, et la commercialisation[11]. Ces trois étapes englobent elles-mêmes le fait d'imiter, d'apprendre, et d'innover. Ce processus implique donc une étude approfondie du positionnement sur le marché, de l'intelligence économique, des inventions et produits novateurs déjà existants, du capital immatériel du réseau de la firme, des technologies de communication, et surtout des attentes du client ou consommateur toujours plus exigeantes, impatientes et presque capricieuses. Fondamentalement, une entreprise qui résout un problème commun ou spécifique à une branche économique suscite forcément l'attention des consommateurs. Ici, « résoudre un problème donné » peut également être synonyme de rendre plus accessible par un moindre coût, faire gagner du temps, ou encore apporter un produit innovant jamais imaginé auparavant. La radio, la machine à laver, le cinéma, le fordisme ou encore le juste à temps sont autant de nouveau produit, nouveau service, nouveau processus de fabrication ou d'organisation qui ont été immédiatement introduit par les entreprises dans l'appareil productif, pour créer et combler les besoins du consommateur dans l'optique d'en tirer un avantage concurrentiel. En résumé, l'offre crée sa propre demande.

Cependant, comme un enfant qui a pris l'habitude de recevoir des cadeaux s'attendra toujours à des cadeaux encore meilleurs … le consommateur a, lui aussi, adopté inconsciemment un comportement puéril d'enfant gâté et est devenu plus exigeant de génération en génération, voire même d'année en année ! Dans la société de consommation de ces dernières décennies, l'habitude de voir en permanence de nouvelles technologies, de nouvelles créations, de nouveaux gadgets insolites, a créé une véritable dépendance à la nouveauté chez les clients. Nous avons tous en tête ces consommateurs chevronnés capable de faire la queue durant de longues heures et d'étendus jours pour décrocher le dernier iPhone d'Apple, la dernière PlayStation de Sony, ou encore le dernier maillot « 2 étoiles » d'une équipe de Foot championne du monde.

Ainsi, il semblerait que les entreprises soient prises à leur propre piège et dépassées par le jeu de l'offre et de la demande. On pourrait presque dire « La demande impose sa propre offre ! ». Et la compétition industrielle n'atténue pas pour autant les choses ; bien au contraire, elle pousse les entreprises à être de plus en plus

[11] Amidon, D. M., (2001). *Innovation et management des connaissances*. Ed. d'Organisation.

innovantes, à proposer constamment de nouveaux modèles, à un rythme effréné notamment en vue des attentes d'un consommateur devenu impatient et versatile.

Certains auteurs soutiennent cette idée d'accroissement du rythme de l'innovation en mesurant le délai de réponse d'une innovation à l'invention ou la découverte en amont. Djebbar et al[12] (2006) ont calculé la moyenne entre « la constatation des possibilités techniques de la découverte ou l'invention, et le début du développement commercial du produit qui en a découlé sur une période récente ». Leurs résultats indiquent une croissance significative du délai de réponse de l'innovation qui commence à 30 ans entre 1885 – 1919, puis atteint 16 ans entre 1920 – 1944, pour enfin arriver à 9 ans entre 1945 – 1964. Néanmoins, la limite de ces travaux réside dans les prémices du raisonnement, puisqu'ils ne considèrent et ne se réfèrent qu'à quelques grandes innovations techniques.

Dans le secteur informatique, les modèles sont renouvelés quasiment chaque année. De manière générale, il en va de soi pour toutes les chaînes économiques de commercialisation Business to Business (B2B), Business to Consumer (B2C), …

En effet, l'innovation est un mur construit brique par brique, et chacune d'elle joue un rôle non négligeable dans la conceptualisation de ladite innovation. On parle alors d'accélération du progrès scientifique et technique. Nombreux sont les auteurs qui défendent ces idées selon lesquelles l'évolution des techniques est additionnelle et la vitesse d'évolution s'accentue de manière prolifique au fil des époques. Fondamentalement, chaque progrès technique, chaque progrès scientifique a une part de responsabilité minime ou prépondérante dans les avancées et percées de demain. Bruno Jacomy[13] (1990), entre autres, insiste sur l'intérêt d'élaborer une « échelle de temps logarithmique » pour dresser un répertoire des différents progrès techniques au cours de l'histoire et depuis les origines.

Si nous prenons l'exemple du smartphone, il représente à lui seul au moins une cinquantaine d'inventions et d'innovations. De l'appareil à photo (inventé par Niepce) aux micropuces et processeurs, en passant par la batterie, l'écran tactile, les baffles sonores, etc … sans parler de l'invention et innovation drastique du téléphone par A.G. Bell (1876) et le téléphone portable ou mobile par Michael Cooper un siècle plus tard (1973). Cela nous montre, en effet, qu'il n'existe aucune entreprise au monde

[12] Ahmed Djebbar, Gabriel Gohau et Jean Rosmorduc, (2006). *Pour l'histoire des sciences et des techniques*, Hachette et CNDP éditeurs

[13] Bruno Jacomy, (1990). *Une histoire des techniques*, Seuil éditeur

qui puisse maîtriser l'ensemble des savoir-faire et la totalité des technologies, chacune d'elles appartenant à une industrie différente et à un segment spécifique. Tout comme aucune équipe de football ne peut se contenter d'avoir le meilleur joueur au monde, seul sur le terrain pour disputer un match, même face à des U-17[14] ; il lui faut bien recruter d'autres joueurs spécialisés dans leurs postes ; de la défense à l'attaque, en passant par le milieu de terrain, sans oublier le gardien de but et un bon entraîneur !

3 - De l'échange et la réciprocité nait l'innovation

Dans le vocabulaire de l'économie de l'innovation, le terme exact serait « Innovation Ouverte ». Ce concept stipule qu'il est beaucoup plus efficace et rapide de chercher à l'extérieur ce dont nous ne disposons pas et que nous ne pouvons créer en intérieur, mais dont nous avons absolument besoin pour obtenir un avantage compétitif de taille. L'innovation ouverte découle de l'expression « Open Innovation » que l'on doit au professeur américain Henry Chesbrough, et qu'il définit comme « l'innovation avec des partenaires en partageant les risques et les bénéfices »[15]. Son idée tente surtout de réduire « l'innovation fermée » caractérisant ces sociétés du XXème siècle, relativement autonomes, générant leurs propres idées et contrôlant toutes les étapes du produit : la production, le financement, la commercialisation, la distribution, … Peter Drucker a explicitement souligné que les deux fonctions qui créent de la valeur sont bien l'innovation et le marketing., toutes les autres fonctions pouvant être externalisées. A ce titre, le géant Apple se spécialise dans la conception de nouveaux produits révolutionnaires et un marketing imparable pour les mettre en vente ; pour ce qui est du reste des fonctions de la chaîne, Apple fait tout simplement appel à l'externalisation.

Henry Chesbrough dresse une typologie de l'innovation ouverte en distinguant d'une part « l'outside – in », et d'autre part « l'inside – out ». La première illustre l'importation par une entreprise de connaissances, méthodes ou technologies innovantes afin de les incorporer dans son organe d'innovation. La deuxième met en avant l'exportation par une entreprise de ses innovations en valorisant sa propriété intellectuelle via le brevet ou une licence libre.

[14] Under 17 – les joueurs de moins de 17 ans –.

[15] « Open Innovation : The new imperative for Creating and Profiting from Technology », 2003

D'un point de vue comptable et financier, nous devons souligner que toutes les entreprises n'ont pas les moyens de développer leur Recherche et Développement (R&D), quand d'autres ne désirent tout simplement pas débourser une somme astronomique dans la R&D pour se mettre à jour dans un marché en particulier – sans compter le temps considérable nécessaire au développement et à la mise en service d'une innovation –. La notion d'innovation ouverte prônant l'expansion vers l'extérieur, nous amène donc à introduire la notion « d'Innovation Collaborative ». Si cette dernière peut être interne en faisant interagir différents départements d'une même structure, elle peut également être externe en poussant différentes entreprises à joindre leurs savoir-faire respectifs pour concrétiser des projets communs. L'innovation collaborative s'inscrit dans une logique d'émergence ou de réalisation de projets d'innovation de façon conjointe, permettant ainsi à une entreprise de collaborer avec d'autres entités partenaires afin d'élargir ses compétences et sa présence dans les nouveaux domaines prisés. Elle sous-entend de trouver un compromis quant à la mise en commun des ressources, la propriété intellectuelle, la répartition des bénéfices, et le partage des risques afférents aux futurs projets d'innovation du partenariat. Les acteurs prenant part à ce genre de partenariat peuvent relever de différents statuts juridiques et il peut s'agir à la fois d'entreprises, d'organismes publics de soutien financier[16] ou encore d'organismes de recherche, qui contractualisent un accord pour formaliser leur collaboration.

4 - La propriété intellectuelle : une protection exclusive de la connaissance

L'échange et l'accumulation des connaissances paraissent donc chose évidente et pour le bien-être de tous … Néanmoins, ce principe de partage demeure nuancé lorsque la propriété intellectuelle entre en jeu.

Attardons-nous quelque peu sur cette récente terminologie de « propriété intellectuelle ». L'origine de cette expression remonte officieusement à plus de deux siècles lorsque le périodique anglais « The Monthly Review » publie en 1769, un article[17] intitulé : « What a niggard this Doctor is of his own, and how he is of other people's intellectual property ? ». Ce n'est qu'en 1967 à Stockholm, lorsque les

[16] Par exemple : PIAVE, FUI, Bpifrance, ADEME, ou encore H2020 de la commission européenne.
[17] Oxford English Dictionary (3rd ed.) Oxford University Press. September 2005

Bureaux Internationaux Réunis pour la Protection Intellectuelle [18] sont devenus l'Organisation Mondiale de la Propriété Intellectuelle (OMPI), que le terme est usité officiellement et n'entre réellement en vigueur dans le langage commun qu'à partir des années 1980[19].

La propriété intellectuelle se décline en deux branches ou dimensions. D'une part, la propriété littéraire et artistique qui protège les œuvres de l'esprit par le biais de droits d'auteur ou droits voisins. D'autre part, la propriété industrielle qui, elle, protège les créations utilitaires par des brevets d'invention, et les signes distinctifs par des marques commerciales ou nom de domaine.

En se référant à l'INPI[20] pour la première branche de la propriété intellectuelle, les droits d'auteurs comprennent les œuvres littéraires, musicales, graphiques, les films ainsi que les logiciels. Quant aux droits voisins, ils sont exclusivement affectés aux artistes-interprètes, aux producteurs de vidéogrammes et aux entreprises de communication audiovisuelle. La seule création de l'œuvre artistique profère automatiquement un droit d'auteur, sans formalités ; tandis que les droits voisins s'acquièrent dès la première interprétation ou communication.

La seconde branche de la propriété intellectuelle a plus spécifiquement pour objet les créations techniques (brevets, certificats d'obtention végétale, topographies de semi-conducteurs), les créations ornementales (dessins et modèles), et les signes distinctifs (marques, dénomination sociale, enseigne, noms de domaine, appellations d'origine, indications de provenance). Dans ce sens, il s'agit donc de protéger et valoriser les inventions, innovations et créations, par un dépôt – pour le brevet et la marque –, ou par l'usage – pour les noms commerciaux et enseignes –.

L'esprit même de l'instauration du concept de propriété intellectuelle réside dans la volonté de stimuler les œuvres et inventions nouvelles en garantissant à son créateur une récolte exclusive des fruits de son travail et une protection optimale contre le « copiage » ou le « piratage ». La propriété intellectuelle est également perçue comme une ouverture à la diversification des voies de recherches, notamment lorsqu'une technique ou un moyen nouveau est déjà protégé, poussant les chercheurs à explorer de nouvelles pistes. Aussi, la propriété intellectuelle est censée inciter et booster les chercheurs dans leurs recherches et à se dépêcher de

[18] Fusion de la convention de Paris (1883) et de la Convention de Berne (1886)
[19] Bayh-Dole Act
[20] Institut National de la Propriété Intellectuelle

produire, pour être le premier déposant d'une invention et obtenir ainsi la propriété intellectuelle.

A contrario, dans son intention positive de favoriser le progrès technique, la propriété intellectuelle a détruit les notions de partage, de collaboration et de complémentarité inhérents à l'équilibre évolutionnel de l'Homme, en accentuant l'égocentrisme et le « nombrilisme » au détriment de l'allocentrisme et l'altruisme. Dans un esprit de développement de la pensée et de l'innovation, le simple fait d'empêcher un tiers de reprendre, d'améliorer et perfectionner une invention sans l'autorisation du protégé, constitue un frein et un ralentissement de poids à la recherche fondamentale et au progrès technique. N'était-ce pas Newton qui disait : « Si j'ai pu voir plus loin que d'autres hommes, c'est en me tenant sur les épaules de géants » …

Dans le cadre de nouveaux partenariats, la protection exclusive par des droits de propriété intellectuelle ainsi que l'obligation inviolable qui en découle pour les membres d'une entité de non-divulgation des secrets techniques, vient littéralement freiner et ralentir tout projet d'une collaboration réussie. Nous pouvons établir une classification en trois catégories des entreprises en fonction de leurs comportements et conditions exigées quand il s'agit de conduire un nouveau partenariat. La première catégorie comporte la majeure partie des entreprises et celles-ci ordonneront un accord contractuel global avant d'entamer tout projet commun. La deuxième catégorie représente certaines firmes qui n'envisageraient même pas la discussion, sans la signature d'un accord de non-divulgation. La troisième catégorie, elle, désigne ces entreprises qui vont systématiquement refuser les discussions avec toute entité ne détenant aucun brevet.

Au fond, pour remédier à cette contradiction paralysante, le postulat théorique voudrait que les entreprises en quête d'inventions et les entreprises détentrices de brevets d'invention transcendent cet antagonisme, pour se concentrer davantage sur les opportunités et synergies potentielles d'une innovation ouverte – ou collaborative –. Néanmoins, les premières sont tout à fait en droit de s'interroger sur la protection de leurs produits contre les imitations si elles ne possèdent pas de propriété intellectuelle. Serai-je en possession d'une protection exclusive ? Mes concurrents peuvent-ils développer à leur tour ce genre de nouveau produit ? Les deuxièmes, quant à elles, vont davantage se questionner sur le gain réel à long terme lié au partage de leurs brevets d'invention.

Quelques éléments de réponses sont apportés par les plates-formes d'innovation ouverte mises en place pour créer une « foire » aux questions, posées par les entreprises en quête de nouvelles technologies, comme l'a fait ideXlab[21]. Cette entreprise du net, s'autoproclamant « the e-Innovation platform », a créé une plateforme virtuelle pour faire fructifier et faciliter l'innovation par le biais d'échange d'informations, de dialogues, de questions/réponses entre les différentes communautés scientifiques et industrielles du monde entier. Ces plates-formes permettent donc d'entrer en contact avec des entités expertes dans une technologie particulière, pour ensuite mener discussions et négociations de façon anonyme jusqu'au point d'accroche entre les deux parties pour se lancer dans un projet mutuel. Voici quelques exemples de requête[22].

– ***Innovative muscle relaxant*** : A market leader in pharmaceutics is looking for innovative self-medication treatment for muscle pain and/or contractures. – /

– *Novel energy storage system* : A global technology company has invented a novel solution to store and reuse energy from braking in railways networks. –

Quand bien même l'échange d'informations est anonyme, la prudence reste de mise. Les demandeurs de nouvelles techniques doivent tout de même atténuer leurs questions et ne pas divulguer un quelconque problème industriel ou l'émergence d'une potentielle innovation de rupture. Quant aux détenteurs de nouvelles techniques, une haute vigilance doit accompagner les informations sur les caractéristiques de l'invention émises au demandeur.
Par ailleurs, il faut bien souligner qu'un accord de collaboration ne va pas de pair avec une exclusivité ou une garantie optimale de protection contre les imitations, puisque l'invention ou la technologie demeure la propriété du fournisseur. En tant que personne morale, une entreprise souhaitant intégrer une nouvelle technologie à un nouveau produit ne peut pleinement l'utiliser et sans encombre, uniquement si elle en est l'inventeur. Autrement, il faudra se pencher sur la nature de protection concernant cette technologie. Si une preuve d'antériorité ou un brevet d'invention existe déjà, une demande de licence ou droit d'utilisation est indispensable auprès de l'entreprise détentrice de la technologie. Pour autant, un droit d'utilisation n'assure

[21] https://www.idexlab.com
[22] https://www.idexlab.com/public-questions/

pas un abri intouchable et l'exclusivité totale sur une invention ou une innovation. En réalité, l'unique moyen de s'assurer une exclusivité et un avantage compétitif solide sur le long terme pour un nouveau produit innovant : c'est l'acquisition même du brevet !

5 - Le Capital Immatériel : une nouvelle mesure de la richesse économique

Cette vision restreinte axée sur le brevet, mérite tout de même une prise de vue aérienne quant à l'environnement ou la sphère complexe encadrant le brevet au sein du monde de l'entreprise, afin de mieux préciser et déterminer l'intérêt de ce droit négatif[23]. En effet, avant de définir concrètement le brevet, il est fort utile de souligner que le brevet n'est qu'un aspect d'un concept beaucoup plus large appelé « Capital Immatériel ». « Le capital immatériel, ce sont tous ces éléments que nous avons pris l'habitude de ne pas compter pendant une période très longue de l'histoire de la finance, alors que c'est l'essentiel même de la richesse des entreprises aujourd'hui, et c'est la richesse des nations[24] ! » Alan Fustech, président-fondateur de Goodwill-management[25]. De ce fait, le capital immatériel peut être étudié tant d'un point de vue macroéconomique, que microéconomique. Le premier faisant allusion au capital immatériel d'un pays[26] par exemple, tandis que le deuxième fait davantage référence à celui d'une entreprise.

On peut effectivement avoir du mal à le quantifier dans l'étude, mais dans la pratique, dans la vie économique de tous les jours, il se traduit par une aptitude à produire plus de prospérité dans une société : une richesse immatérielle qui se transforme en

[23] Voir section 6) Le Brevet : définitions et enjeux.
[24] Edition Spéciale « Capital Immatériel » : Discours du Trône (du roi du Mohamed VI) du 30 Juillet 2014 – 2M
[25] Cabinet de conseil en performance économique responsable
[26] Fouad Benseddik membre du Conseil Economique Social et Environnemental du Maroc a avancé une définition non exhaustive de ce concept lors d'une table ronde traitant de ce sujet.
De façon catégorielle, le capital immatériel d'un pays peut se décomposer en trois agrégats majeurs à savoir, la cohésion sociale, l'efficience des institutions, et la protection du milieu naturel. La cohésion sociale est la capacité d'un pays à former ses citoyens, à leur assurer un accès aux services publics, à résoudre pacifiquement les conflits, et surtout à garantir leur sécurité et leur santé pour un bien-être social optimal. L'efficience des institutions désigne le bon fonctionnement des administrations, des collectivités locales et de la justice indépendante au service du citoyen ; mais aussi une gouvernance des affaires publiques qui protègent les biens/les patrimoines, et qui stimule les initiatives et les investissements sur le territoire national. La protection du milieu naturel fait littéralement allusion au traitement des eaux, à l'entretien des espaces verts, à l'implication dans le développement durable et l'anti-pollution, et à la protection et l'aménagement du littoral, des parcs, des rivières et autres éléments naturels.

richesse matérielle ! Si les festivals de cinéma, de musique, de culture sont difficilement mesurables … leur impact est évident.

Au fond, une société épanouie et libérale va plus facilement réussir dans le tourisme, dans l'attraction des investissements étrangers, et dans la stabilité même de la société. Prenons la ville de Marrakech[27]. Le nom « Marrakech » est devenu mondialement connu, célèbre pour son artisanat, sa maroquinerie, son climat chaleureux, son dépaysement total et sa légendaire place Jamâa El Fna, faisant de cette ville une destination prisée et incontournable. Fondamentalement, ce n'est pas l'argent dépensé par les touristes, ou les hôtels, les clubs et autres parcs à thèmes qui créent la véritable richesse … Mais bien le Nom de la ville « MARRAKECH », devenu une marque internationale ! Remplacez « MARRAKECH » par « TIFELT » et il vous faudra de longues années pour acquérir la même attraction, la même notoriété et la même crédibilité que celles dont jouit Marrakech de nos jours. Au passage, TIFLET est une petite ville avec son charme mi-urbain mi-rural, située à une Soixantaine de kilomètres de la capitale marocaine RABAT.

On peut également appliquer ce concept de capital immatériel à une personne. La marque « FRANCE » s'impose indéniablement sur la scène mondiale pour tout ce qu'elle évoque, et la marque « MAROC » représente une valeur inestimable qui vaut chère pour tout ce qu'elle évoque aussi. Appartenir aux deux pays c'est bénéficier d'une combinaison des atouts de chacune, d'une double culture, d'une double tradition, d'une double histoire, d'une double géographie, d'une double éducation, de deux sublimes langues parlées, d'une double vision du monde, d'une double représentation dans le monde, d'une double gastronomie divine, … Mais du climat d'une seule : la marque « MAROC » ; et du passeport d'une seule : la marque « FRANCE [28] » ! Ces richesses immatérielles différentes mais complémentaires ne sont pas palpables ou tangibles, pourtant elles représentent des milliards et des milliards de Dirhams ou d'Euros ; à dire vrai, elles n'ont aucun équivalent matériel …

D'un point de vue entrepreneurial, le capital immatériel naît de la non-comptabilisation de certains éléments créant une valeur intangible. Au fond, il constitue toute la richesse qui ne figure pas dans un bilan comptable et qu'on ne

[27] Marrakech étant une ville se situant au sud du Maroc (et non la capitale !), au cas où vous vous demanderiez de quoi il s'agit.

[2828] Le passeport français donnant accès à la visite de plusieurs pays sans Visa.

peut donc pas lire. Dans le bilan d'une entreprise figurent la trésorerie, les stocks, les machines, les ressources financières, mais aucunement les équipes, les expériences, les technologies et les savoir-faire, ces éléments étant considérés comme difficilement mesurables. En conséquence, les comptables préfèrent ne pas les comptabiliser pour être prudents !

Au niveau microéconomique, ce capital immatériel au sens d'Edvinson & Malone[29] (1997), peut essentiellement prendre trois formes à savoir 1) le capital humain ; 2) le capital structurel interne, regroupant toutes les informations relatives à l'organisation, l'innovation, et le savoir-faire – incluant les brevets d'invention – ; et 3) le capital structurel externe, principalement axé sur le capital client. Dans le langage anglophone, on parle de « intangible assets », autrement dit, les actifs incorporels regroupant les noms commerciaux, les marques déposées, les brevets, et tout genre de propriété intellectuelle.

Les comptes de l'entreprise constituent probablement la première source d'information sur l'entreprise lorsqu'il s'agit d'apprécier son patrimoine, sa solidité financière ou encore sa performance économique. Simultanément, la capacité de l'information comptable à rendre compte de la réalité économique de l'entreprise apparaît s'être émoussée au cours du temps, et particulièrement ces dernières décennies. L'importance que semblent désormais jouer les brevets, les marques, les enseignes ou encore les fichiers (clients, abonnés, …) dans la dynamique et la croissance de l'entreprise est un élément fréquemment mis en avant afin d'expliquer cette perte de pertinence de l'information comptable. Il en va sans dire que l'innovation et le progrès technologique sont des éléments clés pour la productivité et la croissance des entreprises. La R&D industrielle, les nouvelles technologies de l'information ainsi que le développement scientifique ; qui découlent des universités, des laboratoires de recherches et des entreprises ; boostent la performance économique et propulsent les cours boursiers. Il existe donc un lien indéniable entre la R&D, le progrès technologique et la croissance économique à différentes échelles. Pourtant, les informations publiées concernant l'activité innovante sont à la fois insuffisantes et décalées dans le temps. En effet, de nombreux travaux ont souligné cette insuffisance des informations financières et mis en avant l'utilité des informations non financières. Essentiellement, les rapports financiers divulguent des

[29] "Intellectual capital, realizing your company's true value by finding its hidden brain-power", Harper Business, 1997

indicateurs financiers qui méritent d'être complétés par des indicateurs extracomptables ne représentant pas une mesure quantitative mais davantage une mesure qualitative [Amir & Lev (1996), Cazavan-Jeny & Jeanjean (2005), Béjar (2006), Callen et al (2010)]. Le mercredi 20 avril 2011, les autorités sanitaires européennes décident de ne pas autoriser la commercialisation du médicament phare, le naproxcinod, du laboratoire de biotechnologies NICOX, pour cause d'avantages thérapeutiques non clairement démontrés[30]. Cette décision constitue un deuxième revers de taille[31] pour le laboratoire, dont le naproxcinod était la seule molécule à un stade très avancé de développement, et était considérée comme très prometteuse par de nombreux analystes. Le même jour, à 10h13 précisément, l'action NICOX chute de 18,5% à 1,86 euro, dans des volumes d'échanges importants, après avoir ouvert en baisse de près de 34%. L'exemple de Nicox illustre parfaitement les différentes et nombreuses études menées par les chercheurs autour de la pertinence informationnelle des investissements en R&D ainsi que leur relation avec les cours et rendements boursiers [Chauvin & Hirschey (1993), Lev & Sougiannis (1996), Cazavan-Jeny & Jeanjean (2005), (Boulerne & Sahut, 2010)]. En effet, ces éléments, et de façon plus générale l'ensemble de ce qui est désormais regroupé derrière le terme « d'actifs immatériels[32] » ou simplement « d'immatériels », apparaissent difficiles à mesurer, à valoriser et à comptabiliser.

De nombreux débats sont alors nés autour de ces aspects en France, mais aussi et surtout outre Atlantique : faut-il s'efforcer de rentrer les incorporels dans les comptes ou peut-on se contenter de mentionner leur existence dans les notes et les annexes ? En cas d'inscription dans les comptes, vaut-il mieux faire prévaloir une logique de charges et un impact en termes de résultat immédiat, ou une logique de patrimoine et une reconnaissance bilancielle ? Comment élaborer un contrôle, un audit et une certification des immatériels ?

Dans tous les cas, c'est l'équilibre entre prudence, pertinence et fiabilité de l'information comptable qui est en jeu. Et bien évidemment l'information ainsi produite doit être appréciée au travers de l'utilité qu'elle apporte à ses utilisateurs, ce qui fait naitre de nouvelles questions : Les investisseurs accordent-ils une même attention

[30] Source : bourse.lesechos.fr

[31] Après celui infligé en juillet 2010, par l'agence sanitaire américaine, la Food & Drug Administration

[32] Les actifs immatériels englobent les actifs intangibles (difficilement mesurables) et les actifs incorporels.

selon qu'une information est dans les comptes ou les annexes ? Quel est le degré de détail pertinent et la crédibilité concernant les immatériels ?

6 - Le Brevet : définitions et enjeux

L'objet de cette thèse de doctorat est de contribuer à ces débats par une analyse statistique et économétrique portant sur un « actif immatériel » : le Brevet ! Le choix[33] d'un « actif immatériel » particulier, le brevet, tient à la difficulté d'analyser globalement des « actifs immatériels ». En effet, bien que partageant un certain nombre de caractéristiques communes, en particulier les critères permettant de les identifier comme « immatériels », ces derniers demeurent porteurs de fortes caractéristiques individuelles. Il apparaît à cet égard délicat d'étudier entièrement les « actifs immatériels » et de traiter ainsi de façon similaire, par exemple, les marques, les noms commerciaux, et les brevets, ...

Mais vous vous demandez certainement ce qu'est un brevet ?
Un brevet est un titre de propriété industrielle qui donne à son propriétaire un monopole d'exploitation sur l'invention brevetée[34], en principe, à partir de la date de dépôt et pour une durée maximale de 20 ans[35]. Le brevet constitue un « droit négatif » puisqu'il ne confère pas un droit d'exploitation, mais un droit d'interdiction de l'exploitation par un tiers de l'invention sans le consentement explicite du titulaire. C'est au XVIème siècle av. J.C., que l'ancêtre du brevet né des senteurs de la gastronomie antique, à Sybaris plus précisément, en Grande Grèce où est apparu pour la première fois un régime de propriété intellectuelle octroyant un monopole sur l'invention de recettes de cuisine. Puis, ont suivi les lettres patentes accordées par les rois de l'Ancien Régime[36] ainsi que par la reine Elizabeth I[37] pour protéger des innovations ; avant que n'apparaisse, enfin, le premier brevet industriel connu en Europe, et qui fut délivré en 1421 à Florence. C'est l'architecte, ingénieur et théoricien de « la perspective mathématique », Filippo Brunelleschi, qui obtient ce

[33] Certaines études ont aussi privilégié le brevet à la marque par exemple. Cette dernière ne contribuerait pas au Tobin's Q dans des industries de services à haute valeur ajoutée, notamment le software. Le brevet quant à lieu est joue un rôle principal dans la valeur de marché des industries scientifiques et technologiques. [Greenhalgh & Rogers (2010)]
[34] INPI, USPTO.
[35] D'autres brevets moins importants ont une durée de vie entre 7 et 10 ans.
[36] Royaume de France de la fin du XVIe siècle à la fin du XVIIIe siècle.
[37] The Statute of Monopolies (1624)

brevet pour une invention dans la manutention de marchandises destinées au transport de bateaux. En 1469, un second brevet fut attribué par la ville de Venise à un assistant de Gutenberg, lui conférant ainsi, l'exclusivité pour le restant de sa vie d'imprimer un système utilisant des caractères mobiles. Concrètement, le titulaire du brevet jouit par conséquent, d'un droit exclusif de fabriquer, vendre ou d'utiliser l'invention décrite dans le brevet. Toute personne copiant ou utilisant de manière illicite une invention protégée sans l'autorisation de son propriétaire est un contrefacteur ! Par ailleurs, il n'existe pas de brevet déposé sur une idée, puisqu'une idée ne peut pas se protéger en elle-même, mais surtout parce que le brevet sert à protéger une invention technique apportant une solution nouvelle à un problème pratique donné. D'ailleurs, tous les brevets ne sont pas acceptés. Un brevet est accepté si, et seulement si, les trois conditions[38] de brevetabilité ou validité sont réunies :

- ✓ ***Invention nouvelle***
  - ► L'invention doit être non comprise dans l'état de la technique et non publique avant le dépôt de la demande de brevet.
- ✓ ***Activité inventive***
  - ► Elle ne doit pas être évidente pour découler logiquement de l'état de la technique connue par l'homme du métier.
- ✓ ***Susceptible d'une application industrielle***
  - ► Elle doit pouvoir être fabriquée ou utilisée quel que soit le type d'industrie.

On ne dépose pas un brevet, mais une demande de brevet. En Europe, c'est le premier « déposant » qui a priorité du brevet, contrairement à d'autres pays qui privilégient le premier « inventeur ». Il est possible de déposer une demande de brevet auprès d'un Etat, à l'instar de la France (INPI), des Etats-Unis (USPTO), du Japon (JPO) ; ou bien auprès d'un groupe de pays comme l'Office Européen des Brevets (OEB) regroupant 39 pays européens. En revanche, note importante, le brevet est valable uniquement sur les territoires visés par la demande de brevet !

[38] Source : Insitut National de la Propriété Intellectuelle. Quasi-identique avec l'office Américain du brevet (USPTO), à quelques détails près mais l'esprit demeure le même.

Sur le plan entrepreneurial, la valeur des brevets informe les parties prenantes sur les avantages des brevets, dans le sens où elle aide la comptabilité à « mesurer » la valeur des incorporels ainsi qu'à valoriser la productivité et la qualité de la R&D. Ainsi, il serait judicieux de coupler les montants inscrits dans les postes comptables aux indicateurs extracomptables et révélateurs de qualité. En effet, de nombreuses études américaines ont voulu montrer le rôle de la qualité des brevets en tant qu'informations complémentaires à celles des dépenses en R&D. Outre la mesure quantitative du nombre de brevets, les chercheurs ont créé des variables mesurant la qualité des brevets à travers le lien scientifique, l'avantage technologique, la rapidité d'innovation, les citations de brevets, etc. Dans cette optique, la qualité des brevets a fait l'objet de recherches théoriques et empiriques autour de grands thèmes de la finance d'entreprise.

En effet, le thème de « l'évaluation de l'entreprise » a suscité quelques questionnements sur la qualité informationnelle des brevets : L'information qualitative relative aux brevets est-elle pertinente et valorisée dans les cours boursiers des titres ? Cette même information affecte-t-elle le risque de l'entreprise ? La divulgation volontaire par l'entreprise de ces mêmes informations produit-elle, elle-même, un effet marginal ? Les études portant sur la pertinence informationnelle des brevets ont pris pour point de départ que, pour les investisseurs, les indicateurs de brevets présentaient une utilité au moins complémentaire à celle des informations purement comptables. Ainsi, les données relatives aux brevets sont pertinentes, dans la mesure où elles compensent l'insuffisance des états financiers et véhiculent une information utile aux investisseurs, leur permettant de mieux anticiper les futurs avantages qui découleraient de la recherche scientifique des entreprises, et donc de prédire le cours des actions [Chauvin & Hirschey (1993), Lev & Sougiannis (1996), Cazavan-Jeny & Jeanjean (2005), (Boulerne & Sahut, 2010)].

Le thème de « la structure de financement de l'entreprise » nécessite, lui aussi, de faire un lien avec les actifs immatériels, et plus particulièrement le brevet : La présence de brevets, et au-delà la qualité des brevets, affectent-ils les choix de financement, et finalement, la structure du capital de l'entreprise ? Dans quelle mesure les brevets sont-ils pris en compte par les apporteurs de fonds externes à l'entreprise ? En effet, s'intéresser à l'apport de la qualité des brevets au(x) lien(s) qui existe entre les porteurs d'obligations ou la valeur de la dette et les investissements en R&D semble pertinent sur au moins deux points. Tout d'abord, il est primordial de

souligner que la R&D est associée à un risque résiduel du fait de sa valeur liquidative qui est nulle. Or, l'actionnaire peut prendre ce risque résiduel, mais en aucun cas le créancier (Shi, 2003). D'un autre côté, lorsqu'il y a beaucoup de R&D, il s'en suit souvent une asymétrie d'information opposant les investisseurs informés (le plus souvent parce qu'ils ont eu une information privée) aux autres investisseurs [39] (Aboody & Lev, 2000 ; Boone & Raman, 2001). En outre, dans l'étude menée par Shi (2003), du point de vue des créanciers, l'importance de l'effet d'incertitude et de volatilité des activités de R&D dépasse de loin la valeur des dépenses de R&D. Au fond, l'entreprise doit se dédouaner par le biais de moyens ou d'informations plus convaincants qu'un simple montant. En effet, le détenteur de la dette disposant d'informations « solides » sur la qualité de la recherche scientifique pourrait avoir tendance à réduire le coût de la dette pour le débiteur [Czarnitzki et Kraft (2004)].
Toutes ces interrogations autour de ces grands thèmes sont judicieuses et mériteraient de plus amples recherches se focalisant davantage sur ces aspects de poids et de valorisation des « immatériels » autour de ces mêmes thèmes.

7 - La qualité des brevets comme mesure pertinente de l'inventivité

Le XXIème siècle marque définitivement le passage à une nouvelle ère : celle de l'économie de la connaissance (ou immatérielle). Si dans une économie matérielle, la protection des biens peut se faire dans un bunker, un coffre-fort ou sous un matelas ; dans l'économie de la connaissance, seuls le secret ou la propriété intellectuelle constituent un véritable bouclier pour les biens immatériels.
En témoigne la croissance exponentielle du nombre de brevets passé de 50 milliards de dollars en 1994 à 200 milliards en 2008[40].
Grilliches (1990) a soulevé la question de l'utilité des données statistiques sur les brevets et a mis en avant le caractère pertinent du brevet, qu'il considère comme un indicateur efficace du rendement de la R&D. En effet, il demeure difficile d'identifier et de mesurer l'inventivité d'une entreprise, les avantages qu'elle peut tire de l'activité de R&D. Une façon de résoudre ce problème consiste à utiliser les informations sur les brevets, répartis par classe technologique, « pour regrouper les entreprises dans des ensembles d'activités technologiques communs et vérifier si leurs variables sont

[39] Les créanciers appartenant à cette catégorie dépourvue de l'information relative aux dépenses de R&D.
[40] Source : Organisation Mondiale Propriété Intellectuelle

liées aux niveaux d'activité globaux de son ensemble ». Un grand nombre d'articles scientifiques soulignent le lien étroit qui existe entre la RD et le nombre de brevets, désignant ces derniers comme un bon indicateur des différences d'activité entre les entreprises [Grilliches (1990)]. Cependant, l'utilisation des brevets comme indicateur du rythme de l'inventivité des entreprises ou de production des innovations soulève quelques conflits de réalisme et de fiabilité.

Intuitivement, pour évaluer le rythme d'une activité inventive, les chercheurs et analystes ont tendance à se référer au nombre de brevets déposés pour une société dans une période donnée. Pourtant, Hirschey & Richardson (2004) soulignent que le nombre de brevets est un indicateur imparfait des activités innovantes puisqu'il ne capture pas la vraie valeur économique de l'innovation. En effet, l'innovation varie considérablement en fonction de la valeur technologique et/ou économique, et la distribution de cette valeur est donc « faussée ». Ainsi, la mesure du nombre de brevets est par nature limitée puisqu'elle ne peut effacer cette hétérogénéité. Par ailleurs, des réticences ont été amenées quant à la pertinence informationnelle des brevets, donnant ainsi une perception du brevet comme étant un outil trompeur. En effet, la portée du brevet dépend du lien entre les inventions et de la mesure dans laquelle les innovations nécessitent une diversité d'intrants techniques et non techniques. Certains brevets sont indispensables à la conception du produit final, tandis que d'autres n'interviennent qu'à une étape intermédiaire du processus industriel. Fondamentalement, il n'y a pas de relation directe ou personnalisée entre les dépenses de R&D et l'activité de brevetage [Grilliches et al (1989)]. Lerner (1994), dans son étude de 173 entreprises biotechnologiques, a souligné que tous les brevets ne sont pas perçus de la même manière par les investisseurs ; cela dépend du champ (ou de la portée) basé sur le plan de classification des brevets, communément appelé « Patent Scope ». Lerner (1994) insiste sur l'appréciation du brevet qui doit passer par des indicateurs économiques reflétant davantage la qualité du brevet.

La qualité des brevets peut se définir à travers 2 dimensions :

- La qualité techno-économique de l'invention

- La qualité juridique créée par la fiabilité du brevet en tant que droit de propriété

Cette thèse de doctorat s'inscrivant dans une perspective financière, nous focaliserons exclusivement sur la première dimension afin d'analyser l'aspect « réalité économique », plutôt que la dimension légale qui tient compte des offices et services d'acceptation des brevets comme Office des Brevets Européens (OEB) ou encore United States Patent and Trademark Office (USPTO).

Plusieurs travaux académiques se sont intéressés à cette notion de qualité des brevets et ont tenté de créer ou améliorer des variables statistiques rendant compte d'un aspect qualitatif des brevets. Ces études empiriques mettent clairement en exergue la déposition d'un brevet, qui va de pair avec une documentation riche et exhaustive dont les marchés financiers peuvent s'imprégner pour évaluer la qualité des activités scientifiques et technologiques de l'entreprise. [Squicciarini et al (2013)]
La science et la technologie comme des « prédicteurs » de la performance boursière, c'est ce qu'ont souligné Deng et al (1999). Ces derniers insistent sur les Citations dans la déposition, qui font référence aux précédentes inventions (« backward citations ») ; mais aussi et surtout sur les citations de ce même brevet par des entités voulant utiliser cette invention (« forward citations »). En outre, Deng et al (1999) précisent que les citations dans une candidature de brevets permettent aussi d'analyser le Lien Scientifique qui découle des brevets. Pour cela, ils analysent les références aux travaux/papiers scientifiques, aux conférences, et autres études (mais en aucun cas aux brevets), dont la société s'est servie pour constituer son brevet. Enfin, ces auteurs mettent en avant la Rapidité d'innovation à travers le temps écoulé entre deux générations de brevets. Ces références ou citations permettent donc à l'investisseur d'apprécier la nouveauté de l'invention. Fondamentalement, le fait de citer un brevet indique la qualité de celui-ci et sa capacité à apporter de nouvelles améliorations technologiques. Ainsi, les entreprises disposant de brevets fréquemment cités ont une plus grande probabilité de réussite, à la fois dans la pérennité du produit et au sein des marchés financiers [comparées aux sociétés dont les brevets sont peu cités, voire pas du tout].
Hirschey et al (2001) ont voulu montrer qu'au-delà même de la relation entre la valeur de marché et le nombre de brevets déposés, il existait aussi une association significative avec la qualité des brevets. Dans la suite des travaux de Deng et al (1999), ils ont alors introduit un indicateur de quantité et trois indicateurs de qualité, respectivement comme suit : PATENTS qui rend compte du nombre de brevets déposés ; le Current Impact Index qui mesure la qualité des brevets à travers le

nombre de citations des brevets des 5 dernières années par rapport à l'ensemble des brevets du système américain ; le Science Linkage qui indique le lien avec le monde scientifique ; le Technology Cycle Time qui mesure le temps écoulé entre deux générations de brevets. D'une part, les auteurs démontrent que la qualité des brevets, liée aux investissements de R&D, influence positivement l'évaluation boursière de l'entreprise. D'autre part, ils soulignent que la qualité des brevets relève d'une grande utilité pour les investisseurs. Cela leur permet de concevoir une association positive entre les efforts scientifiques et la valeur ajoutée des dépenses en R&D. Néanmoins, il ressort une corrélation négative entre la rapidité d'innovation et la valeur de marché.

Dans ce sens, Chen & Chang (2010) se sont aussi intéressés à la relation entre la qualité des brevets et la valeur de marché. Dans une étude de 37 entreprises pharmaceutiques américaines, ils adoptent alors 4 mesures originales de la qualité des brevets, toutes aussi intéressantes les unes que les autres. La 1ère variable est la Relative Patent Position (RPP) qui définit le leader dans un domaine technologique comme étant l'entreprise qui détient le plus grand nombre de brevets dans ce domaine. La 2ème variable est la Revealed Technology Advantage (RTA) qui représente un avantage développé par l'entreprise dans un domaine technologique particulier. Mathématiquement, il s'agit du ratio entre la proportion de brevets dans un domaine particulier et la totalité des brevets de tous les domaines de l'entreprise. La 3ème variable est le Herfindahl-Hirschman Index of Patents (HHI) qui mesure le degré de concentration des brevets et des domaines technologiques. Comme 4ème et dernière variable de qualité, Chen & Chang (2010) utilisent les Citations de brevets qui mesurent à la fois la qualité des brevets et les flux de connaissances engendrés par l'entreprise. Parallèlement aux études antérieures, les auteurs insistent sur la corrélation positive et le coefficient significativement différent de 0 (1%) entre les citations de brevets et la valeur de marché.

En outre, Callen et al (2010) ont étudié la relation de complémentarité qui pourrait exister entre des informations financières et non financières. Les auteurs mettent en avant 3 indicateurs non financiers. Le premier est la Rentabilité du Portefeuille des Médicaments en Chantier. Le deuxième est le Nombre de Collaboration. Le troisième est le nombre de brevets/citations de brevets. Dans un premier temps, Callen et al cherchent à savoir si les informations financières sont pertinentes pour leur échantillon, puis tentent de montrer si les informations non financières sont

complémentaires ou plutôt substituables aux informations financières. Leurs résultats démontrent que les coefficients des indicateurs financiers (valeur comptable des capitaux propres et bénéfices), pris séparément, sont positifs et significativement différents de zéro ; les informations financières sont donc pertinentes pour les sociétés riches en R&D. Aussi, leurs résultats montrent que les informations afférentes aux 3 indicateurs non financiers sont statistiquement et économiquement value-relevant pour les investisseurs, d'autant plus que les investisseurs réagissent positivement à l'acceptation d'un brevet.

Par ailleurs, Czarnitzki et Kraft (2004) ont noté que les modèles évaluant la valeur de marché en fonction des indicateurs de l'innovation (R&D) présentent un inconvénient : le « marché » est limité au marché financier. Pour évincer cet inconvénient, il serait judicieux de prendre en compte la notation bancaire ou le « credit rating ». Selon Czarnitzki et Kraft (2004), le « credit rating » concerne plus de sociétés, et l'échantillon est donc plus important que si on se contentait des sociétés par actions. Les deux auteurs ont pris en compte trois variables différentes pour évaluer l'activité innovante des entreprises. D'abord, les Dépenses en R&D, puis la Quantité de Brevets, et enfin la Proportion du Chiffre d'Affaires des Produits Nouvellement Développés. Ces variables ont toutes un impact significatif sur la notation d'autant plus que cette dernière n'augmente que lorsqu'un niveau assez élevé d'innovation est atteint, à savoir : 13% de l'intensité de R&D ; 0.7 brevet pour des ventes d'un million DM ; 54% des actions de nouveaux produits vendus. Cela voudrait dire que la qualité des brevets influencerait, à première vue, de façon indirecte le coût de la dette. Cependant, ils attirent notre attention sur un excès d'innovation qui est perçu comme potentiellement préjudiciable à la notation puisque les activités innovantes demeurent toujours sujettes à d'éventuels échecs.

Sur la base de l'approche de Hart, Bena & Li (2014) ont mis l'accent sur l'existence de synergies entre les sociétés technologiques et l'influence qu'elles pourraient jouer dans le processus de fusions/acquisitions. Ainsi, ils se sont demandé si les partenaires de la fusion détenaient des technologies complémentaires avant la transaction et, le cas échéant, quelles caractéristiques particulières ont eu une incidence sur les décisions de fusion et d'acquisition. Ils ont alors utilisé deux mesures de quantité à savoir, Citation-Weighted Patents qui illustre la somme du nombre pondéré des citations de brevets accordés à l'acquéreur/société cible, et Patent Index qui mesure la quantité de production d'innovation d'une entreprise

référencée par rapport à la médiane de chaque classe technologique et chaque période au sein desquelles la société a breveté. Par ailleurs, ils ont avancé trois mesures de qualité. Le Self-Cites Ratio est le nombre de brevets attribués à une entreprise qui cite l'un de ses propres brevets antérieurs, divisé par le nombre total de brevets octroyés à l'entreprise au cours de la même période. Le Age of Patent Portfolio est le nombre moyen d'années des brevets déjà déposés dans le portefeuille de l'entreprise. Et le Citation Index est l'importance du portefeuille de brevets d'une entreprise par rapport à l'importance ajustée à la médiane de la production de brevets dans chaque classe technologique et chaque période au sein desquelles la société a été active en brevets. En outre, ils ont également introduit des variables de réciprocité technologique entre deux sociétés qui fusionnent. Selon Jaffe (1986), Technological Proximity mesure la proximité des activités d'innovation de deux entreprises dans l'espace technologique en utilisant un nombre de brevets dans différentes classes technologiques. Le chevauchement de la base de connaissances évalue dans quelle mesure les brevets octroyés par deux entreprises citent le même ensemble de brevets antérieurs. Et puis, le Knowledge Base Overlap reflète l'importance de la base de connaissances commune par rapport à la base de connaissances de l'acquéreur/entreprise cible. En conclusion, ils ont fait valoir que les chevauchements technologiques ou les synergies de marché des produits - et non les deux - poussaient les entreprises à fusionner ou acquérir de nouvelles sociétés. Essentiellement, les entreprises peuvent accroître leur production en matière d'innovation par l'acquisition d'entreprises dotées d'une intensité de R&D plus élevée et d'un portefeuille riche en brevets ; ils mettent tout de même l'accent sur les technologies et les actifs complémentaires.

8 - Les Fusions/Acquisitions : à la conquête de productivité et d'innovation

Dans cette course aux brevets, au vu de la vitesse d'innovation et des attentes grandissantes des consommateurs, l'accès au savoir et aux nouvelles technologies est devenu une priorité et une condition indispensable pour la pérennité de l'entreprise ; et la meilleure arme pour se garantir une exclusivité optimale et un avantage compétitif solide sur le long terme pour un nouveau produit innovant : c'est « l'acquisition même du brevet » ! Le processus de Fusions/Acquisitions s'inscrit dans un esprit de compétition et une perspective de domination, où les entreprises

vont même jusqu'à accaparer un fournisseur, un client ou encore un concurrent – direct ou indirect d'ailleurs –. En effet, l'innovation collaborative renforcée juridiquement par une fusion ou une acquisition permet à chacune des entités d'avoir une vision plus large et plus complète du marché, de bénéficier d'une réduction du « time to market » et d'une réduction des risques en les partageant, mais surtout de pouvoir accéder pleinement au capital immatériel de l'autre et d'accélérer les processus d'innovation. Un projet d'innovation issu de l'acquisition d'une société possédant un capital immatériel et appartenant (ou non) à l'environnement d'une entreprise constitue une réelle opportunité de se lancer dans une innovation à risques forts pour maintenir sa compétitivité, plaçant cette dernière en pôle position sur le marché.

Partant de l'hypothèse que le regroupement sectoriel est révélateur des motifs d'acquisition néoclassique, les résultats de Szücs (2013) laissent présager d'une prédominance des motifs néoclassiques dans la constitution des vagues de fusions, tandis que le regroupement par pays ou par marché correspond davantage à des explications comportementales[41].

Selon les théories néoclassiques, les fusions et acquisitions sont définies comme un moyen de réallocation des actifs entre la réaction des entreprises efficaces et inefficaces aux chocs relatifs à un secteur donné. En effet, les vagues de fusions sont essentiellement prononcées dans des industries en pleine mutation et sensibles au changement [Andrade & Stafford (2004), Harford (2005)]. Concrètement, des changements fondamentaux pourraient faire référence à des chocs macroéconomiques tels que la déréglementation ou l'application de lois dans un pays spécifique, mais ils pourraient également faire allusion à des chocs microéconomiques tels que des innovations de produits ou des modifications de la technologie de production.

Au vu de l'engouement et d'une riche littérature autour des activités de fusions/acquisitions, il est clairement constatable que ce phénomène relève d'une ampleur singulière à la fois pour les universitaires et le monde des affaires. Il est d'autant plus intéressant que divers domaines académiques, de la théorie sur

[41] Le rôle des imperfections du marché est souvent étayé par les explications comportementales ainsi que par les décisions irrationnelles ou risquées des entreprises et de leur gestionnaire. D'une part, les entreprises possédant des actions surévaluées pourraient être enclines à les échanger contre des actifs réels [Shleifer & Vishny (2003)]. D'autre part, les gestionnaires irrationnels ont tendance à s'engager dans trop de changements et de fusions [Roll (1986)].

l'organisation industrielle à la finance de marché et d'entreprise, en passant par le contrôle des entreprises, ont avancé différentes explications pour justifier les fusions/acquisitions.

En effet, la littérature académique sur l'organisation industrielle met en évidence les gains d'efficacité réalisés grâce aux économies d'échelle et de gamme, ainsi que la motivation pour atteindre et/ou renforcer le pouvoir du marché [Maksimovic & Phillips (2001), Harford (2005)]. Dans cette perspective, la littérature sur la gestion stratégique souligne le désir d'accéder aux canaux de distribution et d'accéder à de nouveaux marchés par le biais, d'une part, d'économies pécuniaires, à savoir monopole et/ou monopsone ; et d'autre part, par le biais d'économies de diversification, à savoir gestion de portefeuille et/ou réduction des risques [Lubatkin (1983), Balakrishnan (1988), Fee et Thomas (2004), Shahrur (2005)]. Par ailleurs, les études sur le contrôle des entreprises suggèrent que les fusions/acquisitions sont utilisées comme un outil permettant de traiter l'incompétence managériale de la cible, et de gérer des problèmes d'agence et/ou d'orgueil [Jensen & Meckling (1976), Roll (1986)]. Quant à la finance d'entreprise et la finance de marché, elles justifient les fusions et acquisitions par la présence d'un lien technologique dans le même secteur (Coase (1937), Rhodes-Kropf & Robinson (2008)), mais aussi par le biais de marchés haussiers susceptibles de pousser les acquéreurs à acheter des cibles sous-évaluées avec leurs stocks surévalués [Vishny (2003), Rhods-Kropf (2003), Rhodes-Kropf et Viswanathan (2004)]. Enfin, la littérature sur l'innovation implique et prouve que l'acquisition de nouvelles technologies est un motif déterminant pour entreprendre et mener des fusions/acquisitions. Elle vise à accroître les investissements technologiques des entreprises et, surtout, à élargir leurs bases de connaissances en greffant de nouvelles compétences et savoir-faire, de nouveaux brevets et autres, appartenant au même secteur voire même extérieur [Cohen et Levinthal (1989), Huber (1991), Ahuja et Katila (2001), Sevilir et Tian (2011)].

De façon notoire, si les vagues de fusions apparaissent comme un phénomène sensible à des bouleversements ou nouveaux virages économiques, il faut bien souligner le tournant majeur qu'a connu le monde et de nombreuses industries avec l'arrivée des Nouvelles Technologies de l'Information et de la Communication (NTIC). En effet, l'émergence des NTIC ont donné lieu à la troisième

vague de fusions centrée sur la recherche de nouveaux partenaires stratégiques, poussant les entreprises à se diversifier [Betton et al (2008)][42].

Se posent alors les problématiques suivantes : La diversification des entreprises génère-t-elle un réel avantage pour ces dernières ? Y a-t-il une réaction prononcée du marché à ce type de décisions managériales ? Quels risques pourraient survenir à l'issue d'une diversification des entreprises ? Les travaux académiques et résultats empiriques apportant des éléments de réponses sont abondants, mais néanmoins mitigés.

9 - La diversification et la complémentarité technologique au cœur des débats académiques

Depuis longtemps, la diversification des entreprises est une question épineuse en ce qui concerne ses implications pour la santé des entreprises. La diversification a hérité de l'une des idées les plus anciennes de l'économie, selon laquelle la diversification des entreprises était improductive et inefficace. Nombre de précédents chercheurs ont diabolisé la diversification en associant cette dernière à une valeur de destruction au sein des entreprises. Ravenscraft et Scherer (1987) ont montré que 33% des acquisitions réalisées dans les années 1960 et 1970 étaient cédées par la suite, interprétant ainsi les taux de cession comme une preuve que les acquisitions diversifiées détruisent la valeur au lieu de l'augmenter. Lang et Stulz (1994) insistent également sur l'effet pernicieux de cette diversification et soutiennent que les entreprises diversifiées négocient à un taux de décote moyen par rapport aux entreprises à segment unique. Dans la même perspective, Servaes (1996) s'est intéressé à la valeur de la diversification pendant la vague de fusions des conglomérats, en se demandant si la diversification entraînait des valeurs de marché plus élevées durant cette période. À partir de là, Servaes (1996) tente également d'apporter des raisons pour expliquer cet écart d'évaluation. Examinant la valeur de la diversification lorsque de nombreuses sociétés ont commencé à se diversifier et le rapport avantages/coûts de la diversification, il ne trouve aucune preuve de la valeur créée par des sociétés diversifiées. Contrairement aux entreprises spécialisées sur un segment unique au cours des années 1960, les entreprises diversifiées n'étaient

[42] La première vague de fusions fait allusion aux conglomérats des années 1960. La deuxième vague fait référence à la tendance de spécialisation des années 1980.

pas évaluées à la prime, mais au rabais. Néanmoins, cet impact négatif sur le taux de décote lié à la diversification s'estompe peu à peu, et n'est plus significativement différent de 0 au début et au milieu des années 1970.

Quant à la propriété des initiés, les entreprises à forte propriété d'initiés n'avaient pas tendance à se diversifier lorsque le rabais de diversification était très prononcé (1961-1970). En revanche, ces entreprises ont retrouvé le goût de la diversification lorsque la décote a considérablement diminué (1973-1976), signifiant que le coût des actionnaires était minime et que les initiés souhaitaient réduire leur exposition au risque spécifique à l'entreprise. Délit d'initié ou pas ? Là, est une autre question …

De manière générale, pour ces auteurs anti-diversification, cette dernière a été loin d'être bénéfique pour les sociétés américaines durant les décennies 1960 et 1970, à l'exception de la première moitié des années 1970.

Cela étant dit, comme une pièce de monnaie a toujours un côté face et un côté pile, d'autres études ont nuancé les méfaits de la diversification et mis en avant ses avantages. En réalité, cette conception du désinvestissement en tant qu'échec complet n'est pas la seule raison des taux de désinvestissement élevés, puisqu'une entreprise fait partie d'un vaste processus de changement continu de la société, et que les besoins d'aujourd'hui ne sont pas a fortiori identiques à ceux d'hier ou de demain.

Ce n'est pas parce qu'une cession a eu lieu, que l'acquisition initiale a été synonyme d'échec ou de mauvais investissement. Vous pouvez vendre une entreprise source de gains synergiques et de nouvelles compétences simplement parce qu'il n'y a plus de synergies possibles à en tirer après un certain temps [Kaplan & Weisbach (1992), Patel & Pavitt (1997)]. Par conséquent, l'acquisition initiale et la vente ultérieure pourraient avoir un effet positif et augmenter la richesse des actionnaires.

Kaplan & Weisbach (1992) ont évalué dans quelle mesure les désinvestissements résultaient d'acquisitions infructueuses au cours des années 1980. Ces auteurs ont utilisé des preuves empiriques pour nuancer l'idée que ces cessions équivalaient à des échecs d'acquisitions ou à de mauvais investissements, et ils ont constaté que les rendements anormaux des soumissionnaires concernant la diversification des acquisitions sont mitigés. Certes, ils ont constaté que 43,9% des acquisitions avaient été cédées à la fin de 1989, mais pour autant, plusieurs de ces cessions ne ressemblent pas à de véritables désastres microéconomiques. Leurs observations et résultats ont montré que 42% des cessions enregistrent un gain, tandis que 44% font

état d'une perte à la vente ; de plus, 43% des désinvestissements diversifiés et 40% des désinvestissements spécialisés enregistrent un gain sur vente. Au final, il n'y a aucune différence significative entre les réactions des marchés boursiers à l'annonce de la diversification et les réactions aux acquisitions connexes.

Dans cette même perspective, des études empiriques ultérieures ont montré que le rabais apparaît comme une décision de diversification ex ante, et n'est en réalité que le résultat d'un biais de sélection de l'échantillon [Villalonga (1999), Campa & Kedia (2002)]. Pour l'essentiel, la décote de diversification semble disparaître ou même se transformer en prime une fois que l'on corrige ce biais de sélection de l'échantillon. En suivant cette idée, Graham et al (2002) montrent que plus de 50% de l'escompte est dû au fait que les entreprises ont choisi de se diversifier au sein de segments faisant déjà l'objet de rabais avant leur acquisition. Villalonga (2004) soulève une nouvelle question empirique visant à déterminer si les données sectorielles de Compustat (SIC) entraîneront une décote supérieure ou inférieure à d'autres sources de données relatives aux secteurs d'activité. Elle propose les Business Information Tracking Series (BITS) comme alternative à la classification Compustat (SIC), afin de classer autrement les segments et d'évaluer l'impact de la diversification sur les activités. Ses résultats ont montré que les sociétés diversifiées négociaient une prime moyenne de 0,28 par rapport aux entreprises spécialisées, cette prime étant statistiquement significative et allant de 0,11 à 0,43. Selon Villalonga (2004), cette différence de valeur découle, en premier lieu, du biais qui provient des données de segment de Compustat en pointant du doigt l'agrégation des activités dans un segment désigné par un code SIC mais qui diffère d'une entreprise à une autre car les segments sont auto-déclarés par celles-ci. En second lieu, il existe une latitude managériale dans le report des segments d'activités qui, en réalité, ne se ferait pas dans un esprit authentique mais plutôt stratégique.

Fondamentalement, l'effet de la diversification doit être pris avec beaucoup de distance puisque la valeur de la diversification dépend de la source de données utilisée, mais aussi et surtout de la décision stratégique et anticipatrice des entreprises.

Pour autant, la diversification demeure une notion générale et complexe, pouvant être décomposée en trois grands types ; ceux-ci incluent la diversification du marché, des produits et des technologies. Etant donné la singularité et la complexité afférente à chacune d'elle, nous focaliserons exclusivement dans cette thèse de

doctorat sur la diversification technologique. Notre préoccupation concernant la diversification technologique des entreprises découle du fait que cette dernière est généralement supérieure à la diversification des produits et anticipe la diversification des marchés [Breschi et al (2003)][43].

Vraisemblablement, la collaboration technologique est devenue omniprésente dans le monde de l'entreprise, et ce n'est pas un hasard si les grandes sociétés étendent leurs compétences et savoir-faire dans de nombreux domaines technologiques. Nous pouvons synthétiser les raisons plausibles à ce phénomène en trois points.

- - - Premièrement, nous devons relever une interdépendance technique entre ; d'une part, des améliorations de la complexité des produits et des processus de production, et d'autre part, des améliorations complémentaires requises de la part des fournisseurs de matériaux. Patel & Pavitt (1997) se sont interrogés sur la nature et les déterminants des compétences technologiques propres aux entreprises. Ils ont constaté que « la complexité contraint les entreprises à rechercher et à expérimenter ce qu'elles savent déjà », de manière à aller au-delà de leur noyau distinctif ou cœur de métier isolé. Malgré la nécessité d'une « capacité d'absorption » et des coûts d'assimilation afférents aux technologies acquises à l'extérieur, il est devenu indispensable pour les grandes entreprises d'investir dans différents domaines technologiques [Granstrand et al (1997), Leten et al (2007)]. Les entreprises évoluent dans un monde interactif où l'innovation résulte d'un va-et-vient entre les possibilités techniques existantes, le marché, et les nouvelles technologies de pointe. La diversification des investissements dans différents secteurs d'opportunité est plus susceptible de générer une valeur de croissance que les investissements dans un secteur sélectionné, à condition que les innovateurs veillent à garder une cohérence technologique. Effectivement, les entreprises doivent penser aux opportunités technologiques émergentes : un profil technologique qui était « marginal » hier pourrait bien devenir un « profil central[44] » aujourd'hui ou demain. Développer des connaissances dans des domaines variés ouvre la voie à une fertilisation croisée et

[43] En effet, le fait qu'une entreprise soit spécialisée dans une seule ligne de produits ne signifie pas que cette entreprise est aussi spécialisée dans les technologies. La spécialisation des produits n'implique pas nécessairement une spécialisation technologique ; au contraire, se concentrer uniquement sur une ligne de produit nécessite des compétences issues de différents domaines technologiques, de manière à assurer et à assurer le bon fonctionnement du produit final.

[44] Marginal technological profile versus Core technological profile [Patel & Pavitt (1997)].

crée des fonctionnalités permettant aux entités d'améliorer les processus de production.

- - - Deuxièmement, contrairement à un portefeuille diversifié, les investissements dans les domaines technologiques les plus proches sont généralement portés à une sélection interne plus stricte en raison de la duplication des opportunités. En prenant le contexte des portefeuilles d'alliance, Vassolo et al (2004) ont montré que lorsqu'une entreprise investit dans plusieurs nouvelles sociétés d'un_segment industriel défini, la valeur de croissance globale de ses investissements est inférieure à la somme de la valeur de croissance individuelle de chaque entreprise (effet de sous-additivité). À vrai dire, les entreprises diversifiées peuvent davantage tirer parti des gains de synergie que les entreprises spécialisées ou moins diversifiées dans le cas où les complémentarité ou proximité technologiques permettent de telles interactions. En effet, plusieurs articles ont examiné les relations entre diversification technologique et performance technologique, par le biais de la cohérence technologique [Breschi et al (2003), Van Loy et al (2005), Chiu et al (2008), Lai et al (2010)]. Le résultat commun qui ressort de ces études indique que les entreprises qui respectent une cohérence technologique dans la diversification de leur portefeuille peuvent accroître les avantages de la diversification. Leten et al (2007) ont montré que plus le niveau de cohérence technologique d'une entreprise est élevé, et plus l'effet positif de la diversification technologique sur la performance technologique est grand. Breschi et al. (2003) ont étudié des entreprises de 6 pays de 1982 à 1993 et ont insisté sur la complémentarité des connaissances comme étant un catalyseur clé de la diversification technologique des entreprises. Sans oublier, que l'influence des technologies connexes sur la probabilité d'une entreprise à se diversifier dans un domaine donné, augmente avec le niveau de diversification de l'entreprise. En somme, les grandes entreprises diversifiées sont plus « cohérentes » que les plus petites, probablement parce qu'elles sélectionnent d'abord tous les segments industriels étroitement liés à leurs segments d'origine et choisissent ensuite d'autres segments, si nécessaire, situés plus loin dans le lexique technologique.

- - - Troisièmement, de nombreux articles ont avancé que la diversification des savoir-faire surperforme la diversification des produits. Les portefeuilles technologiques, dont les connaissances sont réparties sur un spectre plus large, vont de pair avec un niveau élevé de signaux de diversification technologique [(Leten et

al. (2007), Chiu et al. (2008)]. D'ailleurs, Patel & Pavitt (1997) ont montré que les grandes entreprises chimiques et électriques sont plus actives dans les technologies relatives aux minéraux non métalliques que les entreprises de minéraux non métalliques elles-mêmes. L'essentiel serait ainsi de tirer profit d'une technologie différente qui pourrait avoir une valeur ajoutée importante pour leur cœur de métier, sans pour autant avoir accès à d'autres marchés ou à vouloir gagner des parts sur un autre marché spécifique. Dans ce sens, Gambardella & Torrisi (1998) ont analysé les relations entre diversification technologique et diversification des activités principales en aval (downstream activities). Se concentrant sur 5 différentes industries[45], ils ont fait valoir que les entreprises devraient se concentrer sur leurs activités principales mais aussi élargir l'éventail de leurs compétences technologiques. Certes, la convergence technologique est « le processus par lequel différentes industries parviennent à partager des bases technologiques similaires » [Rosenberg (1976)], mais la convergence technologique est également motivée par la montée en puissance de technologies génériques pouvant être utilisées dans plusieurs technologies différentes. Fondamentalement, une performance plus élevée est positivement associée aux entreprises qui, à la fois se concentrent sur leurs activités concrètes en aval, et augmentent simultanément leur diversification technologique.

10 - Positionnements académique et épistémologique de notre recherche

Pour parfaitement comprendre l'esprit et l'idée même qui imprègne cette thèse de doctorat, nous avons choisi de citer Bryer & Lebson (2002)[46] : « The driving force behind a majority of mergers completed during the past decade has been the acquirer's desire to obtain the targets' Intellectual Property Assets (IPA). »

L'objet de cette thèse a donc pour visée d'enrichir le lien qui pourrait exister entre les opérations de fusions/acquisitions et la qualité des brevets perçus comme un moyen de diversifier et/ou perfectionner les compétences technologiques en place. Hypothétiquement, un portefeuille de brevets diversifié pourrait être un gage de qualité technologique, ouvrant la voie à plusieurs connections possibles, reflétant une entreprise qui vit avec son temps et annonçant l'émulation qui en découle.

[45] Computers, telecommunication equipment, electrical components, other electronics, and non electronic technologies

[46] *This article has been redacted from the recent book Intellectual Property Assets in Mergers and Acquisitions, published in 2002 by John Wiley & Sons publication.

Fondamentalement, cette thèse se veut être une réflexion sur le choix de la société cible – ou Target –, et dans lequel nous considérons que l'acquéreur va davantage s'intéresser à des informations plus « concrètes » et visionnaires, rendant mieux compte de la richesse économique que le simple montant figurant dans la case R&D. Ces informations seraient donc axées sur la qualité des brevets et la valeur ajoutée des opportunités qui découle du potentiel de diversification et de complémentarité technologiques dans un contexte de concentration d'entreprises.

Plus précisément, eu égard à la nécessité d'anticiper le monde de demain, à la prolifération inouïe des connaissances, à la vitesse de l'innovation et du progrès technique, à l'utilité de transcender les frontières de l'entreprise, à l'importance d'élargir et de combiner les compétences technologiques, au caractère exponentiel des échanges immatériels, et notamment à l'impossibilité de posséder l'ensemble des compétences techniques et de faire cavalier seul dans le monde technologique, nous souhaitons positionner notre travail sur les trois questions de recherche suivantes renvoyant au thème des brevets et la valorisation des acquisitions :

- ✓ Les fusions/acquisitions renforcent-elles la concentration autour du cœur de métier ou, au contraire, permettent-elles aux acquéreurs de transcender les frontières et d'améliorer leur degré de diversification ?

- ✓ Dans quelle mesure la diversification technologique de la société cible affecte-t-elle les primes de fusion payées par les acquéreurs et la réaction du marché à la synergie ?

- ✓ L'acquisition de nouveaux portefeuilles de brevets complémentaires impacte-t-elle la valeur des rivaux de l'acquéreur ?

Nos trois questions de recherche seront traitées dans le cadre de trois essais constituant le cœur de cette thèse de doctorat. A partir d'un travail de traitement, de « nettoyage », de classification et de regroupement par entreprise d'une population de 3 279 509 brevets, l'expérimentation portera sur le marché américain qui demeure le terrain standard ou classique des tests de nouvelles idées et de nouvelles hypothèses. La période de notre étude s'écoulera de 1990 à 2006. Pour l'essentiel, les données mobilisées ont été collectées à partir de différentes bases de données en fonction de l'information recherchée. Les données relatives aux brevets sont

disponibles à partir de NBER[47] (National Bureau of Economic Research) qui réunit tous les brevets d'utilité délivrés par USPTO [48]. Les données afférentes aux fusions/acquisitions sont extraites de la base de données Thomson Financial's SDC [49]. Quant aux données financières et aux rendements anormaux, ils sont respectivement extraits de Compustat et CRSP, ces deux bases de données faisant partie de WRDS.

Le travail proposé s'inscrit dans une démarche positiviste et largement empreinte par l'approche hypothético-déductive. Contrairement à une vision normative consistant à dire ce qui doit être ; la vision positive tente de voir et de comprendre ce qui est. Notre posture épistémologique s'aligne donc sur l'Etat positif d'Auguste Comte[50] (1843) prônant la mise en œuvre d'hypothèses reposant sur des faits constatables et mesurables vérifiés par l'expérience, donnant ainsi lieu à la formation de lois non contradictoires. Bien que le processus rationnel d'induction[51] soit censé venir compléter l'approche positiviste, il est tout de même important de souligner la qualité prédictive de la science mise en avant par le positivisme. Nous avons choisi d'adopter cette méthode hypothético-déductive, eu égard aux données quantitatives utilisées et de leur exploitation en vue de formuler des hypothèses pour en déduire des prédictions sur les données observées. Ce choix s'inscrit également dans la lignée des travaux précédents en Finance, et nous permet ainsi d'évaluer la valeur de nos apports. « Nous ne savons pas, nous ne faisons que conjecturer » Karl Popper[52] (1934). Cette démarche nous a, par conséquent, conduit à élaborer des jeux d'hypothèses qui seront testées empiriquement. Les essais adoptent le format classique des travaux publiés dans la discipline : Introduction / Revue de littérature et développement des hypothèses / Présentation, justification et discussion de la méthodologie retenue / Présentation des données mobilisées et des variables retenues / Analyse descriptive des données et des variables / Mise en œuvre du

[47] NBER est une base de données de 3 279 509 brevets entre 1976 et 2006, et contient pour chaque brevet, une année de demande, une année de délivrance, un numéro de brevet unique, un numéro de cessionnaire de brevet et une classe de technologie de brevet (selon le système IPC); parmi d'autres.

[48] US Patent and Trademark Office

[49] Nous commençons à partir de 1990 car les informations fournies par le SDC sont moins fiables avant 1990 et se terminent en 2006 car les données de brevets disponibles dans NBER se terminent en 2006.

[50] A. Comte distingue trois Etats évoluant de l'Etat théologique à l'Etat métaphysique, pour enfin atteindre l'Etat positif. *Discours sur l'ensemble du positivisme* (1843).

[51] Elaborer une théorie générale à partir de cas singuliers.

[52] *La logique de la découverte scientifique* (1934), où il traite notamment deux concepts nouveaux phares : la Réfutabilité et l'Infaillibilité.

protocole empirique et résultats principaux / Raffinement des hypothèses et des tests / Analyse de robustesse / Conclusion.

11 - Définition de nos variables d'intérêt

Il est communément admis qu'une ressource définie comme précieuse, rare, imparfaitement imitable et non substituable (VRIN) constitue un facteur d'avantage concurrentiel. Cependant, se concentrer uniquement sur cette ressource et ses capacités pourrait être imprudent voire même insuffisant. Aucune ressource technologique ne peut durer dans le temps sans être améliorée incrémentalement afin de répondre aux attentes progressives des clients. Et il n'existe aucune compagnie au monde qui puisse maîtriser l'ensemble des savoir-faire et la totalité des technologies, chacune d'elles appartenant à une industrie différente et à un segment spécifique. Il est donc vivement conseillé pour les entreprises riches en R&D de recourir à la diversification technologique au sein de différentes sous-catégories ou segments industriels, mais aussi au sein de différentes catégories ou industries. D'ailleurs, la propriété intellectuelle est également perçue comme une ouverture à la diversification des voies de recherches, notamment lorsqu'une technique ou un moyen nouveau est déjà protégé, poussant les chercheurs à explorer de nouvelles pistes extérieures. Garcia-Vega (2006) a montré qu'une augmentation de la diversification technologique peut considérablement créer un potentiel de fertilisation croisée avec différents domaines technologiques, et réduire l'effet de blocage des technologies peu rentables.

Dans cet élan d'ouverture vers l'extérieur et d'acquisition de brevets, nous avons donc développé deux principales variables reflétant la qualité des brevets, donnant ainsi lieu à nos trois variables d'intérêt. La première variable est une **mesure de diversification technologique** appliquée au processus de fusions/acquisitions, nous permettant d'analyser les relations réciproques qui peuvent exister entre ces deux phénomènes. Une société qui se diversifie technologiquement acquiert de nouveaux brevets et enrichit la qualité de son portefeuille qui devient multi-dimensionnel. Cette variable de diversification technologique fera l'objet de notre variable d'intérêt pour notre premier et deuxième essai[53]. La deuxième variable, quant à elle, est une

[53] Le deuxième essai introduira une nouvelle mesure de diversification technologique réadaptée à la question de recherche de ce papier comme expliqué ci-dessous.

mesure de proximité technologique entre les sociétés qui fusionnent nous permettant d'examiner son impact sur les rivaux de l'acquéreur. Cette deuxième mesure fera l'objet de notre variable d'intérêt pour le troisième essai.

– – –► Pour rendre compte de **la première variable « diversification technologique »**, nous nous sommes inspirés de la mesure du Herfindhal Hirschman Index (HHI). À l'origine, cet indice était utilisé pour mesurer le niveau de concentration industrielle. Un niveau élevé de monopole dans une industrie équivaut à un HHI proche de 1, tandis qu'un HHI proche de zéro traduit un faible pouvoir monopolistique. Dans cette perspective, Hall (2002) a défini le HHI comme la concentration de brevets dans des domaines technologiques et le degré de concentration des capacités technologiques d'une entreprise. Concrètement, si tous les brevets d'une entreprise sont situés dans un même domaine technologique, le HHI des brevets est égal à 1. En revanche, si les brevets de l'entreprise sont répartis sur de nombreux domaines technologiques, le HHI serait proche de 0.

En outre, l'innovation survient à la suite d'une combinaison d'éléments techniques existants pour donner lieu à de nouvelles synthèses complémentaires (Schumpeter, 1934), et l'innovation incite de plus en plus d'entreprises de différents secteurs à coopérer ensemble en matière d'inventions technologiques. Hall et al. (2001) ont travaillé sur les brevets via la base de données NBER et ont proposé une classification de chaque brevet par catégories et sous-catégories, tout en respectant la classification internationale des brevets (IPC). Les catégories se rapportent aux secteurs ou aux industries et vont de 1 à 6, il s'agit donc d'une vision de conglomérat. Les sous-catégories au nombre de 37 font référence à des secteurs d'activité ou à des segments d'industries et sont numérotés de 11 à 69[54], il s'agit plus d'un contexte de fusions horizontales ou verticales[55].

À cet égard, nous avons donc calculé deux niveaux de diversification technologique pour distinguer entre l'environnement de l'entreprise et l'au-delà de ses frontières. Le premier niveau fait allusion au degré de diversification (HHI) à l'échelle des sous-catégories – secteurs d'activité ou segments d'industrie – d'une même industrie. Par

[54] Les sous-catégories sont numérotées en fonction de la catégorie à laquelle elles appartiennent ; ainsi la sous-catégorie 12 appartient à la catégorie 1 et la 23 appartient à la 2. Toutes les catégories n'ont pas le même nombre de sous-catégories, c'est pour cela d'ailleurs qu'il n'y en a pas 58.

[55] Les données de la base Compustat Industry Segment ne sont pas toujours fiables quant au nombre de segments d'une entreprise et de ses variations [Hyland & Dlitz (2002), Villalonga (2004)].

exemple, une société possède des brevets dans la sous-catégorie 52 appelée « Travail des métaux » et dans la sous-catégorie 55 appelée « Transport », les deux appartenant à la même catégorie « Mécanique ». Puis, le deuxième niveau fait référence aux conglomérats, une diversification à travers différentes catégories – secteurs ou industries –. Par exemple, une société possède des brevets dans la catégorie 2 appelée « Ordinateurs et communications » et dans la catégorie 4 appelée « Electrique », chacune représentant une industrie à part entière. (Voir Appendix 1)

L'intérêt d'étudier la diversification à ces deux niveaux s'inscrit dans l'approche de Oliver Hart (1995), affirmant que les actifs très complémentaires devraient être sous propriété commune, tandis que les actifs indépendants devraient être détenus séparément. Notre étude apporte donc de nouveaux éléments de réponse permettant de confirmer ou infirmer cette théorie relative aux droits de propriété intellectuelle.

A partir de là, nous avons généré ces deux niveaux de diversification en calculant cet indice Herfindhal Hirschman en deux étapes. Premièrement, nous avons calculé la mesure de l'Avantage Technologique Révélé – Revealed Technology Advantage (RTA) – qui donne l'importance relative de la société à chaque domaine de compétence technologique, après prise en compte du volume total des compétences de la société (Patel & Pavitt, 1997).

$$\mathbf{RTA}_{i,t} = \frac{\text{Patent Share}}{\text{The firm's aggregate share in all the fields}}$$

Deuxièmement, nous partons du RTA exprimé pour chaque niveau afin de calculer l'Indice Herfindhal Hirschman, et tenir compte de la diversification ou de la concentration à l'échelle des secteurs d'activité des entreprises ainsi qu'à l'échelle des industries.

Pour un ensemble de N brevets appartenant à k segments industriels allant de 1 à 37, le degré de diversification des brevets au niveau des sous-catégories

(HHI_Subcategories) pour l'acquéreur i (ou la société cible) au cours de l'année t est défini par l'expression suivante :

$$\textbf{HHI\_Subcat}_{i,t} = \sum_{k=1}^{37}(\mathrm{RTA})^2 \;\; ; \;\; 0 < \mathrm{HHI} < 1$$

Pour un ensemble de N brevets appartenant à k industries allant de 1 à 6, le degré de diversification des brevets au niveau des catégories (HHI_Categories) pour l'acquéreur i (ou la société cible) au cours de l'année t est défini par l'expression suivante :

$$\textbf{HHI\_Cat}_{i,t} = \sum_{k=1}^{6}(\mathrm{RTA})^2 \;\; ; \;\; 0 < \mathrm{HHI} < 1$$

▬▬► Pour rendre compte de **la deuxième variable « proximité technologique »**, nous nous sommes penchés sur le papier de Jaffe (1986) qui fut le précurseur dans l'élaboration d'une mesure de proximité technologique. À l'origine, Jaffe (1986) a introduit cette variable afin de mesurer la proximité de deux entreprises innovantes en utilisant le nombre de brevets dans différentes classes de technologies. À travers 49 domaines technologiques, il calcule cette proximité comme la séparation angulaire entre deux vecteurs de position technologique. Ainsi, la séparation angulaire entre l'acquéreur (acq) et la cible (targ) est calculée comme suit :

(1)

$$\textbf{\textit{Tech prox}} = \frac{\mathbf{F}_{acq} * \mathbf{F'}_{targ}}{(\mathbf{F}_{acq} * \mathbf{F'}_{acq})^{½} (\mathbf{F}_{targ} * \mathbf{F'}_{targ})^{½}}$$

(1.1) Où :

$\mathbf{F}_{acq} = (\mathbf{F}_{acq,1} ; \ldots ; \mathbf{F}_{acq,k})$; où $k \in (1, k)$ est le segment ou l'industrie.

(1.2) Où :

$$F_{acq,k} = \frac{\text{Nb of awarded patents in tech class k with application year -4 to -1}}{\text{Total nb of awarded patents in all tech classes applied over the same 4-year}}$$

Pour notre part, cette corrélation non centrée sera calculée à deux niveaux différents de classification des brevets à la suite des travaux de Hall et al (2001, 2005). Ces derniers ont mis en avant différents niveaux de classification des brevets : 6 catégories principales, 37 sous-catégories, 400 classes de brevets principales (à 3 chiffres), 120 000 sous-classes de brevets. Nous considérons une entreprise technologique comme une entreprise possédant au moins un brevet dans son portefeuille ou son capital immatériel. En revanche, une entreprise non technologique n'a pas le moindre brevet dans son portefeuille. À partir de là, en utilisant les commandes « foreach » et « forvalues » sur Stata, nous avons lancé plusieurs boucles pour tenir compte de la proximité entre les entreprises fusionnantes au sein de chaque secteur ou industries (Catégories) et de chaque segment industriel (Sous-catégories) dans lequel ces dernières auraient au moins une demande de brevet pour la période 1990-2006. Par conséquent, nous avons généré deux variables différentes basées sur la mesure de Jaffe (1986) et tenant compte de la proximité technologique à un niveau horizontal et à un niveau vertical. Chacune de nos deux variables[56] est comprise entre 0 et 1 ; où 1 signifie des structures technologiques d'activité innovante parfaitement identiques, et 0 signifie qu'il n'y a aucun avantage à tirer du croisement des activités de recherche.

12 - Synthèse du premier essai de recherche

Notre premier essai repose sur l'ubiquité de l'interdépendance technologique dans l'univers entrepreneurial et la cadence accélérée du progrès technique qui incitent vivement les entreprises à se concentrer sur leur cœur de métier, mais aussi

[56] Nous tenons tout de même à souligner la perfectibilité de notre variable de proximité technologique dans la mesure où nous avons mené plusieurs tentatives économétriques pour évincer les incohérences. Cependant, la complexité de la variable couplée à notre lourde base de données suscitent des réticences sur la précision et la représentativité de notre variable.

et surtout, à s'émanciper au-delà des frontières pour gagner en polyvalence technologique. [Rosenberg (1976), Gambardella & Torrisi (1998)].

Dans cet esprit, une problématique légitime vient se poser quant aux moyens d'une entreprise à s'ouvrir ou à améliorer sa diversification et, par transitivité, sa performance technologique. Certes, la diversification implique des coûts de communication, de gestion et d'assimilation, ainsi qu'une capacité d'absorption non négligeable. Néanmoins, un moyen de réduire les incertitudes liées à la diversification pourrait être de fusionner[57] avec des entreprises possédant une base de connaissances[58] nouvelle et/ou complémentaire. De ce fait, à partir d'un large échantillon de 4 708 entreprises actives dans les brevets (NBER database) et 36 817 observations entre 1990–2006, nous avons voulu examiner si le volume de fusions/acquisitions des entreprises technologiques, ceux qui possèdent au moins un brevet, influence le degré de diversification de ces mêmes entreprises. Ainsi, nous étudions l'arrivée de nouveaux deals et l'évolution dans le temps du degré de diversification de l'acquéreur, à deux niveaux d'aggrégation, durant l'année t, t+1 et t+2.

En conséquence, l'objectif de cette étude est non seulement d'analyser si les fusions/acquisitions ont un impact sur la diversification au niveau des segments d'industrie, mais également de déterminer si ces opérations ont une influence sur la diversification à un niveau plus large et plus risqué, celui des industries***. La question de recherche consiste essentiellement à se demander si le volume des fusions/acquisitions renforce la concentration autour du cœur de métier ou si, a contrario, il permet aux acquéreurs de transcender les frontières et d'améliorer leur degré de diversification (autres profils de compétences technologiques).***

Notre questionnement autour du rôle des fusions/acquisitions dans la diversification technologique est motivée par l'approche de Hart (1995), affirmant que les actifs très complémentaires devraient être sous propriété commune, tandis que les actifs indépendants devraient être détenus séparément. La société cible viendrait donc compléter et améliorer l'innovation déjà présente du soumissionnaire ou l'accompagner dans de nouveaux domaines technologiques auxquels elle

[57] En effet, 60% de toutes les fusions d'entreprises publiques aux États-Unis sur la période 1984-2006 impliquent des entreprises innovantes, définies par leurs activités de brevets antérieures à la transaction.

[58] Similaires à toutes les entreprises de l'économie plutôt qu'à celles qui ressemblent davantage à leurs rivaux locaux [Hoberg & Phillips (2010)].

appartient.[59] Ainsi, nous prédisons que les sociétés vont chercher à acquérir des sociétés au sein de leur propre industrie pour accroitre leur degré de diversification au niveau des segments industriels. Notre première hypothèse suppose donc que, plus le volume de fusions/acquisitions est élevé, plus grand sera le degré diversification au sein des sous-catégories.

Par ailleurs, au lieu de percevoir la diversification à travers différentes industries comme une décision hasardeuse ou impétueuse, nous supposons que ce phénomène pourrait être compris comme une stratégie visionnaire et dynamique visant à maximiser la valeur. Il en va sans dire que le processus de recherche d'une entreprise correspondant aux compétences de celle-ci est rempli d'incertitude, mais dans certaines situations, l'incertitude est résolue en entrant dans une nouvelle industrie / catégorie [Matsusaka, (2001)]. Si nous prenons l'exemple d'une information asymétrique entre les entreprises et les investisseurs, les premières peuvent être amenées à renoncer, à tort, aux projets positifs à valeur actuelle nette proposés par les seconds. Pourtant, la diversification peut ouvrir de nouvelles bases de connaissances et permettre aux gestionnaires de créer des marchés de capitaux internes, moins sujets aux problèmes d'information asymétriques [Williamson, (1970)]. Ainsi, nous prédisons que dans une logique de pérennisation, les sociétés vont tenter de transcender leur propre industrie pour augmenter leur degré de diversification au niveau de différentes industries. Notre deuxième hypothèse est donc que, plus le volume de fusions/acquisitions est élevé et plus grand sera le degré diversification au sein des catégories.

Néanmoins, nous gardons à l'esprit que la diversification par le biais d'une autre catégorie ou d'un autre secteur « étranger » reste risquée et pourrait engendrer des conséquences néfastes pour les sociétés qui fusionnent. Selon Granstrand (1998), « les entreprises dotées d'un portefeuille technologiquement diversifié sont susceptibles de supporter des coûts importants d'intégration, de coordination et de communication ». Dans cette optique, nous ajoutons un corollaire et prédisons que le degré de diversification au niveau des industries sera nuancé ou atténué par rapport au degré de diversification à l'échelle des segments industriels.

[59] Un autre argument susceptible de favoriser la diversification dans les industries et les segments d'industrie pourrait être le carriérisme et l'auto-agrandissement des gestionnaires. Dans certains cas, la diversification dérive de la volonté des dirigeants de protéger la valeur de leur capital humain. Ils préféreraient être en charge des actifs au sein de différents secteurs et rendre ainsi leurs compétences plus diversifiées et essentielles pour l'entreprise. [Jensen & Meckling (1976), Eckbo (1986)]

Pour répondre à notre question, nous avons donc introduit en variable indépendante et d'intérêt le Volume de fusions/acquisitions (MA_Volume), mesuré par le ratio de la valeur total des transactions opérées par une firme i au cours d'une année t divisée par la valeur comptable des actifs de cette même firme à la fin de la même année [Sevilir & Tian (2011)]. Quant à la variable dépendante, nous avons donc utilisé le HHI calculé à partir de nos données de brevets, et pris en compte chaque niveau de diversification.

Les principales contributions de ce premier essai peuvent donc se présenter en trois dimensions. Premièrement, nous contribuons à la littérature restreinte sur la relation entre les fusions/acquisitions et la diversification technologique, en démontrant que les fusions/acquisitions constituent un réel moyen pour l'acquéreur de se diversifier au sein de son secteur mais reflètent tout de même une réticence quand il s'agit d'aller au-delà des barrières de la firme. Deuxièmement, nous menons une étude temporelle sur la production d'innovation non pas par le nombre de brevets ou de citations de brevets, mais par la diversification technologique afin de savoir si l'impact de ces opérations sur le degré de diversification de l'acquéreur se perpétue durant les trois années qui suivent la transaction. Troisièmement, nous menons une étude transversale qui analyse l'impact des fusions et acquisitions sur 37 sous-catégories et 6 catégories différentes, telles que rapportées par la classification des brevets du NBER [Hall et al (2001)] et formant nos deux niveaux de diversification technologique.

A partir de régressions linéaires suivant le modèle d'Ohlson (1995) ainsi que de modèles à effets fixes contrôlant les secteurs d'activité (SIC 2-digit et 4-digit) et les années, nous avons trouvé les résultats suivants pouvant se résumer en trois points comme suit.

Tout d'abord, nous avons constaté qu'il existait un lien étroit entre l'activité de fusions/acquisitions et le degré de diversification au sein des segments industriels, car la variable MA_Volume à l'année t se traduit par un coefficient négatif et significatif sur la diversification au cours de cette même année, ce qui laisse à penser que les entreprises qui effectuent des fusions/acquisitions améliorent leur degré de diversification à ce premier niveau de sous-catégories. Sur le plan économique, l'ampleur de la variable MA_Volume suggère qu'une augmentation de 10% des activités de fusions et acquisitions équivaut à une modification de 0,002 du HHI des sous-catégories allant de 0 à 1.

Ensuite, nos résultats montrent que l'estimation du coefficient de MA_Volume reste négative et hautement significative même un an et deux ans après la première année de l'opération. Statistiquement, le coefficient MA_Volume reste négatif et significatif aux seuils de 5% et 1%, respectivement pour les années t+1 et t+2, après avoir contrôlé la technologie, les caractéristiques des entreprises, et les effets fixes du secteur d'activité et de l'année. Ce résultat suggère que les fusions/acquisitions conclues au cours de l'année t continuent de contribuer à augmenter le degré de diversification des entreprises au sein des segments industriels au cours des deux années suivantes.

Et enfin, quand il s'agit du degré diversification au niveau des catégories / industries, nous montrons que la variable MA_Volume a un coefficient positif l'année t et devient négatif au cours des deux années suivantes, mais qu'il est nettement insignifiant au cours des trois années t, t+1 et t+2. Ces résultats suggèrent donc que les entreprises ont recours au canal des fusions et acquisitions pour renforcer leurs compétences autour de leurs activités principales plutôt que pour transcender les frontières de l'entreprise.

En conclusion, il nous semble important de souligner que la richesse, et plus spécialement la richesse immatérielle, sont des sujets d'études de temps long pour lesquels nous ne pouvons faire des bilans de cette nature là au bout de 2 ou 3 ans … Il faut donner du temps au temps pour voir comment la richesse se développe, et principalement la richesse immatérielle qui découle d'une diversification technologique avec toutes les nouvelles adaptations « qu'elle requiert » !

13 - Synthèse du deuxième essai de recherche

Notre deuxième essai repose sur de précédents articles ayant montré que les caractéristiques d'un soumissionnaire, d'une cible ou d'une transaction qui impliquent un plus grand potentiel de synergies ou qui renforcent la concurrence éventuelle pour la cible, sont une des raisons phares des primes de fusion plus élevées [Flanagan & O'Shaughnessy (2003), Moeller et al (2004), Bargeron et al (2008), Madura et al (2012), Alexandridis et al (2013), Davis and Madura (2017)]. En ce qui concerne les entreprises de haute technologie, Higgins et Rodriguez (2006) se sont intéressés à 160 prises de contrôle dans le secteur pharmaceutique entre 1994 et 2001, et en ont conclu que plus l'intensité interne de la R&D était faible, plus les

entreprises pharmaceutiques seraient susceptibles d'acquérir des sociétés riches en R&D dans l'optique de repenser leurs bases de connaissances en matière de recherche.

Antoniou et al. (2008) ont constaté qu'entre 3 et 5 jours après l'annonce de la fusion, les acquéreurs qui payaient des primes élevées surpassaient considérablement leurs homologues payant des primes moins élevées. Les rendements anormaux cumulés à court terme sont positivement corrélés au niveau de la prime payée par les acquéreurs. Ainsi, ils démontrent que les primes de fusion élevées ne constituent pas le principal suspect de la sous-performance à long terme des soumissionnaires, et leurs résultats empiriques à court terme suggèrent que les primes de fusion sont un indicateur important de synergies entre les entreprises qui fusionnent.

A dire vrai, toute entreprise technologique qui souhaite obtenir une technologie qui la rend plus compétitive serait prête à payer le prix fort pour posséder cette technologie – tant qu'elle dispose de suffisamment de liquidités ou de stocks pour le faire, cela va de soi –. Deux options se présentent alors : soit développer des technologies en interne, ou alors les détenir de manière externe. Notre étude traite de la deuxième option puisque nous souhaitons aider à expliquer les primes payées et la réaction du marché à l'annonce de fusions impliquant des brevets diversifiés détenus par la société cible.

La plupart des études se sont concentrées sur les fusions/acquisitions en général, omettant de spécifier et d'expliquer la grande variation entre les primes payées lorsque la technologie entre en jeu. Dans une volonté d'avancer d'autres arguments sur ce qui pourrait influencer les primes versées lorsque des brevets d'inventions sont impliqués, ***nous nous sommes demandé dans quelle mesure la diversification technologique de la société cible affectait les primes de fusion payées par les acquéreurs et la réaction du marché à la synergie.***

Notre intuition de base provient d'Antoniou et al (2008), dont les résultats indiquent que « des primes élevées seraient en réalité révélatrices des possibles synergies de la transaction et non un signe de gaspillage d'argent ». À partir de ces synergies d'opérations, ce deuxième papier évoque donc les gains technologiques potentiels et leurs relations avec les primes de fusion versées et la réaction du marché. La prime est pertinente car elle représente le paiement et la détermination des acquéreurs d'accéder et de jouir pleinement du patrimoine technologique de la cible. En effet, en matière de technologie, les primes élevées devraient être perçues

comme un gain futur résultant de la combinaison des savoir-faire plutôt que comme de l'argent jeté par les fenêtres. La réaction du marché, elle, sera capturée par les rendements anormaux cumulatifs [Cumulutative Abnormal Returns (CARs)] des acquéreurs et des sociétés cibles.

Les hypothèses de conflit d'intérêts [Jensen & Meckling (1976)] et de l'hubris [Roll (1986)] soutiennent que les gestionnaires recherchent une diversification malgré l'impact négatif sur les actionnaires et pourraient être prêts à trop payer pour des sociétés cibles qui n'appartiennent pas au même segment industriel de l'acquéreur ni même à la même industrie[60]. Outre les intérêts privés des dirigeants et leur décision de se diversifier, de nombreux chercheurs précédents ont diabolisé la diversification réduisant cette dernière à une valeur de destruction au sein des entreprises et ont montré que le marché réagissait négativement à l'achat de croissance, parallèlement à des stratégies d'acquisitions diversifiées[61]. Cependant, Kaplan & Weisbach (1992) ont constaté qu'il n'y avait pas de différence significative entre les réactions des marchés boursiers à l'annonce de la diversification et aux acquisitions liées, tandis que Hyland & Dlitz (2002) ont constaté qu'en termes de rendements anormaux, la moyenne des rendements sur le marché est positive et statistiquement significative pour les acquisitions diversifiées durant les années 1980 et 1990.

Avec l'avènement des NTIC, les combinaisons technologiques apparaissent à la vitesse de la lumière et les besoins des entreprises se renouvellent au jour le jour. En particulier, cela suggère que les primes de fusion et la réaction du marché vis-à-vis de la synergie attendue seront également plus prononcées dans des secteurs qui favorisent davantage les inventions et l'innovation, qui génèrent de la propriété intellectuelle et qui créent sa protection par le biais de brevets.

Typiquement, une société cible diversifiée possédant un large éventail de brevets, rime forcément avec transversalité, multi-dimensions, polyvalence, et opportunité de se distinguer. Ainsi, les industries dans lesquelles les entreprises sont des sociétés en exploitation peuvent amener les soumissionnaires à sérieusement considérer et envisager la fusion en payant le prix fort, car ces acquisitions pourraient avoir des gains attendus et partagés avec la cible. Par conséquent, nous prédisons qu'un acquéreur peut offrir un prix élevé à une cible possédant des inventions et

[60] Les dirigeants diversifieraient les avoirs de l'entreprise afin de renforcer leur capital humain ou d'en assurer la pérennité, même si cette stratégie de diversification nuirait à la fortune de leurs actionnaires. [Amihud & Lev (1981), Lorsh & Donaldson (1983, 1984), Shleifer & Vishny (1990)].

[61] Ravenscraft & Scherer (1987), Morck et al. (1990), Lang & Stulz (1994), Servaes (1996).

innovations diversifiées qui sont « à la mode » ou utiles pour les acquéreurs, afin de tirer parti du brevet et d'exploiter ces inventions ou innovations. De la même manière, notre deuxième hypothèse prédit une réaction positive du marché à la fusion de deux sociétés technologiques, et peu importe le niveau … « L'innovation systématique requiert la volonté de considérer le changement comme une opportunité ! » Peter Drucker.

A partir de là, nos deux variables expliquées sont d'une part, la prime d'acquisition, et d'autre part la réaction du marché. La prime d'acquisition est mesurée par le prix exprimé 4 semaines avant la date d'annonce. Pour rendre compte de la réaction du marché à la synergie, nous avons mesuré les CARs combinés, c'est-à-dire le produit des rendements anormaux cumulatifs de l'acquéreur et de la cible. Quant à notre variable explicative d'intérêt, nous nous sommes appuyés sur l'indice HHI que nous avons calculé précédemment, pour évaluer dans quelle mesure la diversification technologique de la cible influence la prime d'acquisition et la réponse du marché. Néanmoins, dans notre premier essai, nous nous sommes intéressés au degré de diversification technologique de l'acquéreur avec la venue de nouvelles fusions/acquisitions. Nous avons donc étudié l'évolution de la diversification technologique en la mesurant par un indice de concentration plus communément appelé « HHI ». Cet indice étant une probabilité, plus il se rapproche de 1 plus la firme est spécialisée, et plus il se rapproche de 0 plus la firme est diversifiée. Dans ce deuxième essai, nous nous intéressons à l'impact de la diversification technologique de la société cible ! Ici, nous ne cherchons pas à savoir si le HHI tend vers 0 ou vers 1, mais à savoir si le statut de diversifiée ou spécialisée joue un rôle dans la prime payée ou reçue. Ainsi, se pose alors la question du critère de qualification d'une société cible comme étant diversifiée ou spécialisée. Il faut dire que se baser sur la simple dichotomie, attribuant un statut selon que le HHI est égal ou différent de 1, pourrait fausser une grande partie de nos résultats et ne pas rendre compte de la réalité économique. Voici un exemple. Notre mesure de diversification technologique étant l'agrégation des brevets détenus dans chaque champ technologique ramenée à la totalité des brevets présents dans le portefeuille de la firme, une société possédant 30 brevets dans un champ A et 2 brevets dans un autre champ B serait considérée comme diversifiée. Pourtant, d'un point de vue réaliste, cette société apparaît clairement comme une entité spécialisée ou en voie de diversification mais en aucun cas comme diversifiée au vu de son portefeuille de

brevets concentré à plus de 90% dans le champ A. Par conséquent, dans un souci de préservation de la richesse économique et en raison d'une distribution asymétrique positive car nous traitons de brevets et de valeurs extrêmes, nous avons créé une nouvelle variable binaire ajustée à la médiane du HHI des catégories et des sous-catégories sur l'ensemble de l'échantillon afin de pouvoir distinguer deux sous-échantillons correspondant aux sociétés diversifiées et spécialisées. Concrètement, la cible est considérée comme étant diversifiée dans les sous-catégories et égale à 1 si son HHI est inférieure à la médiane de référence, sinon elle est spécialisée et égale à 0. Nous avons suivi la même logique pour les catégories.

L'objectif de ce deuxième essai est d'examiner comment les primes de fusion et les marchés réagissent en fonction de trois aspects principaux, à savoir : 1) si la cible est technologique ou non ; si tel est le cas, 2) si la cible est technologiquement diversifiée ou non ; et, 3) si l'acquéreur lui-même est technologique ou non.

Notre première contribution a été de compléter la littérature existante sur les facteurs spécifiques qui affectent les primes de fusion. Étant donné que de nombreux documents se sont concentrés sur les fusions/acquisitions sans pour autant expliquer la grande variation entre les primes dans un contexte technologique, notre analyse de la diversification technologique met en avant la qualité des brevets, mesurée par leur dispersion au sein des domaines technologiques, et son influence sur la prime versée aux sociétés cibles.

Notre deuxième contribution met en exergue une approche comparative entre les primes de fusions et le sentiment du marché. La réaction d'une institution ou un mécanisme qui analyse et produit une information sur les événements qui se produisent dans l'économie, à savoir le marché ; et la réaction réaliste, pragmatique et plus humaine, des entreprises qui fusionnent avec un projet d'avenir derrière la tête.

Notre troisième contribution se situe dans notre mesure de la diversification technologique à deux niveaux, mais aussi dans la nouvelle mesure du critère de qualification de la société cible comme étant spécialisée ou diversifiée au vu de ses brevets.

Concrètement, les résultats de ce deuxième essai sont triptyques. Premièrement, en prenant l'ensemble de notre échantillon de 1493 transactions entre 1990 et 2006, nous avons observé que les primes de fusion étaient moins sensibles à la dimension technologique de la cible que la réaction du marché. À

première vue, en introduisant toutes les variables de contrôle et en procédant à des régressions groupées, la dimension technologique (si la firme possède des brevets ou non) des acquéreurs semble l'emporter sur celle de la cible. Quant aux rendements anormaux, ils semblent être plus réceptifs et attentifs au portefeuille de brevets de la cible.

Toutefois, notre deuxième résultat concerne exclusivement un sous-échantillon de cibles technologiques lorsque seule la cible est technologique – peu importe que l'acquéreur possède des brevets ou non -. En exploitant un modèle à effets fixes contrôlant les secteurs d'activité à 2-SIC digit de la cible et l'année du deal, nous avons trouvé que la diversification dans les segments industriels était positivement significative à 10% (5.19) et que la diversification au sein des industries devenait négative à 5% (- 5,47). De surcroît, une fois que nous avons contrôlé les effets fixes du SIC à 4 chiffres pour gagner en précision, non seulement les deux coefficients conservent les mêmes signes opposés, mais ils deviennent amplement significatifs et rejetant l'hypothèse nulle à 1%. D'une part, cela indique indéniablement que les primes payées par les acquéreurs technologiques ou non-technologiques sont augmentées lorsque la cible est diversifiée au niveau des segments industriels ; en revanche, elles sont sérieusement ajustées à la baisse lorsque la cible est diversifiée à travers diverses industries. En ce qui concerne la réaction du marché, elle apparaît positivement liée à la diversification au sein des secteurs d'activité, alors qu'aucun impact n'apparaît au niveau supérieur des catégories - lorsque nous avons contrôlé le code 2-SIC de la cible. De manière surprenante, aucune de notre diversification technologique n'est significative, ni les sous-catégories ni les catégories, une fois que nous avons contrôlé le code 4 SIC de la cible nous empêchant de rejeter l'hypothèse nulle pour la variable dépendante synergy_CARs.

Troisièmement, nous nous sommes concentrés sur un autre sous-échantillon lorsque la cible **et** l'acquéreur sont deux entreprises technologiques – possédant toutes deux des brevets –. Pour ce qui est des primes de fusion, avec les mêmes procédures de contrôles, nos résultats sont largement significatifs avec une p-value de 1% et pratiquement identiques, à cela près, que l'impact négatif de la diversification des catégories/industries est légèrement plus prononcé que l'impact positif de la diversification des sous-catégories/segments industriels. Quoi qu'il en soit, ces résultats suggèrent fortement que, dans un contexte de possession réciproque de technologies, les acquéreurs perçoivent toujours de manière positive les sociétés

cibles diversifiées à l'échelle des sous-catégories, mais ils demeurent très clairement réticents à payer davantage pour celles qui se dispersent au sein de différentes catégories ou industries. Quant au sentiment du marché, la diversification au sein des segments de l'industrie a toujours un impact positif sur les rendements anormaux combinés (5%) lorsqu'on tient compte du code à 2 chiffres SIC ; en revanche, plus aucune réaction ne fait surface en contrôlant avec un SIC à 4 chiffres, qu'il s'agisse de la cible ou des acquéreurs et peu importe le niveau de diversification.

Au final, la différence dans nos résultats empiriques est assez criante entre les primes de fusion et la réaction du marché. Nous avons montré que la diversification technologique joue un rôle prépondérant pour les primes payées aux sociétés cibles technologiques, mais ne semblent avoir aucun effet sur la réaction du marché aux potentielles synergies. Au fond la possession d'un éventail diversifié de brevets constitue une information pertinente aux yeux des sociétés qui fusionnent, mais semble transparente aux yeux du marché.

Notre conclusion met clairement en évidence une différence de perception à l'égard de la diversification technologique et du potentiel qualitatif que peuvent apporter les brevets, selon que nous analysons la réaction du marché ou la détermination des acquéreurs à payer le prix fort pour s'offrir une société diversifiée !

14 - Synthèse du troisième essai de recherche

Notre troisième essai s'inscrit dans l'approfondissement de l'interaction technologique entre sociétés fusionnantes et de son impact par ricochet sur les rivaux de l'acquéreur.

La théorie des droits de propriété, notamment par le biais des travaux d'Oliver Hart (1990, 1995), a introduit une notion de complémentarité plus communément appelée "Synergie" en économie industrielle. En effet, l'absence de synergies réduit considérablement la concurrence des entreprises qui fusionnent, les rendant moins agressives sur le marché. Cela pourrait conduire à des parts de marché de la nouvelle structure inférieures à la somme des parts de marché antérieures à la fusion [Vassolo (2004)]. En conséquence, suivant l'esprit de cette théorie, on pourrait s'attendre à une réaction positive du marché à une fusion impliquant une proximité technologique et des gains de synergie potentiels.

Dans cette perspective, nous avons posé la question de la proximité technologique des entreprises qui fusionnent et de son impact sur la réaction du marché mesurée par les rendements anormaux cumulatifs. Dans l'état actuel des choses, les innovations, les technologies et la course aux brevets suscitent un engouement prépondérant parmi les entreprises de tous les secteurs technologiques. Au-delà de la théorie des droits de propriété, l'économie de la connaissance a également contribué à cette course à l'innovation en mettant l'accent sur l'aspect immatériel caractérisé par la collégialité et la prolifération des connaissances au sein des entreprises. Idriss Aberkane (2015) a énoncé trois règles qui régissent ce concept d'économie de la connaissance et a insisté sur la troisième règle stipulant que les échanges de connaissances ne sont pas linéaires. Cela signifie que la combinaison de deux actifs immatériels ou de connaissances générera au pire une innovation nulle et au mieux une innovation révolutionnaire. Mathématiquement, I. Aberkane (2015) propose une simple équation selon laquelle 1 kilogramme de connaissances plus 1 kilogramme de connaissances équivalent à 3 kilogrammes de connaissances, car connaître A et B ensemble vaut plus que de connaître A et B séparément : $K(A \cap B) > K(A) \cap K(B)$; où K est la connaissance, A et B sont des actifs immatériels.

Fondamentalement, la différenciation des produits et le processus de fusions/acquisitions font davantage référence à la théorie de l'efficacité productive selon laquelle la réduction des coûts et l'optimisation de ressources sous-évaluées ont un impact positif sur les entreprises en fusion, mais mitigé sur les entreprises concurrentes. Cette théorie prédit un effet bilatéral sur la richesse d'une industrie suite à une annonce de fusion.

D'une part, l'annonce d'une fusion peut donner une information positive sur la valeur des ressources du secteur et sur celles contrôlées par les rivaux de l'acquéreur. On peut soutenir que deux entreprises fusionnantes ayant des actifs complémentaires obtiendront une production plus efficace, ce qui se traduira par des loyers infra-marginaux plus élevés et un impact positif sur les gains de synergies attendus par les acquéreurs et les actionnaires cibles [Ahuja & Katila (2001), Sevilir & Tian (2011), Ang & Wu (2011)]. Cependant, le volume accru de fusions/acquisitions au sein d'un secteur peut révéler la haute présence de synergies potentielles, mais également une forte demande de ressources appartenant à d'autres sociétés, ce qui conduit à une réévaluation positive des entreprises concurrentes. En réalité, l'acquisition d'une

autre entreprise pourrait facilement être considérée comme un appel à l'aide et/ou une incapacité à suivre la cadence industrielle ; indiquant ainsi que la concurrence est forte et que les entreprises rivales sont trop compétitives. Fondamentalement, la demande accrue peut donner lieu à des prévisions d'activité de fusion future, donnant lieu à un effet positif « in-play » sur les entreprises concurrentes dès l'annonce de la fusion. [Eckbo (1983), Schumann (1993), Fee & Thomas (2004)].
D'autre part, la théorie de l'efficacité productive prédit que les entreprises concurrentes pourraient souffrir d'une concurrence prononcée dans l'industrie avec l'arrivée d'une nouvelle entreprise combinée et plus efficace [Eckbo (1985)]. Au fond, des fusions se traduisant par des économies d'échelle et une grande efficience, ont tendance à avoir un impact négatif sur le prix du produit d'équilibre du secteur, ce qui nuit aux concurrents et engendre par là-même un effet de richesse négatif. Par ailleurs, un conglomérat ou l'acquisition d'une entreprise appartenant à un autre secteur peut renforcer la nouvelle entreprise en augmentant la diversification de ses compétences et la richesse de ses bases de connaissances. Cet avantage technologique concurrentiel pourrait certainement nuire aux performances des entreprises concurrentes et engendrer des rendements anormaux négatifs pour les concurrents [Aktas et al. (2006), Akdogu (2009), Chung et al. (2014), Stahl (2010), Grimpe et Hussinger (2008)].

Dans le but de faire valoir d'autres arguments sur ce qui pourrait influencer la réaction du marché aux fusions/acquisitions technologiques, nous nous sommes demandé **dans quelle mesure la proximité technologique renforçait les entreprises qui fusionnent et nuisait aux concurrents des acquéreurs**. Concrètement, l'objet de cette étude est d'examiner les conséquences sur les concurrents lorsque les brevets des acquéreurs et des cibles sont industriellement « liés » (fusions horizontale ou verticale) ou « non liés » (conglomérats). Ainsi, nous analysons la proximité de deux entreprises innovantes possédant des brevets appartenant à différents champs technologiques et son impact sur le sentiment du marché, mesuré par les rendements anormaux prévus pour les entreprises qui fusionnent (Synergy_CAR) et les entreprises rivales (Rivals_CAR). L'objectif de cet article est de montrer que plus les portefeuilles de brevets des entreprises qui fusionnent sont proches, et plus les effets nocifs sur les concurrents des acquéreurs sont importants. Notre postulat de base provient de Hart (1995), dont les travaux indiquent qu'une fusion entre entreprises dotées de technologies complémentaires

se traduira par une création de valeur, tandis qu'une fusion comprenant des entreprises dotées de technologies indépendantes est destructrice de valeur. Un chevauchement modéré des bases de connaissances des acquéreurs et des cibles est susceptible de créer des synergies et d'avoir un impact positif sur la production d'innovations de l'entreprise acheteuse. Ainsi, les synergies générées par les fusions donnent naissance à une nouvelle entité plus puissante, capable de baisser ses prix, d'offrir des produits plus performants et surtout de se positionner comme un concurrent majeur.

Notre analyse de la proximité technologique complète la littérature existante sur les effets des fusions/acquisitions sur les entreprises concurrentes. En effet, de nombreux articles se sont concentrés sur les fusions/acquisitions en général, oubliant de spécifier et d'expliquer le rôle crucial joué par les technologies et la course aux brevets. La plupart des études ont montré que la relation entre les rendements anormaux et la proposition de fusion est incompatible avec l'hypothèse de collusion, mais cohérente avec la théorie de l'efficacité productive [Stillman (1983), Eckbo (1983), Fee et Thomas (2004), Becher et al (2008))]. Étant donné que cet article traite de la proximité technologique à un niveau horizontal mais également à un niveau vertical, il n'y a donc apparemment aucun lien avec la théorie du pouvoir de marché ou la formation éventuelle d'un cartel [Betton et Eckbo (2000)].

Par conséquent, cet essai est largement empreint des théories de l'efficacité productive et des droits de propriété.

A partir de Hall et al. (2001, 2005) qui ont réparti chaque brevet par catégories et sous-catégories, tout en respectant la classification internationale des brevets (IPC), nous avons utilisé la mesure de Jaffe (1986) pour rendre compte de la proximité technologique à deux niveaux différents : fusions verticales et fusions horizontales. Le premier fait référence à une proximité technologique au sein de catégories d'entreprises – ou d'industries –, et le second à des sous-catégories – ou à des segments d'industries –. Ensuite, nous avons créé deux variables d'intérêt décrivant, d'une part, la proximité de deux entreprises innovantes utilisant des brevets dans six industries principales, et d'autre part, dans 37 segments industriels. Chacune de ces deux variables est comprise entre 0 et 1 ; où 1 correspond à des modèles technologiques identiques d'activités d'innovation et 0 ne permet pas de tirer parti des activités de recherche de chacun.

La principale contribution de cet essai est de mieux comprendre l'impact des fusions et acquisitions sur les concurrents au regard de la réponse du marché à une annonce de fusion impliquant une proximité technologique entre les acquéreurs et les cibles. En étudiant 428 opérations de fusions/acquisitions dans lesquelles l'acquéreur et la cible ont, chacun, au moins un brevet déposé entre 1990 et 2006, nos résultats empiriques peuvent être présentées en trois points.

Premièrement, nos résultats indiquent une corrélation positive entre les entreprises qui fusionnent et les entreprises concurrentes en ce qui concerne l'impact de la proximité technologique sur les rendements anormaux prédits, cet impact sur les rivaux des acquéreurs allant de pair avec celui sur la fusion des entreprises. D'une part, la proximité technologique au sein de segments industriels se traduit par une réaction positive du marché pour les sociétés fusionnantes, mais également pour les concurrents. D'autre part, la proximité technologique entre différentes industries se traduit par une réaction négative du marché pour l'acquéreur et sa cible, mais également pour ses entreprises rivales.

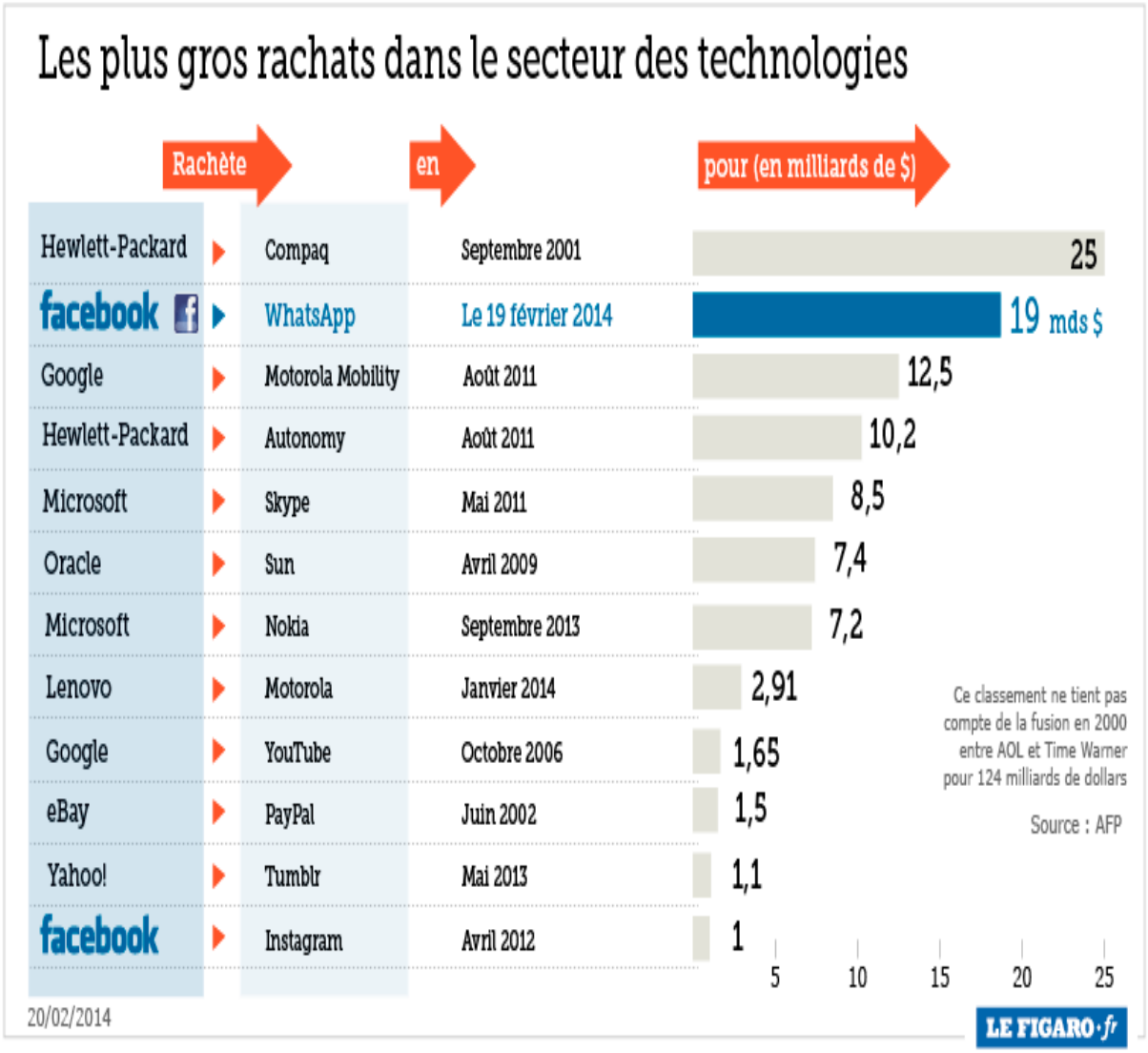
Cela nous conduit à notre deuxième résultat. La proximité de deux entreprises innovantes, utilisant des brevets dans différents segments d'une industrie spécifique (Tech_Prox_S), a un impact positif sur les rendements anormaux prédits ; bien qu'elle soit hautement significative à 5% ou 1% pour les entreprises qui fusionnent, et seulement au niveau de 10%, voire sans importance pour les entreprises concurrentes. Cela suggère qu'une hausse de la demande peut donner lieu à des prévisions d'activités de fusion futures, donnant lieu à un effet « in-play » positif créé par les rendements anormaux des concurrents en réponse à une fusion impliquant une proximité technologique entre les cibles et les acquéreurs.

Troisièmement, la proximité de deux entreprises innovantes, utilisant le nombre de brevets dans plusieurs industries (Tech_Prox_C), a un impact négatif sur les rendements anormaux prévus ; même si elle est très significative à 5% pour les entreprises fusionnées, mais légèrement significative à 10% pour les entreprises concurrentes. Ceci suggère que la proximité technologique au-delà des frontières des entreprises aboutissant à un processus de conglomérat est perçue par le marché comme préjudiciable aux entreprises en fusion, mais également aux entreprises concurrentes. Fondamentalement, une prise de contrôle par un conglomérat peut mettre en avant une sous-performance d'un secteur spécifique dans la mesure où les acquéreurs fusionnent avec des cibles d'un autre secteur. Par conséquent, cela

pourrait avoir un effet de richesse négatif sur ce secteur spécifique et les autres parties prenantes qui en font partie.

Globalement, nos résultats ne concordent pas avec la collusion prévue par la théorie du pouvoir de marché, mais concordent avec la théorie des droits de propriété et l'effet d'information positif prédit par la théorie de l'efficacité productive.

Figure 1 – Les plus gros rachats dans le secteur des technologies



Chapter 1

CORPORATE TAKEOVERS AND TECHNOLOGICAL DIVERSIFICATION
- LINK WITH KNOWLEDGE ECONOMY -

« Quand on partage un bien matériel, il se divise ;
***quand on partage un bien immatériel, il se multiplie** ! »*

Serge Soudoplatoff

Résumé

A partir d'un large échantillon d'entreprises détenant des brevets référencés par NBER durant la période 1990-2006, nous étudions l'impact de l'activité des fusions/acquisitions sur le degré de diversification technologique à deux niveaux différents, à savoir les ***sous-catégories*** (également appelées segments de l'industrie) et les ***catégories*** (également appelées industries). Nous démontrons, tout d'abord, qu'il existe une forte relation entre les activités de fusions et la diversification au sein des *sous-catégories*, suggérant ainsi que les entreprises qui fusionnent, se voient améliorer leur degré de diversification dans les sous-catégories d'une même industrie. En outre, nous constatons que les fusions/acquisitions conclus dans l'année t ne cessent de contribuer au degré de diversification des entreprises au sein des *sous-catégories* au courant des années t+1 et t+2. Enfin, en ce qui concerne le degré de diversification à travers différentes *catégories/industries*, nous avons constaté que l'activité de fusions a un coefficient positif dans l'année t et devient négatif au cours des deux années suivantes mais reste statistiquement insignifiant au cours des trois années t, t+1 et t+2. Nous concluons, donc, que ces entreprises recourent aux fusions afin de performer leur coeur de métier et leurs principaux champs technologiques plutôt que de transcender les frontières de l'entreprise.

Mots clés : Diversification Technologique, Qualité des brevets, Volume Fusions/acquisitions.

Abstract

Using a large sample of firms active in patents from NBER and during the period 1990 – 2006, we study the impact of M&A activity on the degree of technological diversification at two different levels, namely ***Subcategories*** (also called industry segments) and ***Categories*** (also called industries). We first show a strong relationship between M&As activity and diversification's degree within subcategories, suggesting that firms running M&As improve their degree of diversification among industry segments. Further, we find that M&As concluded in year t keep contributing to firms' diversification within subcategories in year t+1 and year t+2. Finally, when it comes to the degree of diversification across *Categories/industries*, we found that M&As activity has a positive coefficient in year t and becomes negative within the two following years but is statistically insignificant over the three years t, t+1 and t+2.
We conclude that firms resort to M&As channel in order to perform their core business and main technological fields rather than to go far beyond the borders of the company.

Keywords: Technological Diversification, patent quality, Mergers & Acquisitions volume

Introduction

On October 2006, Google made the biggest acquisition of its history and purchased Youtube for 1.65 billion dollars. If the Giant of search engines is accustomed to acquiring start-ups for relatively small sums, Google heavily invested to capture the competitor Youtube which is none other than the leader site for sharing and broadcasting videos on the internet. Google only holds 11%[62] of the US market for video broadcasting platforms. In addition to helping Google acquire a dominant position in the video market, this corporate takeover offers the search engine the opportunity to improve the Youtube platform through its technological know-how. A synergy that could enable Google to implement as soon as possible a solution to moderate videos in violation of copyright. As Eric Schmidt said, CEO of Google, "the Youtube team has built a powerful media plateform that complements Google's mission to organize the world of information to make it useful and accessible to all".

Literature on corporate diversification knew a long debate that revolves around the benefits and drawbacks of diversification. Granted, diversification has often been perceived as a detrimental decision to the company or at least as a phenomenon that is not all rosy [Ravenscraft & Scherer (1987), Lang & Stulz (1994), Servaes (1996)]; still, during the last two decades, many authors have shown the interest of diversification for technological companies and its positive impact on the technological performance of the firm. Corporate diversification could be broken down into several types of diversification; these include market, product, and Technological diversification. Our concern about firm's technological diversification stems from the fact that the latter is usually greater than product diversification and anticipates market diversification [Breschi et al (2003)] [63] . Technological interdependence has become ubiquitous within the corporate world. It is no accident

[62] According to a study carried out by Hitwise in the US market.

[63] Indeed, just because a firm is specialized in only one line of business does not mean that this firm is technologically specialized. Fundamentally, product specialization does not necessarily imply technological specialization ; to the contrary, concentrating on just on line of product requires competencies from different technological fields so as to perform and ensure the proper functioning of the final product.

that large firms expand their technological competencies over many technological fields. The literature put forward some plausible reasons to explain this phenomenon of technological diversification. First, there is a technical interdependence between; on one hand, enhancements in the complexity of products and production processes, and on the other hand, complementary improvements required from suppliers of materials [Patel & Pavitt (1997), Granstrand et al (1997), Leten et al (2007)]. Second, firms should concentrate on their core business and spread technological capabilities [Rosenberg (1976), Gambardella & Torrisi (1998)]. Lastly, diversified firms may benefit more from synergy gains than focused or less diversified firms in case technological complementarities and/or proximity enable such interactions to occur [Breschi et al (2003), Van Loy et al (2005), Chiu et al (2008), Lai et al (2010)].

With this in mind, it is legitimate to ask what factors can influence the diversification, and by transitivity, the performance of the company. In this paper, using a large sample of firms active in patents from NBER and during the period 1990 – 2006, we focus on merger activity, in the sense of all mergers and acquisitions undertaken by a firm in a year [Sevilir & Tian (2011)], and its impact on the degree of technological diversification. Indeed, 60% of all public firm mergers in the US over the period 1984 – 2006 involve corporate innovators, as captured by patenting activities, prior to the transaction. We examine whether M&A activity of technological firms, those having at least one granted patent, impacts these very firms' diversification degree across two levels. Thereby, we investigate the evolution, over time, of firms' ***Subcategories***[64] – also called "*Industry Segments*" in the literature and "*Subcategories*" in the NBER database[65] (see Appendix 1 below) –. Intrinsiquely, we also investigate diversification at an upper level, that is technological ***Categories***[66] – called "*Industries or Sectors*"[67] in the literature and "*Categories*" in NBER – [Hall et al (2001, 2005)].

Accordingly, the goal of this study is not only to analyse whether M&As impact the degree of diversification within *technological industry segments* level, but also

[64] It refers more to horizontal or vertical mergers.

[65] The data from Copustat Industry Segment database are not always reliable about reported increases in a firm's number of segments [Hyland & Dlitz (2002), Villalonga (2004)]

[66] It refers to conglomerates.

[67] In this paper, we will use the terms « Categories », « industries » and « sectors » interchangeably. On that same way, we will use « Subcategories », « industry segments » and « business lines » interchangeably.

whether M&As influence diversification's degree across different technological industries. Basically, ***the research question is to wonder whether M&As activity increases firms' degree of diversification among a specific industry, and/or beyond the borders, it enables large firms to improve their degree of diversification across several industries.***

There is no technological resource that can last over time without being incrementally improved so as to live up with customers' expectations. Granted, diversification implies communication, managerial and assimilation costs, still, one way to reduce diversification's uncertainty could be to merge with firms that possess new and/or complementary knowledge base; similar to all firms in the economy rather than those that are more similar to their local rivals [Hoberg & Phillips (2010)]. Our focus on the role of M&A activity on technological diversification is motivated by Hart's (1995) approach, arguing that highly complementary assets should be under common ownership while independent assets should be separately owned.

To answer our question, we compute technological diversification as a Herfindhal Hirschman Index – ranging from 0 to 1[68] – once at *subcategories* and *categories* levels for firms active in patents and referenced in NBER. Moreover, we account for M&As activity as MA_Volume measured by the ratio of M&As' deal value operated by the firm in a year t divided by the firm's total book assets as of the end of the year.

We first found that a strong relation exists between M&As activity and the degree of diversification within industry segments since MA_Volume in year t has a negative and significant coefficient on diversification in this very year across *Subcategories*, suggesting that firms running M&As improve their technological diversification within *industry segments*. Economically, the magnitude of MA_Volume suggests that a 10% increase in M&A activity is tantamount to a 0.002 change in HHI of subcategories ranging from 0 to 1.

Second, we found that the estimated coefficient of MA_Volume in year t remains negative and highly significant even one and two years after the transactions. Statistically, the MA_Volume coefficient is still negative and significant at the 5% and 1% levels, respectively in year t+1 and t+2, after controlling for technology, firms' characteristics, industry and year fixed effects. This result suggests that M&As

[68] Where 0 means highly diversified and 1 means definitely specialized.

concluded in year t keep contributing to firms' degree of diversification within *Industry segments* in year t+1 and year t+2.

Third, when it comes to diversification across *Categories/industries*, we found that MA_Volume has a positive coefficient in year t and becomes negative within the two following years but is definitely insignificant over the three years t, t+1 and t+2. These findings illustrate that firms resort to M&As channel in order to perform their core business and main technological segments rather than to go far beyond the industry's borders of the company.

Our paper's main contributions are threefold. First, we contribute to the restricted literature on the relationship between M&As and Technological diversification. Second, we focus on innovation output not through patent counts or citations but through *Technological diversification* so as to know whether M&As activity impacts the degree of technological diversification over time. Third, we test whether this impact is prominent at different levels of technological diversification, on one hand *Subcategories/industry segments*, and on the other hand, *Categories/industries*. We carry out a cross sectional study that analyses M&As' impact on 37 subcategories and 6 different categories as reported by NBER classification of patents [Hall et al (2001)].

Our paper proceeds as follows. We review the literature in Section 1. We develop our hypotheses and define our variables in Section 2. We portray our sample and descriptive statistics in Section 3. We examine M&As activity impact on technological diversification and show empirical results in Section 4. We close the paper with a conclusion.

Section 1: Literature review

1.1. Why do firms resort to technological diversification?

1.1.1. Corporate Diversification: Opponents V.S. Proponents

Corporate diversification has long been a thorny issue as for its implications on companies' health. Diversification has inherited from one of the oldest ideas in economics that considered corporate diversification as unproductive and inefficient. Previous researchers have demonized diversification by associating the latter to a destruction value within firms. Ravenscraft & Scherer (1987) showed that 33% of acquisitions in the 1960's and 1970's was later divested, interpeting then the divestiture rates as an evidence that diversified acquisitions are value-destroying rather than value-increasing. Nevertheless, this view of divestitures as a fiasco is not the only reason consistent with high divestiture rates because a business is part of a huge continuous change in society and the needs of today are not a fortiori the same as yesterday or even tomorrow. Just because a divestiture occurs, does not mean that original acquisition was unsuccessful or a bad investment; you may sell a business that was a source of synergistic gains and new competencies merely because there are no more synergies to benefit from after a certain time [Kaplan & Weisbach (1992), Patel & Pavitt (1997)]. Hence, both the original acquisition and the sale could have improved shareholder value. Kaplan & Weisbach evaluated the extent to which divestitures result from unsuccessful acquitions during the 1980's and use empirical evidences to qualify the idea that divestitures are tantamount to failed acquisitions or bad investments. They found that bidder announcement returns for diversifying acquisitions are mixed. Granted, they found that 43,9 % of the acquisitions have been divested by the end of 1989, still, several divestitures are not disasters. From an expost view, their findings showed that 42 % of divestitures exhibit a gain while 44% report a loss on sale; furthermore, 43% of diversifying and 40% of related divestitures register a gain on sale. Actually, there is no significant

difference what with the stock market reactions to diversification announcement and reactions to related acquisitions.

Lang & Stulz (1994) insisted also on this diversification's pernicious impact and argued that diversified firms trade at an average discount relative to single-segment firms. On that same perspective, Servaes (1996) dealt with the value of diversification during the conglomerate merger wave, wondering whether diversification resulted in higher market values during this period. From that point, he also tries to find some reasons to explain this valuation differential. Examining the value of diversification when many corporations started to diversify and whether the benefits of diversification outweigh the costs, he finds no striking evidence about the value of diversified companies. Compared to single segment firms during 1960's, diversified firms were not valued at a premium but instead at a discount. Nevertheless, diversification discount declines to 0 and is not significantly different from 0 in the early and mid 1970's. When it comes to insider ownership, firms with high insider ownership did not have a tendency to diversify when the diversification discount was large (1961 – 1970). However, these firms found the taste of diversification when the discount declined (1973 – 1976), meaning that the cost of shareholders was minor and insiders wanted to lower their exposure to firm-specific risk. From managers' point of view, there are no collateral costs on shareowners through diversifying since diversification costs was close to 0 over 1970's. Notwithstanding, managers who decided to diversify, when diversification discount is considerable, did generate significant costs on their shareowners by not improving their specialization. Roughly, diversification has not been beneficial for US corporations with an exception in the first half of the 1970's.

That said, subsequent empirical studies showed that discount appears ex-ante diversification decision and is, actually, merely a result of sample selection bias [Villalonga (1999), Campa & Kedia (2002)]. Diversification discount seems to fade from view or even turns into a premium once one corrects for this sample selection bias, for all that matters. Following this idea, Graham et al (2002) shows that more than 50% of the discount occurs because firms chose to diversify within segments that are already discounted before their acquisition. Villalonga (2004) raises a new empirical question to test whether segment data will result in a higher or lower

discount than other sources. The bottom line is to know whether diversification discount is an artifact of segment datas. She pinpoints the bias that comes from Compustat's segment datas due to the fact that the aggregation of activities into any given segment SIC code differs from firm to firm because segments are self-reported by firms. Previous empirical works that used Compustat classification reported a diversification discount. Instead of this classification, Villalonga (2004) puts forward Business Information Tracking Series (BITS) as an alternative data source to categorize segments and assess the value impact of diversification. Using a sample of 41 203 605 firm-year from BTIS data over the period 1989 – 1996, she finds that diversifiers deal at an average premium of 0.28 compared to single-business firms. During this period, the premium is statistically significant and ranges from 0.11 to 0.43 values. According to her work, this value differential stems first from the fact that « compustat yields a conglomerate discount that is different but consistent with the premium found in BITS for related diversification, and second from managerial latitude in reporting segments through strategic ways. Basically, the effect of diversification should be taken with a grain of salt since the value of diversification is contingent on data source used.

1.1.2. Technological Diversification: key success factor?

Technological interdependence has become ubiquitous within the corporate world. It is no accident that large firms expand their technological competencies over many technological fields. The literature put forward some plausible reasons to explain this phenomenon.

First, we must note a technical interdependence between; on one hand, enhancements in the complexity of products and production processes and on the other hand, complementary improvements required from suppliers of materials. Patel & Pavitt (1997) raised the question of nature and determinants of firms' technological competencies. They found that « complexity constrains companies to search and experiment in and out what they already know », so as to range beyond their distinctive core. In spite of assimilation costs of externally acquired technologies called « Absorptive capacity », it became a necessity for large firms to make investments in different technological fields [Granstrand et al (1997), Leten et al

(2007)]. Businesses evolve in an interactive technological world where innovation is the result of going back and forth between the technological possibilities in place, the market and the new trend technologies. Diversifying investments accross different industry segments of opportunity is more likely to generate growth value than investing in a selected industry segment, provided that innovators keep an eye on technological coherence (as explained below). Arguably, firms have to think in terms of emerging technological opportunities: what was a marginal technological profile yesterday could become a core profile today or tomorrow. Developing knowledge in a variety of fields engenders new possibilities to cross fertilize and create functionalities to make their production process better.

Second, technology portfolios, where knowledge is spread over a wider spectrum, go hand in hand with high level of signals of technological diversification [Leten et al (2007), Chiu et al (2008)]. Many papers argued that diversification in technological bases outperform product diversification. Patel & Pavitt (1997) showed that large chemical and electrical firms are more active in non-metallic minerals technologies than non-metallic firms themselves. The bottom line here is to take advantage from a different technology which is important for their core business, and definitely not to get access into other different markets. On that way, Gambardella & Torrisi (1998) analysed the relationships what with technological diversification and business diversification in the sense of downstream activities. Focusing on 5 factors [69], they argued that firms should concentrate on their core business and spread technological capabilities. Granted, technological convergence is « the process by which different industries come to share similar technological bases » [Rosenberg (1976)], still technological convergence is also motivated by the rise of generic technologies that can be used in several different technologies. Basically, higher performance is positively associated to companies that focused on their downstream activities and increased their technological diversification at the same time.

Third, in contrast to a diverse portfolio, investing within nearest technological fields is usually proned to stronger internal selection due to duplicate opportunities. Taking the context of alliance portfolios, Vassolo et al (2004) showed that when a firm

[69] Computers, telecommunication equipment, electrical components, other electronics, and non electronic technologies

invests in several new ventures within a proximate defined industrial segment, the aggregate growth value of its investments is inferior to the sum of each venture's individual growth value (sub-additivity effect). To speak truth, diversified firms may benefit more from synergy gains than focused or less diversified firms in case technological complementarities and/or proximity enable such interactions to occur. Indeed, several papers examined the relationships between technological diversification and technological performance, through technological coherence [Breschi et al (2003), Van Loy et al (2005), Chiu et al (2008), Lai et al (2010)]. The common result that stands out from these studies states companies that diversify technology portfolio in a technologically coherent way may increase benefits of diversification. Leten et al (2007) showed that the higher the level of technological coherence of a firm's, the greater the positive effect of technological diversification on technological performance. Breschi et al (2003) studied firms from 6 countries from 1982 to 1993 and insisted on knowledge-relatedness as a key driver of firm's technological diversification. The influence of related technologies on the likelihood for a firm to diversify in a given field increases with the level of the firm's diversification. Furthermore, large diversified firms are more « coherent » than smaller diversifiers, possibly because they select first all the classes closely minked to those classes they start with, and thus select other classes within the « technological gap » if necessary.

Figure 2 – Technological diversification's characteristics and stakes

	1	2	3
Authors	Patel & Pavitt (1997)	Leten et al (2007)	Breschi et al (2003)
Sample	440 world's largest firms	184 global firms	Firms from 6 countries
Period	1969-1974 and 1981-1990	1995-2003	1982-1993
Research Question	What are characteristics of technological competencies?	What is the impact of Tech Coherence on the relationship between Tech Diversification and Tech Performance?	The range of firms' innovative activities? The impact of knowledge-relatedness on technological diversification?
Dependent variable(s)	- Rate of technological accumulation	- Patents: ↳ Yearly number of firm EPO patent applications.	- Presence versus absence in a certain technology class
Results	• Firms are **multi-field** ↳ *complexity constrains firms to search and experiment **in and out what they already know.*** • Firms are *highly stable and differentiated*. • Firms are **even more diversified in technological portfolios** *than product portfolios*.	• The marginal effect of Tech Diversification is initially **positive** BUT decreases after a certain level to **become negative** for highly diversified firms. • The ***higher the level of Tech Coherence*** ⟹ *the greater the positive effect of Tech Diversification* on Tech Performance.	• Firms tend to diversify in technologies in which a country has advantages. • **Relatedness effect on diversification increases with the extent of firm's diversification**. • It is possible that *firms which diversify in two or few more technology classes do not necessarily reach the closest one*.
Conclusions	Each *firm's technology profile is **very stable over time**, is **similar** to firms in the same industry, but is **strongly differentiated*** from other industries.	Too much diversification may negatively impact technological performance. ***Firms can ↗ diversification's benefits by extending activities into Tech Coherence.***	**Knowledge-relatedness is a key booster of firms' diversification**. *Large diversifiers are more « coherent » than smaller diversifiers.*

Figure 3 – Technological diversification's characteristics and stakes (ctd)

	4	5	6
Authors	Gambardella & Torrisi (1998)	Garcia-Vega (2006)	Servaes (1996)
Sample	19 US and 13 European firms	544 firms for 15 EU countries	From 266 firms in 1961 to 518 in 1976
Period	1984-1992	1995-2000	1961-1976
Research Question	The relationships between technological diversification and business diversifation.	The linkage between technological diversification and innovation.	Did diversification lead to higher market values during this period? If so, what were the sources of this valuation differential?
Dependent variable(s)	- Measures of Performance: ↳ Log(sales), Profits, and Sales/Employees	- Log (R&D/Sales) - Nb of patents	- Q ratios - Primary ind-adj Market/Sales - Insider Ownership
Results	• Firms that ***focus on business operations enhance their performance***. • ***Technological diversification*** *has a* ***positive*** *impact on performance.* • ***Technological convergence*** implicitly drives firms to diversify.	• Significant ***positive correlation*** *between Tech Diversification and innovation*. • An ↗ in the firm's Tech diversification can promote the cross-fertilization between different Tech areas, and reduce the lock-in effect in low profitable technologies.	• *Diversifiers are valued at a* ***discount*** *relative to single segment firms* during 1960's. • Diversification **discount declines over time** and is not significantly different from 0 in the first half of 1970's • Strong insider ownership firms specialized when diversification discount was peaked (61-70), BUT diversify when it evaporates (73-76).
Conclusions	*Greater performance is associated to a* **focus on downstream activities and an increase in technological diversification**.	*Technologically diversified firms invest a higher proportion of their sales in R&D which* **impacts positively** its **innovativeness** through **diversification**.	**Diversification has not been beneficial for US corporations** with an exception in the first half of 1970's.

1.2. M&As, innovation, and technological diversification

1.2.1. Knowledge Bases improveness: a good motive for M&As

In the last two decades, several papers linked new acquisitions (M&As, external CVIs) to firms' innovativeness. The common point that came out of this literature is about complementary competencies. Basically, mergers between companies possessing complementary technologies is value-enhancing. Regarding « technological langage » and required managerial skills, firms must move towards technologies that are familiar to them. From that, the property rights approach underlines that « a party is more likely to own an asset if she has an important investment decision ». We can then define mergers as being a meeting between competencies with a view to improving innovation by internalizing issues related to property rights and technology transfer.

Hart (1995) starts from the basic idea that firms arise in situations where writing good contracts is complicated making the allocation of power or control a thorny issue. However, the boundaries of firms are drawn so as to obtain power optimally amid the parties to a transaction. He defined ownership as having residual rights of control or power over « the machine »; which implies that purchasing the machine is more profitable than just rent it. Typically, highly complementary assets should be under common ownership while independent assets should be separately owned. Basically, a merger between firms with highly similar assets is value-enhancing while a merger between firms with dissimilar assets is value-reducing. Moreover, integration should be urged when the industry contains a small number of firms due to the fact that complementarities between the bidder and the target are significant.

Following the same spirit, Hoberg & Phillips (2010) examined the impact of product market relatedness on merger-pairing and ex-post performance. Strating from the companies' product description in 10K reports from the SEC Edgar website, they introduced a variable called « product market relatedness » and implemented it to 49 908 firm-observations over the period 1997-2006. They found that bidders

purchase targets that are more broadly similar[70] to all firms in the economy rather than those that are more similar to their local rivals. Also, long-term real outcomes are better when the merging firms are similar; the latter are even more significant when the merger allows the acquirer to stand out from its rivals. Definitely, product market relatedness plays a crucial role ex-ante and ex-post the transaction.

Based on Hart's approach, Bena & Li (2014) worked on the existence of synergies between merging companies in the realms of innovation and their influence on corporate acquisition. Taking the merger-pairing context, they wondered whether merger partners possess complementary technologies prior to the transaction and –if so – which characteristics of overlaps impact M&As decisions. Studying 1135 pairing through 4 measures of innovation overlaps[71] from 1984 to 2006, they showed that technological complementarities what with bidder and target innovation activities have positive and significant effect on merger-pairing. Also, Technological complementarities help downplay information asymetry due to the fact that if the merging firms are familiar with each other's technologies, then information asymetry between them is reduced. Furthermore, they argued that technological overlaps or product market synergies –not both – drive firms into purchasing others.

Intuitively, to assess the pace of an inventive step, researchers and analysts tend to refer to the number of patents filed for a company in a given period. However, Hirschey & Richardson (2004) point out that the number of patents is an imperfect indicator of innovative activities since it does not capture the true economic value of innovation. In fact, innovation varies considerably depending on the technological and/or economic value, and the distribution of this value is therefore "distorted". Thus, the measurement of the number of patents is by nature limited since it can not erase this heterogeneity. In addition, reluctance has been brought about the informational relevance of patents, thus giving a perception of the patent as a deceptive tool. In his study of 173 biotechnology companies, Lerner[72] (1994) emphasized that not all patents are perceived in the same way by investors; it

[70] In their paper, Hoberg &Phillips (2010) defined « similar » as close to each other in distance in this product location space.

[71] Technological proximity ; Knowledge Base Overlap ; Acquirer's/Target's Base Overlap Ratio ; Acquirer's/Target's Cross-Cites Ratio

[72] "The Importance of Patent Scope: An Empirical Analysis," Rand Journal of Economics, 25 (Summer 1994): 319-333

depends on the field based on the patent classification plan. Lerner (1994) insists on the assessment of the patent, which must go through economic indicators that better reflect the quality of the patent.

1.2.2. M&As impact on innovation output measured by patents

The twenty-first century definitely marks the transition to a new era: that of knowledge economy. This is evidenced by the exponential growth in the number of patents from $ 50 billion in 1994 to $ 200 billion in 2008[73]. If in a material economy, the protection of your property can be done in a bunker, a safe or under your mattress; in the knowledge economy, only secrecy or intellectual property is a real shield for your inmmaterial goods.

Grilliches (1990) raised the question « What can one use patent statistics for? » and stated that Patents are an effective indicator of R&D output. A major problem is the identification and measurement of innovations and inventiveness, the benefits a company receives from R&D activity. One way to tackle this issue is to use information on patenting by patent's technological class « to cluster firms into common technological activity clusters and looking whether a firm's variables are related to the overall activity levels of its cluster ». A wide body of academic papers highlight the strong relationship between R&D and patents number, suggesting that the latter are a good indicator of differences in activity across firms [Grilliches (1990)]. However, using patents as a proxy for the pace of innovation output poses a serious threat on the economic reality and reliability.

Patent Scope depends on the linkage between inventions and the extent to which innovations require a diversity of technical and non technical inputs. Some patents are essential to the design of the final marketable product, while others interven only at a milestone or an intermediate step of the industrial process. Basically, there is no one-to-one relationship between R&D expenses and patenting activity. [Grilliches et al (1989)].

At a time when knowledge doubles every 9 years in quantity since the 1980s, and when the volume of M&As reached $ 4,123 billion in 2007 and the all-time record

[73] Source : World Intellectual Property Organisation.

of $ 4,590 billion in 2015[74], one can realize that mergers have become a formidable weapon to gain innovation and develop a competitive advantage. That said, the biggest deals are mainly in the US and in the technological fields. Among them we can mention Google, Facebook, Pfizer, ... All of them are intensive R&D companies in search of new patents and new technologies.

Arguably, firms that merge with a complementary partner are diversifying their portfolio, at least at the industry segments or subcategories level. Nonetheless, it still remains the question of the real impact of M&As as a volume on firm's degree of technological diversification. That said, other studies – although few in number – focused more on new acquisitions as a variable of interest, wondering about the impact of the latter on several aspects of innovation.

Among them, Lin & Lee (2011) concentrated on the impact of portfolio diversity and strategic linkage, wondering whether and how a corporate investor can enhance future growth opportunities through corporate venture investments (CVIs). They took CVI magnitude as the ratio of the total costs of CVI portfolio and a firm's total assets. Within the IT&E sector, they studied 111 firms over the period 2000-2003 and found that increasing CVI portfolio diversity and maintaining vertical strategic linkages between companies and firm's core business lead to firm's growth. Basically, diversifying CVIs accross differential industry groups and pursuing multiple invest in a narrow product arena can result in growth opportunities. Strategically, investing in ventures that are horizontally linked with the investing firm's core business is better than opting for vertical linkage.

One of the first papers that tackles the issue of external corporate ventures (CVs) is the one of Lai et al (2010). The latter examined the role of complementary assets in the relationships between external corporate ventures run by 583 Taiwanese firms and their technological scope from 1997 to 2003. They measured external corporate ventures as all long-term assets invested in via corporate ventures in a year out of assets' book value in this very year. Their findings showed that acquiring external resources through CVs contributes to diversify firm's portfolio and plays a role in broadning of its technological scope, defined as « the extent to which a firm expands its technological capabilities from specific fields into a broader range of technological domains » [Breschi et al (2003)]. That said, technological specialization and

[74] Source : https://www.amkeo.fr/1087-2/

diversification must be construed as two interacted choices on a single continuum. Increasing investments in specialized complementary assets will compel firms to run external CVs in order to perfect their technological scope, for all that matters.

On that same perspective, Sevilir & Tian (2011) investigated the relation between M&A volume and innovativeness of all US public firms during the period 1990-2006. Measuring M&A volume by aggregating the transaction values of M&As undertaken by the firm in a year and divide this total by firm's total book assets as of the end of the year. They tried to put forward evidence of a significant positive association what with M&A activity of a firm and its innovation output measured as the number and the novelty of the firm's patents obtained after M&A activity. Statistically, an increase of 10% in the volume of M&As transactions is tantamount to a 1.01% increase in the number of filed patents in the first year following the M&A activity. Their results also showed that the target's ex-ante R&D intensity and patent activity are positively associated with the acquirer's contemporaneous as well as ex-post innovation. Statistically, an increase of 10% in the target's number of patents in the 3-year before acquisition is tantamount to an increase of 2.23% in the acquirer's number in the year after the transaction. Roughly, they found that M&A activty has a positive effect on subsequent innovation outcome and that acquistions including R&D intensive targets result in positive and significant announcement returns.

Figure 4 – Value added of M&As and technological diversification

	7	8	9
Authors	Hoberg & Phillips (2010)	Sevilir & Tian (2011)	Lai et al (2010)
Sample	49 908 firm-observations	105 314 firm-observations (All U.S. public firms)	583 Taiwanese firms (Electronic and Information Technology category)
Period	1997-2006	1990-2006	1997-2006
Research Question	The impact of product market relatedness on merger-pairing and ex-post performance.	The relation between M&A activity and the innovativeness of the firm.	How does a firm's engagement in external CV determine the scope of its capabilities?
Dependent variable(s)	- Profitability and Sales	- Ln (innovation) ↳ Ln (nb of patents) ↳ Ln (cites/patents)	- Technological Scope
Results	• ***Bidders purchase targets that are more broadly similar to all firms in the economy*** rather than those that are more similar to their local rivals. • *Long-term real* ***outcomes are better*** *when the merging* ***firms are similar.*** • Outcomes are better when acquirers reside in ex ante competitive product markets.	• Firms with **greater M&A volume generate more patents** than lower M&A volume. • Increasing *M&A activity* by **10%** ⇒ ↗ **1.01%** *in the nb of filed patents* in the first year. • **Positive** association between M&A activity and innovation – stronger for large and mature firms –. • An increase of **10%** in the *target's nb of patents* in **acq–*3years*** ⇒ ↗ **2.23%** in the *acquirer's nb of patents* in **acq*+1year.***	• ***Tech specialization and diversification*** are not considered as two independent choices but as ***a single continuum***. • External corporate ventures make firm's broadening of its scope easier. • *Investments in specialized complementary assets will incite firms engage in external CV to perfect their Technological Scope*.
Conclusions	Product market relatedness has a **positive impact** on profitability and sales.	Post-acquisition patents of the *Acquirer* are **positively related** to the R&D intensity of the *Target* and its patents ex-ante the merger.	**Concentrated Technological Scope is the conjunction of tech capabilities and complementary assets**, not determined by either individually.

Figure 5 – Value added of M&As and Technological Diversification (ctd)

	10	11	12
Authors	Lin & Lee (2011)	Bena & Li (2014)	Lerner (1994)
Sample	444 firm-year observations	1135 merger-pairing (2572 acquirers, 1744 targets)	173 biotechnological firms
Period	2000-2003	1984-2006	1973-1992
Research Question	Whether and how a corporate investor can enhance furture growth opportunities through CVIs?	Are acquisitions driven by technologically advanced firms or by technology laggards? Do merger partners possess complementary technologies prior to the transaction?	The impact of patent scope on market value.
Dependent variable(s)	- Firm's growth value ↳ Tobin's Q ↳ Growth option value	- *Binary variable*: 1 if merger-pairing; 0 otherwise	- Log (Market Value)
Results	• *Diversifying investments accross different fields* of opportunity is **more likely to generate growth value** than investing in a selected field. • **Horizontal linkages and synergistic gains** between the acquirer and the target ***positively impact investing firm's growth value.***	• ***Acquiring firms*** are: ↳ More innovative firms as measured by the quantity of *innovation output.* • ***Aquired firms*** are: ↳ Less innovative as measured by the declining rate of growth in *innovation output.* • ***Technological synergies*** *between merging firm's innovation activities* have a **Positive and significant** *impact on merger-pairing.*	• **Patent scope** has a *significant **impact** on the value of the firm.*
Conclusions	Firm's growth is associated to ***increasing CVI portfolio diversity and maintaining strategic linkages between companies and firm's core business***.	**Technological complementarities** are a *specific and tremendous **source** that drives **acquisitions.***	**Patents are misleading tools.**

Section 2: Hypotheses and variables' description

2.1. Hypotheses

It is commonly believed that a resource defined as valuable, rare, imperfectly imitable and non-substitutable (VRIN) is a factor of competitive advantage. However, focusing only on this resource and its capabilities might be reckless. There is no technological resource that can last over time without being incrementally improved so as to live up with customers' expectations. Firms then should resort to technological diversification within technological industry segments or even across other categories. Garcia-Vega (2006) showed that an increase in technological diversification can tremendously create the potential to cross-fertilize with different technological areas, and reduce the lock-in effect in low profitable technologies.

However, one must keep in mind that granted diversification implies new opportunities, still it also implies managerial and assimilation costs. In many cases, firms cannot develop these new resources internally. One way to reduce diversification's uncertainty could be to merge with firms that possess new and complementary knowledge base; similar to all firms in the economy rather than those that are more similar to their local rivals [Hoberg & Phillips (2010)]. Following Hart's approach (1995), highly complementary assets should be under common ownership while independent assets should be separately owned. Basically, a merger between firms with highly similar assets is value-enhancing while a merger between firms with dissimilar assets is value-reducing. The target would then improve bidder's innovation that already exist or accompany him within new technological fields that she is part of.

Another argument that may favor diversification is managers' careerism and self-aggrandizement. Actually, diversification comes in the aftermaths of managers' will to protect their human capital's value. They would prefer to be in charge of assets within different industries and, thus, making their competencies more diversified and essential to the business. We then hypothesize that:

H1: The higher M&A volume, the greater is firm's degree of technological diversification within subcategories/industry segments.

Instead of perceiving categories diversification as a hazardous decision, we assume this phenomenon could be understood as a dynamic value-maximizing strategy. It goes without saying that the process of looking for a business that is a good match for firm's competencies is filled with uncertainty, but in some situations the uncertainty is resolved by entering a new industry/category [Matsusaka, (2001)]. Taking the example of an asymmetric information between firms and investors, the former may decide to relinquish positive net present value projects offered by the latter. And yet, diversification can open new knowledge bases' doors and allow managers to create internal capital markets, which are less prone to asymmetric information problems [Williamson, (1970)]. Nevertheless, we keep in mind that diversifying through another "stranger" category or industry remains risky and could engender negative consequences for the acquirer or even for both acquirer and target. As Granstrand[75] (1998) argued, "firms with a technologically diversified portfolio are likely to bear large integration, coordination and communication costs." We then hypothesize that:

H2.a: The higher M&A volume, the greater is firm's degree of technological diversification across categories/industries.

H2.b: The M&A volume impact on diversification degree across several categories/industries is relatively smaller than the one within subcategories/industry segments.

Thereby, not only could a merger enhance technological diversification across technological fields, but also across categories.

Basically, acquiring external technological resources might give access to new equipment, new technological know-how and new environment; that is, technological diversification.

We expect a negative sign for the coefficient estimate of M&A activity on technological diversification measured by HHI that ranges from 0 (diversifiers) to 1 (specializors) – see section 2.II for variables' construction.

[75] Granstrand, O. (1998). Towards a theory of the technology-based firm. *Research policy*, *27*(5), 465-489.

2.2. Variables' description

2.2.1. Dependent Variable: Technological Diversification

To account for the degree of technological diversification, we choose Herfindhal Hirschman Index (HHI) measure. Originally, HHI was used to measure the level of industrial concentration. A high level of monopoly power within an industry is tantamount to an HHI close to 1; while a weak monopoly power is traduced by an HHI close to 0. On that perspective, Hall[76] (2002) defined HHI as the concentration of patents within technological fields and the concentration degree of a firm's technology capabilities. Concretely, if all firm's patents are located at one technological field, HHI of patents is equal to 1. By contrast, if firm's patents are spread over many technological fields, HHI would be close to 0.

Moreover, innovation comes in the aftermaths of recombining existing elements of knowledge into new complementary syntheses (Schumpeter, 1934), and increasingly innovation urge firms from different industries to cooperate together in the realms of technological inventions. In this connection, we first compute HHI within firm's industry segments, and in the second instance, we compute HHI across firm's industries in which the latter was reported to have at least one patent application during the period 1990-2006.

This HHI measure[77] is computed in two steps.

First, we calculated the Revealed Technology Advantage (RTA) measure that gives the relative importance of the firm to each field of technological competence, after taking account of the firm's total volume of competencies (Patel & Pavitt, 1997).

$$\mathbf{RTA}_{i,t} = \frac{\text{Patent Share}}{\text{The firm's aggregate share in all the fields}}$$

[76] B.H. Hall, A note on the bias in the Herfindahl based on count data, in: A. Jaffe, M. Trajtenberg (Eds.), Patents, Citations, and Innovations, MIT Press, Cambridge, MA, 2002.

[77] Other measures of diversification have been derived from the initial HHI measure depending on the authors and the way they want to adapt this diversification measure to their paper. For example, Leten et al (2007) computed diversification as the inverse of HHI ; Chiu et al (2008) used 1- HHI over 364 technological classes ; and Chen & Chang (2010) worked on the original HHI adapted to firms as we do in this paper.

Second, we used the Herfindhal Hirschman Index to account for technological diversification or concentration within firms' subcategories and also within categories[78]. Hall et al (2001) worked on patents through NBER database and put forward a classification of each patent by categories and subcategories, while respecting International Patent Classification (IPC). Categories refered to industries and ranges from 1 to 6 – it refers to conglomerate view –. Subcategories allude industry segments and are referenced by a number from 11 to 69; that said, there are 37 technological fields[79] - it refers more to horizontal and vertical mergers –.

For a set of N patents falling into ***k*** *technological classes* ranging from 1 to 37, HHI of patents across the subcategories for acquirer ***i*** in year ***t*** is defined by the following expression:

$$\textbf{HHI\_Subcat}_{i,t} = \sum_{k=1}^{37} (\mathrm{RTA})^2 \;\; ; \;\; 0 < \mathrm{HHI} < 1$$

For a set of N patents falling into ***k*** *categories* ranging from 1 to 6, HHI of patents across the categories for acquirer ***i*** in year ***t*** is defined by the following expression:

$$\textbf{HHI\_Cat}_{i,t} = \sum_{k=1}^{6} (\mathrm{RTA})^2 \;\; ; \;\; 0 < \mathrm{HHI} < 1$$

[78] The data from Copustat Industry Segment database are not always reliable about reported increases in a firm's number of segments [Hyland & Dlitz (2002), Villalonga (2004)]

[79] See NBER databases for more details

APPENDIX 1: *CATEGORIES level and SUBCATEGORIES level from NBER*

CATEGORIES / industries		SUBCATEGORIES / industry segments	
1	***Chemical***	11	***Agriculture, Food, Textiles***
		12	***Coating***
		13	***Gas***
		14	***Organic Compounds***
		15	***Resins***
		19	***Miscellaneous***
2	***Computers & Communication***	21	***Communications***
		22	***Computer Hardware & Software***
		23	***Computer Peripherials***
		24 / 25	***Information Storage***
3	***Drugs & Medicals***	31	***Drugs***
		32	***Surgery & Medical Instruments***
		33	***Genetics***
		39	***Miscellaneous***
4	***Electrical***	41	***Electrical Devices***
		42	***Electrical Lighting***
		43	***Measuring & Testing***
		44	***Nuclear & X-rays***
		45	***Power Systems***
		46	***Semiconductor Devices***
		49	***Miscellaneous***
5	***Mechanicals***	51	***Mat Proc & Handling***
		52	***Metal Working***
		53	***Motors & Engines***
		54	***Optics***
		55	***Trannsportation***
		59	***Miscellaneous***
6	***Others***	61	***Agriculture, Husbandry***
		62	***Amusement Devices***
		63	***Apparel & Textile***
		64	***Earth Working***
		65 / 66	***Furniture, House Fixtures / Heating***
		67	***Pipes & Joints***
		68 / 69	***Receptacles / Miscellaneous***

2.2.2. Independent variable of interest: M&As volume

To measure our M&As volume variable, we were inspired first by the paper of Lai et al (2010) where the latter use « external corporate ventures » to account for acquisition run be 583 Taïwanese firms. They compute that measure as the ratio of all long-term assets invested via corporate ventures in a year and the book value of assets in this year.

In this spirit, we were mainly inspired by the M&A volume measure of Sevilir & Tian (2011) using SDC Database. Focusing on M&As activity, they construct their M&A volume variable by aggregating the transactions values of M&As operated by the firm in a year and then normalize it by the firm's total book assets as of the end of the year.

Taking, in our study, all US public and private firms reported by SDC from 1990 to 2006, we compute our M&As volume following the measure of Sevilir & Tian (2011).

$$\mathbf{MA\_Volume}_{i,t} = \text{Log}\left[\frac{\text{Aggregating the transaction values of M\&As undertaken by the firm } \mathbf{i} \text{ in a year } \mathbf{t}}{\text{Firm } \mathbf{i}\text{'s total book assets at the end of year } \mathbf{t}}\right]$$

2.2.3. Construction of control variables

We cannot speak about technologies and innovation without mentioning R&D expenditures. Because technological diversification might be affected by other parameters than just M&A activity, we introduce some firm characteristics to control for the impact of M&A volume on diversification within technological subcategories and categories. Following the innovation literature, we control for Firm_size, RD_expense, Firm_logSales, profitability (measured by ROA), Leverage, and growth opportunities (measured by Tobin_Q) - See Appendix 2 for details -. That said, we must keep in mind that firms are not forced to report R&D expenditures which results

in a considerable number of missing values in this variable. Since we lose a high percentage of observations due to missing values within control variables, we create a dummy variable equals to one if the R&D information is reported and zero otherwise. We then replace missing values in R&D expenditures with 0 and reproduce the same standard practice[80] practice for ROA, Leverage, Firm_logSales, and Tobin_Q so as to abtain an homogeneous sample with the same number of observations in our regressions that makes them comparable. All of these five dummies are included in all the specifications in which these controls are used.

Aside from deal and financial characteristics of a firm, one must not overlook a firm's technological characteristics. Following Breschi et al (2003), we introduced two variables that intervene as control variables of the impact on acquirer's technological diversification. Actually, large firms – that are highly active in patents applications and that possess resources along with abilities to develop independent industry segments – would not necessarily resort to a merger in order to diversify. Thus, M&As would impact less firms with higher Size_Pat and higher Size_class, as defined below.

Size_class_Subcat $_{i,t}$ = Number of technological fields in which firm i possesses at least one patent application, from 1990 to 2006, it ranges from 1 to 37.

Size_class_Cat $_{i,t}$ = Number of categories in which firm i possesses at least one patent application, from 1990 to 2006, it ranges from 1 to 6.

Size_Pat $_{i,t}$ = Total number of patent applications held by firm i within year t, from 1990 to 2006, it ranges from 1 to 36778.

[80] Fernández-Kranz, D., & Santaló, J. (2010). When necessity becomes a virtue: The effect of product market competition on corporate social responsibility. *Journal of Economics & Management Strategy*, *19*(2), 453-487.

Section 3: Sample formation and descriptive statistics

3.1. Sample and data collection

In order to form our sample over the period 1990 - 2006, we start with the NBER Patent Data Project that provides data about all utility patents[81] awarded by the US Patent and Trademark Office over the period 1976 – 2006[82]. Using papers from Hall et al (2001) and Bessen (2009), we matched patent assignees by names to firms in Compustat and get the gvkey for each patent. From that point, we sorted patents by gvkey, application year (according to Hall et al (2001), the application year should be used as the realistic time placer for a patent), citations (allcites), a technology class (icl_class), and so on. We then make dataset of summary statistics[83] in order to summarize the number of patents per technology class corresponding to each gvkey and compute Revealed Technology Advantage along with Herfindhal Hirschman Index of diversification for each firm in the NBER database. Accordingly, we obtain 81 617 observations and 4 801 firms. We match these firms with WRDS so that we get financial and firm characteristics, we obtain a sample of 41 702 observations with HHI and financial informations.

From that point, we match this sample with all announced & completed US M&As with announcement dates from January 1st, 1990 to December 31st, 2006 covered by the Mergers and Acquistions database of the Thomson Financial's SDC database[84]. We analyse all deals coded as a merger, an acquisition of majority interest, or an acquistion of assets. Thereby, we only keep an acquisition if the acquirer controls (if any) less than 50 % of the target's shares before the announcement, obtains at least 51% after the deal, and controls greater than 90% of the target after the deal completion. We require that 1) tansaction value be greater than $1 million; 2) neither the acquirer nor the target be from the financial sector (SIC

[81] In our analysis we dropped firms that does not have utility patents (firms whose Pdpass is negative) because utility is a necessary requirement for patentability (US Patent Law).
[82] The NBER is a database of 3 279 509 observations/patents and contains for each patent, an application year, a grant year, a unique patent number, a patent assignee number, and a patent's technology class (according to IPC system) ; among others.
[83] We used the command collapse (sum) on Stata
[84] We begin from 1990 because the information in SDC is less reliable before 1984 and end in 2006 because the patent data available in the NBER Patent Data Project ends in 2006.

6000 – 6999); 3) the acquirer be a public firm and covered by Compustat and CRSP for financial information; 4) deals include both public and private targets. We generate 4 708 deals which brings our sample to 42 827 observations. Removing redundancy within a year because 2 or more M&As occurred and dropping firms with less than 6 year-observations, we obtain our Final Sample of 36 817 observations.

Figure 5 - Construction of the 1990-2006 sample of Acquisitions

Sample over the period 1990 – 2006	
NBER	*81 617 observations and 4801 firms*
WRDS	*52 774 observations covered by WRDS*
Firms Sample = 41 702 observations with HHI and Financial infos	
SDC	*4 708 Public and Private M&As*
NBER + WRDS + SDC = 42 827 observations	
Removing redundancy	*41 706 observations*
Drop firms < 6 year-observations	*4881 observations deleted*
⇒ **FINAL SAMPLE = 36 817 observations**	

3.2. Descriptive statistics

In order to stay on the technological diversification perspective, we split our sample into two kinds of firms, namely, specializors (dummy equals to 0) versus diversifiers (dummy equals to 1). The former refers to firms that are exclusively active in only one technological field or category – depending on the level that is studied –. The latter refers to firms that are active in several technological fields or categories.

Panel A of Table 1 provides summary statistics of the main variables for specializors involved in the study of technological diversification following ***Technological fields Classification***. Intuitively, specializors have an HHI_Subcat equal to 1 and a number of patents (Size_Pat) ranging from 1 to 64 over the period 1990 – 2006. The mean of M&As is equal to 0.014 meaning that an average specializor spends 1.4% of its assets' book value to deal with M&A transactions. Economically, the maximum number of M&As run by a specialized firm is 5 and they spend on average 27 million for purchasing target(s).

As for diversifiers, Panel B exhibits that the mean of HHI_Subcat is 0.4 revealing a high tendency to diversification within industry segments and even more so because half of this subsample revolves around 0.3. Unlike specializors, diversified firms are more active in patenting given that 50% of them are present in more than 5 different technological fields 25% are active in more than 11 different technological fields; and their Size_Pat ranges from 1 to 36 778, for all that matters. Sizeclass_Subcat shows that diversifiers spread over technological fields from 2 to 37 but the mean is about 8 subcategories per firm reminding us that costs of diversification may increase with the spread of businesses due to relative scarcity of managerial capabilities. That said, diversifiers spend on average 1.8% of its assets' book value for M&As but are definitely bigger spenders compared to specializors since they advance at least twice more money on the table when it comes to buy target(s).

Table 2 follows the same spirit of specializors versus diversifiers but reports, this time, descriptives statistics within ***Categories Classification***. Once again, it is normal that Panel C that displays specializors should have an HHI_Cat equals to 1 as they are active in only one category. The number of patents ranges from 1 to 119 and specializors spend on average 2.1% of its assets' book value on M&As

transactions. On the contrary, Panel D puts forward diversifiers whose HHI_Cat is on average equal to 0.53. As we noted it in Table 1, diversifiers are more present in patent activities and corporate takeovers. Table 2 shows that the maximum number of M&As run by a diversified firm is 18 and they spend on average 58 million for purchasing target(s). I would also argue that half of Panel D possesses granted patents inside at least 3 different categories and the top 25% of Panel D are active in at least 5 categories out of 6.

In comparison, Servas (1996) showed that, in 1961, 55% firms[85] of his sample operate in a single segment while 8% only are active in more than 4 industry segments ; In 1976, 28% of his sample operate in a single segment while 30% are active in more than 4 segments.Taking into account our desciptive results, our final sample shows that diversification is very much present across technological firms over the period 1990 – 2006 indicating that innovative interdependence has become an obvious notion and the decision to technologically diversify has become ever-present.

[85] Servaes' (1996) sample was from 266 firms in 1961 to 518 in 1976.

Table 1 : Subcategories / Industry segments Classification

Subcat_Diversifiers	variable	N	mean	p50	p25	p75	p99	sd	min	max
0	HHI_Subcat	6696	1	1	1	1	1	0	1	1
	Total_MAs	6696	27.17327	0	0	0	322.5	498.6798	0	30957.5
	MA_Volume	6696	.0142721	0	0	0	.4101812	.0881723	0	1.978085
	Nb_MAs	6696	.078853	0	0	0	2	.3293839	0	5
	Numb_MAs	6696	.0503156	0	0	0	1.098612	.1964825	0	1.791759
	Sizeclas~cat	6696	1	1	1	1	1	0	1	1
	Size_Pat	6696	2.790621	1	1	3	28	4.643536	1	64
1	HHI_Subcat	30121	.403381	.3274506	.16	.5683536	1	.3005061	5.36e-06	1
	Total_MAs	30121	57.3315	0	0	0	907.09	970.5474	0	89167.72
	MA_Volume	30121	.0184746	0	0	0	.4575254	.1011711	0	3.82981
	Nb_MAs	30121	.1222403	0	0	0	2	.4671802	0	18
	Numb_MAs	30121	.0741548	0	0	0	1.098612	.2451016	0	2.944439
	Sizeclas~cat	30121	8.251784	5	3	11	34	7.584466	2	37
	Size_Pat	30121	222.1801	13	4	51	4353	1276.714	1	36778
Total	HHI_Subcat	36817	.5118896	.4444445	.1994991	1	1	.3561535	5.36e-06	1
	Total_MAs	36817	51.84655	0	0	0	830	903.3265	0	89167.72
	MA_Volume	36817	.0177103	0	0	0	.4532819	.0989463	0	3.82981
	Nb_MAs	36817	.1143493	0	0	0	2	.445613	0	18
	Numb_MAs	36817	.0698191	0	0	0	1.098612	.2371782	0	2.944439
	Sizeclas~cat	36817	6.932884	4	2	9	34	7.408568	1	37
	Size_Pat	36817	182.2792	8	2	35	3791	1157.888	1	36778

Table 2 : Categories / Industries Classification

Cat_Diversifiers	variable	N	mean	p50	p25	p75	p99	sd	min	max
0	HHI_Cat	9715	1	1	1	1	1	0	1	1
	Total_MAs	9715	33.77416	0	0	0	497.525	506.418	0	30957.5
	MA_Volume	9715	.0213098	0	0	0	.5003687	.1188323	0	3.82981
	Nb_MAs	9715	.1139475	0	0	0	2	.4129941	0	6
	Numb_MAs	9715	.0709069	0	0	0	1.098612	.2357171	0	1.94591
	Sizeclas~Cat	9715	1	1	1	1	1	0	1	1
	Size_Pat	9715	4.57684	2	1	4	45	9.003828	1	119
1	HHI_Cat	27102	.53213	.5078125	.3211111	.7346939	1	.2816021	.000063	1
	Total_MAs	27102	58.32479	0	0	0	920.857	1008.181	0	89167.72
	MA_Volume	27102	.01642	0	0	0	.4317514	.090731	0	2.81198
	Nb_MAs	27102	.1144934	0	0	0	2	.456746	0	18
	Numb_MAs	27102	.0694292	0	0	0	1.098612	.2377029	0	2.944439
	Sizeclas~Cat	27102	3.559442	3	2	5	6	1.403708	1	6
	Size_Pat	27102	245.9785	16	5	61	4972	1343.84	1	36778
Total	HHI_Cat	36817	.6555881	.6513983	.4	1	1	.3176409	.000063	1
	Total_MAs	36817	51.84655	0	0	0	830	903.3265	0	89167.72
	MA_Volume	36817	.0177103	0	0	0	.4532819	.0989463	0	3.82981
	Nb_MAs	36817	.1143493	0	0	0	2	.445613	0	18
	Numb_MAs	36817	.0698191	0	0	0	1.098612	.2371782	0	2.944439
	Sizeclas~Cat	36817	2.884075	2	1	4	6	1.650129	1	6
	Size_Pat	36817	182.2792	8	2	35	3791	1157.888	1	36778

Section 4: Empirical results – Public and Private Targets

4.1. Methods and Models

With a view to analysing M&As volume's impact on firms' technological diversification, we estimate the following empirical model in our baseline OLS regressions:

$$\mathbf{HHI\_Subcat}_{i,t+n} = \alpha_o + \alpha_1 \text{HHI\_Subcat}_{i,(t+n)-1} + \alpha_2 \text{MA\_Volume}_{i,t} + \alpha_3 \text{MA\_Volume}_{i,t+s} + \alpha_4 T_{i,t} + \alpha_5 X_{i,t} + \text{SIC\_2}_{i,t} + \text{Year}_{i,t-1} + \varepsilon_{i,t} \quad \textbf{(1)}$$

Where i indexes firms, t indexes time, and n is equal to zero, one or two. The $\mathbf{HHI\_Subcat}_{i,t+n}$ term is the dependent variable and ranges from zero (diversified firms) to one (specialized firms) as we explained above in Section 2. The $\text{HHI\_Subcat}_{i,(t+n)-1}$ term at the right side captures diversification within technological fields for the previous year so as to focus only on the variation between the preceding year and the current year. Our interest variable is $\text{MA\_Volume}_{i,t}$ whose coefficient is α_2. The second term α_3 $\text{MA\_Volume}_{i,t+s}$ captures M&As that occurred during the previous year t-1 or during the following year t+1 and t+2 ; we can then control for other M&As that could affect technological diversification of the studied year – thus, "s" is equal to -1, 1 or 2 – . T is a vector of technological size firm control encompassing Size_Pat and Sizeclass_Subcat measures, as defined in Section 2, that may impact technological diversification. X is a vector of firm's characteristics that may impact technological diversification. Working on diversification within industry segments, we control for industries characteristics by including a SIC-2 digit fixed effects, along with year fixed effects captured by Year.

Examining the impact of M&As on the following years t+1 and t+2 is motivated by the fact that mergers require time and effort from managers and their teams to succeed in integrating and assimilating the new facilities and procedures that result from the transaction.

4.2. Empirical evidences – Subcategories Classification

4.2.1. Linear Regression following Industry Segments Classification

Table 3 : M&As Impact on Industry Segments diversification

	HHI_Subcat i,t		HHI_Subcat i,t+1		HHI_Subcat i,t+2	
	(1) MA Volume only	(2) Tech & Firm Co~l	(3) MA Volume only	(4) Tech & Firm Co~l	(5) MA Volume only	(6) Tech & Firm Co~l
HHI_Sub_exante1	0.88***	0.85***				
	(310.05)	(244.23)				
MA_Volume	-0.02*	-0.02**	-0.02*	-0.02**	-0.01	-0.01
	(-1.90)	(-2.20)	(-1.67)	(-2.39)	(-0.99)	(-1.56)
MA_Volume_exante1	-0.02*	-0.02**				
	(-1.67)	(-2.11)				
HHI_Subcat			0.88***	0.85***		
			(310.05)	(245.77)		
MA_Volume_expost1			-0.02*	-0.02**	-0.02**	-0.02**
			(-1.90)	(-2.22)	(-2.27)	(-2.45)
HHI_Sub_expost1					0.90***	0.88***
					(316.84)	(257.27)
MA_Volume_expost2					-0.02*	-0.02**
					(-1.91)	(-2.02)
Sizeclass_Subcat		-0.00***		-0.00***		-0.00***
		(-25.15)		(-24.87)		(-20.59)
Size_Pat		0.00***		0.00***		0.00***
		(12.02)		(11.16)		(9.18)
Firm_size		0.00		0.00		0.00*
		(1.54)		(1.51)		(1.95)
RD_expense		0.02		0.00		0.02
		(1.33)		(0.07)		(0.84)
Tobin_Q		-0.00		-0.00		-0.00
		(-0.53)		(-0.44)		(-0.34)
ROA		-0.00		-0.00		-0.01**
		(-1.46)		(-1.46)		(-2.14)
Leverage		0.00*		0.00		0.00*
		(1.84)		(0.29)		(1.82)
Firm_logSales		-0.00*		-0.00**		-0.00**
		(-1.90)		(-2.00)		(-2.29)
Constant	0.03***	0.06***	0.03***	0.07***	0.03***	0.03
	(23.41)	(3.69)	(23.41)	(4.22)	(20.78)	(1.47)
Number of Cases	33429.00	33429.00	33429.00	33429.00	30053.00	30053.00
R-Squared	0.80	0.80	0.80	0.80	0.83	0.83

* p<0.1, ** p<0.05, *** p<0.01

4.2.2. Fixed effects Model following Industry Segments Classification

Table 3 reports linear regression of MAs impact following Technological fiels (or Industry segments) Classification and accounts for a significant impact during year t and year t+1 – the coefficient is negative and significant meaning that MAs pull the HHI to zero which suits to diversified firms. However, regarding diversification within industry segments, we use a fixed effects model and control for industries characteristics by including a SIC 2-digit fixed effects, along with year fixed effects captured by Year. Table 4 reports a fixed effects model of MAs impact over technological fields and generates the OLS regression results estimating equation (1). In columns (1) – (3), the dependent variable is **HHI_Subcat** $_{i,t}$ and we examined the M&A volume impact on the degree of technological diversification in year t. The first regression concentrates exclusively on M&A_Volume and the coefficient α_2 is negative and significant at the 5% level. The second regression (2) takes into account both technological and firm characteristics while the third one (3) adds year effects. The coefficient α_2 continues to be negative and significant at the 5% level (even if it gains some more significativity), suggesting that firms that run M&As improve their degree of diversification within technological industry segments. Economically, the magnitude of MA_Volume suggests that a 10% increase in M&A activity is tantamount to a 0.002 increase in technological diversification.

In columns (4) – (6), the dependent variable moves forward to take technological diversification (HHI_Subcat) of year t+1. Thereby, the MA_Volume coefficient is still negative and significant at the 10% level; however, once we introduce control variables it becomes significant at the 5% level, meaning that M&As concluded in year t keep contributing to firms' diversification within industry segments.

On that same perspective, in columns (7) – (9), the estimated coefficient of MA_Volume relative to year t+2 remains negative but definitely more significant since the latter is significant at the 1% level after controlling for technology, firms characteristics, industry and year fixed effects. This result is with no doubt the most interesting one as it goes hand in hand with literature and showing that firms running M&As require time to familiarize themselves with new skills, new technologies, and above all to manage people and new teams. In the realms of technological

diversification across technological fields, we can say that M&As activity bears « delicious » fruit even two years after the transaction.

Beyond the property rights theory, these outcomes are part of a vision of Knowledge Economy since they validate the three rules that govern this concept of knowledge economy as enounced by Idriss Aberkane (2015):

- Exchanges are a positive-sum game.
- Exchanges are not immediate.
- Exchanges are not going on a linear way.

The first rule states that sharing a material good is tantamount to split it or lose it as two people cannot exactly wear the same pair of shoes; either one of them will wear the pair of shoes or each of them will wear one shoes - which does not make sense -. However, when it comes to immaterial capital, sharing an immaterial good is resulting in multiplying this very immaterial good for the reason that the beneficiary of knowledge takes advantage of it and the transmitter of knowledge still owns it. When two firms decide to merge, each of them holds its own immaterial goods – here we take patents – and once they merge, they propagate each of their immaterial goods to make it better through diversification, for all that matters.

The second rule stipulates that knowledge trading is not instantaneous in the sense that it needs Time and Attention. If the trade of tangible assets would require a signature or a click to complete a transaction, and sometimes even at the nanosecond time scale; the transmission of knowledge is played out over the long term. Our results show that a 10% increase in M&A activity produce a 0.002 change in technological diversification which may be said to be a weak impact but with regard to knowledge transmission time it seems to be normal given that departments, managers, teams and all the processes require time to incorporate the new knowledge and to put their attention and effort on it. Moreover, taking the case Google-Youtube (2006), the acquisition carried out by Google is a long-term view. The ambition of Google is, therefore, to evaluate at first a competitor who became too troublesome, then especially in a second time to set himself up as the new world leader in video on the internet. This is in line with the equation of I. Aberkane (2015)

stating that the knowledge flow is proportional to the combination of Attention and Time:

- $\Phi(K) \propto A*T$

Where Φ (K) is the Knowledge flow; A is Attention and T is Time.

The third rule is well illustrated by our results since it underlines that knowledge exchanges are not linear. Indeed, our study focuses on the merge of two companies in the context of immaterial diversification and the benefit to pool two knowledges owned separately by two firms in order to at worst gain technological diversification and at best combine knowledges to create a groundbreaking innovation. This result is in line with the sub-additivity concept and I. Aberkane (2015) inequation where he puts forward that 1 pound of knowledge plus 1 pound of knowledge is equal to 3 pounds of knowledge since knowing A and B together is worth more than knowing A and B separately:

$$K(A \cap B) > K(A) \cap K(B)$$

Where K is knowledge; A is an Immaterial good and B another Immaterial good.

Basically, these results are in line with literature since firms that diversify their technological portfolio in a technologically coherent way may be able to attenuate the potential negative impact and costs attached to technological diversification. Intuitively, coherence implies a presence of sufficient scale and eases coordination and communications. Specialized complementary assets - defined by Chiu et al (2008) as marketing resources, production resources, and human capital – facilitate the process of integration and mitigate the risks related to unfamiliar technologies and environment.

Table 4 : Fixed Effects Model – M&As Impact on Industry Segments

	HHI_Subcat i,t			HHI_Subcat i~1			HHI_Subcat i~2		
	MA Volume only	Tech & Firm ~l	Year Effects	MA Volume only	Tech & Firm ~l	Year Effects	MA Volume only	Tech & Firm ~l	Year Effects
HHI_Sub_exante1	0.87***	0.84***	0.85***						
	(137.45)	(129.14)	(126.06)						
MA_Volume	-0.02**	-0.02**	-0.02**	-0.02***	-0.02***	-0.02***	-0.01**	-0.01***	-0.01***
	(-2.21)	(-2.22)	(-2.39)	(-2.68)	(-3.54)	(-3.58)	(-2.09)	(-2.68)	(-2.79)
MA_Volume_exante1	-0.02***	-0.02***	-0.02***						
	(-2.68)	(-3.15)	(-3.19)						
HHI_Subcat				0.87***	0.85***	0.85***			
				(137.45)	(129.32)	(127.35)			
MA_Volume_expost1				-0.02**	-0.02**	-0.02**	-0.02***	-0.02***	-0.02***
				(-2.21)	(-2.41)	(-2.60)	(-2.69)	(-2.89)	(-2.83)
HHI_Sub_expost1							0.90***	0.87***	0.87***
							(160.94)	(146.96)	(143.82)
MA_Volume_expost2							-0.02**	-0.02**	-0.02**
							(-2.23)	(-2.21)	(-2.20)
Sizeclass_Subcat		-0.00***	-0.00***		-0.00***	-0.00***		-0.00***	-0.00***
		(-11.00)	(-10.39)		(-10.36)	(-9.98)		(-10.39)	(-10.50)
Size_Pat		0.00***	0.00***		0.00***	0.00***		0.00***	0.00***
		(5.25)	(4.94)		(5.22)	(4.94)		(5.23)	(4.46)
Firm_size		-0.00	-0.00		-0.00	-0.00*		0.00	-0.00
		(-0.21)	(-1.29)		(-0.28)	(-1.84)		(0.53)	(-0.29)
RD_expense		0.03***	0.02***		0.01	-0.00		0.03	0.02
		(2.89)	(3.16)		(0.39)	(-0.01)		(1.07)	(1.02)
Tobin_Q		0.00	0.00		0.00	0.00		0.00	0.00
		(1.17)	(1.16)		(1.25)	(1.29)		(1.07)	(1.07)
ROA		-0.00	-0.00		-0.00	-0.00		-0.00	-0.00
		(-0.93)	(-0.29)		(-1.17)	(-0.61)		(-1.52)	(-1.35)
Leverage		0.00***	0.00*		-0.00	-0.00*		0.00	0.00
		(2.83)	(1.93)		(-0.48)	(-1.78)		(1.29)	(1.12)
Firm_logSales		0.00	0.00		-0.00	0.00		-0.00	-0.00
		(0.08)	(0.50)		(-0.08)	(0.59)		(-0.81)	(-0.32)
Number of Cases	33429.00	33429.00	33429.00	33429.00	33429.00	33429.00	30053.00	30053.00	30053.00
R-Squared	0.79	0.79	0.79	0.79	0.79	0.79	0.82	0.82	0.82

* p<0.1, ** p<0.05, *** p<0.01

4.3. Empirical evidences – Categories Classification

4.3.1. Linear Regressions following Categories Classification

Table 5 : M&As Impact on Categories / Industries diversification

	HHI_Cat i,t		HHI_Cat i,t+1		HHI_Cat i,t+2	
	(1) MA Volume only	(2) Tech & Firm Co~l	(3) MA Volume only	(4) Tech & Firm Co~l	(5) MA Volume only	(6) Tech & Firm Co~l
HHI_Cat_exante1	0.89***	0.82***				
	(313.74)	(193.49)				
MA_Volume	0.02***	0.01**	0.01	-0.00	0.01	0.00
	(2.99)	(2.14)	(0.57)	(-0.24)	(0.79)	(0.15)
MA_Volume_exante1	0.01	-0.00				
	(0.57)	(-0.20)				
HHI_Cat			0.89***	0.82***		
			(313.74)	(194.38)		
MA_Volume_expost1			0.02***	0.01**	-0.00	-0.00
			(2.99)	(2.48)	(-0.14)	(-0.29)
HHI_Sub_expost1						
MA_Volume_expost2					0.01	0.01
					(1.33)	(1.43)
Sizeclass_Cat		-0.03***		-0.03***		-0.02***
		(-36.44)		(-36.28)		(-30.77)
Size_Pat		0.00***		0.00***		0.00***
		(11.59)		(10.72)		(8.37)
Firm_size		0.00**		0.00*		0.00*
		(2.23)		(1.95)		(1.79)
RD_expense		0.00		-0.03		-0.01
		(0.01)		(-1.64)		(-0.56)
Tobin_Q		-0.00		-0.00		-0.00
		(-1.49)		(-1.17)		(-0.84)
ROA		0.00		-0.00		-0.00
		(0.61)		(-0.12)		(-0.40)
Leverage		0.00***		0.00		-0.00
		(3.30)		(1.45)		(-0.01)
Firm_logSales		0.00		0.00		0.00
		(1.55)		(1.33)		(1.02)
Number of Cases	33429.00	33429.00	33429.00	33429.00	30053.00	30053.00
R-Squared	0.78	0.79	0.78	0.79	0.81	0.82

* p<0.1, ** p<0.05, *** p<0.01

4.3.2. Fixed Effects Model following Categories Classification

One of this paper's contributions is our analysis of two different levels of technological diversification. After examining diversification within Subcategories or industry segments, we concentrate now on the degree of diversification within Categories or industries as defined in Appendix 1. Following Hall et al (2001, 2005) classification of patents, we tried to see whether MA activity impacts diversification across 6 main categories that are 1. Chemicals, 2. Computers & Communications, 3. Drugs & Medicals, 4. Electrical, 5. Mechanicals, 6. Other miscellaneous.

Accordingly, we replace our dependent variable HHI_Subcat in the previous model with HHI_Cat corresponding to diversification within 6 categories:

$$\mathbf{HHI\_Cat}_{i,t+n} = \beta_o + \beta_1 \, HHI\_Cat_{i,(t+n)-1} + \beta_2 \, MA\_Volume_{i,t} + \beta_3 \, MA\_Volume_{i,t+s} + \beta_4 \, T_{i,t} + \beta_5 \, X_{i,t} + SIC\_2_{i,t} + Year_{i,t-1} + \varepsilon_{i,t} \quad \textbf{(2)}$$

Where indexes refer to the same parameters and numbers as those we use in equation (1) for technological fields.

The basic intuition in this study is to check whether M&As could be a channel to go above firms' borders to explore other industries in order to either obtain new patents, or to get access into new markets, or even to dampen firms' competitors.

Table 5 reports linear regression of MAs impact following Categories (or Industries) Classification and accounts for a significant impact only during year t – the coefficient is positive meaning that MAs pull the HHI to 1 which suits to specialized firms. However, working on diversification within industries, we introduce a fixed effects model and control for industries characteristics by including a SIC 2-digit fixed effects, along with year fixed effects captured by Year. Table 6 reports a fixed effects model of MAs impact over categories and generates the OLS regression results estimating equation (2). In columns (1) – (3) we examined the impact of M&A activity on the dependent variable HHI_Cat in year t. Focusing only on MA_Volume and categories diversification in regression (1), the coefficient β_2 is positive and

statistically significant at the 1% level. Notwithstanding, when we include technology and firm controls in regression (2) and (3), the coefficient remains positive but is no longer significant. We can also add that Size_Pat, Sizeclass_Cat, Firm_size and Leverage are highly significant at the 1% level. The most striking point in results is that the coefficient of M&A volume is positive which can imply that M&As have a counter-effect on diversification across categories in year t. Mergers within independent technological categories may have a negative impact on the merging firms, thus giving rise to the loss of human capital and declining commitment, motivation and morale. Cultural mismatch along with assimilation and integration costs could definitely disturb firms' activities.

In columns (4) – (6) and (7) – (9), we take **HHI_Cat** $_{i,t+1}$ and **HHI_Cat** $_{i,t+2}$ as dependent variable so as to account for subsequent diversification one and two years after the M&A occurs, respectively. Although MA_Volume $_{i,t}$ becomes negative, the coefficient β_2 is no more significant before and after controlling for technology, firms, industries and years. We can advance one plausible explanation to this insignificant impact of M&A activity on diversification across categories. Acquirers expect that mergers within categories may have an adverse effect on their ability to collaborate and innovate making firms reluctant to merge with another firm from a different category given that the risks and costs of such corporate adventure are too important.

If financial markets opposed unrelated diversification during the 1980's, while they favoured diversification across related businesses [Shleifer & Vishny (1991)], our results show that diversification follow this general trend during the 1990's and the early 2000's. These results are not completely surprising since diversifying through another "stranger" category or industry implies a fortiori non-negligible assimilation, coordination and communication costs.

We clearly note a high difference of impact depending on the level of diversification. There is a strong diversification across industry segments compared to categories' diversification where the impact is definitely not significant, which is in line with literature stating that a substantial variance in technological diversification levels remains among companies belonging to the same sector. Fai (2003) and Cantwell (2004) who found that even over a 100 years period, the bulk of companies keep

developing and improving skills within technological fields in which they gained their initial technological competencies. Furthermore, this result images the risks taken by management in the face of technological complexity and uncertainty [Patel & Pavitt (1997)].

Accordingly, if the property rights theory states that highly complementary assets should be under common ownership while independent assets should be separately owned, this paper supports this theory by demonstrating that M&As involving highly complementary technological fields have a tendency to favour technological diversification while M&As between different categories have no significant effect on technological diversification.

Table 6 : Fixed Effects Model – M&As Impact on Categories / Industries

	HHI_Cat i,t			HHI_Cat i,t+1			HHI_Cat i,t+2		
	MA Volume only	Tech & Firm ~1	Year Effects	MA Volume only	Tech & Firm ~1	Year Effects	MA Volume only	Tech & Firm ~1	Year Effects
HHI_Cat_exante1	0.88***	0.81***	0.81***						
	(133.07)	(112.22)	(113.96)						
MA_Volume	0.01***	0.01	0.01	-0.00	-0.01	-0.01	0.00	-0.00	-0.01
	(3.05)	(1.64)	(1.40)	(-0.20)	(-0.72)	(-0.84)	(0.10)	(-0.61)	(-0.84)
MA_Volume_exante1	-0.00	-0.01	-0.01						
	(-0.20)	(-0.76)	(-0.85)						
HHI_Cat				0.88***	0.81***	0.81***			
				(133.08)	(111.56)	(114.62)			
MA_Volume_expost1				0.01***	0.01**	0.01**	-0.01	-0.01	-0.01
				(3.04)	(2.31)	(2.05)	(-0.45)	(-0.49)	(-0.58)
HHI_Cat_expost1							0.90***	0.84***	0.84***
							(150.53)	(141.29)	(139.43)
MA_Volume_expost2							0.00	0.01	0.01
							(0.97)	(1.12)	(0.97)
Sizeclass_Cat		-0.03***	-0.03***		-0.03***	-0.03***		-0.02***	-0.02***
		(-13.66)	(-14.49)		(-13.48)	(-14.48)		(-13.70)	(-15.88)
Size_Pat		0.00***	0.00***		0.00***	0.00***		0.00***	0.00***
		(4.20)	(4.09)		(4.14)	(4.04)		(3.63)	(3.63)
Firm_size		0.00***	0.00***		0.00***	0.00***		0.00**	0.00**
		(2.85)	(2.95)		(2.70)	(2.76)		(2.25)	(2.53)
RD_expense		0.00	0.00		-0.02	-0.02		-0.00	0.00
		(0.51)	(0.58)		(-1.09)	(-0.98)		(-0.18)	(0.09)
Tobin_Q		-0.00	-0.00		-0.00	-0.00		-0.00	-0.00
		(-0.65)	(-0.63)		(-0.42)	(-0.40)		(-0.02)	(-0.03)
ROA		0.00	0.00		-0.00	-0.00		-0.00	-0.00
		(0.49)	(0.59)		(-0.33)	(-0.41)		(-0.40)	(-0.63)
Leverage		0.00***	0.00***		0.00**	0.00***		0.00	0.00
		(4.97)	(4.68)		(2.44)	(2.82)		(0.73)	(1.40)
Firm_logSales		0.00**	0.00**		0.00***	0.00***		0.00	0.00
		(2.60)	(2.61)		(2.73)	(2.85)		(0.87)	(0.64)
Number of Cases	33429.00	33429.00	33429.00	33429.00	33429.00	33429.00	30053.00	30053.00	30053.00
R-Squared	0.77	0.78	0.78	0.77	0.78	0.78	0.80	0.80	0.80

* p<0.1, ** p<0.05, *** p<0.01

Conclusion

Immaterial capital has become one of the main concerns for modern firms and in particular for technological firms. In this paper, focusing on patents, we study the impact of mergers and acquisitions on technological diversification at two different levels, namely ***Subcategories/industry segments*** and ***Categories/industries***.

We first show a strong relationship what with M&As activity and diversification within technological industry segments since MA_Volume in year t has a negative and significant coefficient on diversification in this very year across *Subcategories*, suggesting that firms running M&As improve their degree of diversification within *Technological segments*. Economically, the magnitude of MA_Volume suggests that a 10% increase in M&A activity is tantamount to a 0.002 change in HHI of subcategories ranging from 0 to 1[86].

Further, we show that the coefficient of MA_Volume in year t remains negative and highly significant even one and two years after the transactions. This result suggests that M&As concluded in year t keep contributing to firms' diversification within *Industry segments* in year t+1 and year t+2. These two results imply that firms that extend their technological portfolio in a technologically coherent way may be able to increase benefits of diversification and attenuate the potential negative impact and costs attached to technological diversification.

Finally, when it comes to diversification across *Categories/industries*, we found that MA_Volume has a positive coefficient in year t and becomes negative within the two following years but is statistically insignificant over the three years t, t+1 and t+2.

Overall, our findings demonstrate that firms resort to M&As channel with a view to performing their core business and main technological fields rather than to go far beyond the industry's borders of the company.

[86] Where 0 means highly diversified and 1 means definitely specialized.

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Appendix 2 : Control Variables' measurement

Variables	***Measurement***
- Firm's characteristics :	
Firm size	Ln of firm's market capitalization on day – 42
Tobin's Q	Total Assets – Common Equity + (MV of equity / Total Assets)
R&D intensity	R&D / (Total Assets)
Return on Assets	Operating Income / (Total Assets)
Leverage	(Total Debts – Cash) / (Total Assets)
Firm Sales	ln (Sales)

Additional investigation – Fixed effects – Number of M&As

Table 7 : Impact of number of Mas on Subcategories diversification

Fixed Effects Models : Number of MAs Impact on Subcategories/industry segments diversification

	HHI_Subcat i,t			HHI_Subcat i~1			HHI_Subcat i~2		
	MA Volume only	Tech & Firm ~1	Year Effects	MA Volume only	Tech & Firm ~1	Year Effects	MA Volume only	Tech & Firm ~1	Year Effects
HHI_Sub_exante1	0.87***	0.84***	0.85***						
	(137.60)	(129.94)	(126.79)						
Numb_MAs	-0.01*	-0.00	-0.00	-0.01***	-0.01***	-0.01***	-0.00	-0.00	-0.00
	(-1.80)	(-0.96)	(-1.14)	(-2.70)	(-2.72)	(-2.88)	(-0.23)	(-0.11)	(-0.27)
Numb_MAs_exante1	-0.01***	-0.01**	-0.01**						
	(-2.70)	(-2.19)	(-2.49)						
HHI_Subcat				0.87***	0.85***	0.85***			
				(137.60)	(130.25)	(128.18)			
Numb_MAs_expost1				-0.01*	-0.00	-0.00	-0.01***	-0.01***	-0.01**
				(-1.80)	(-1.19)	(-1.34)	(-3.29)	(-3.36)	(-3.29)
HHI_Sub_expost1							0.89***	0.87***	0.87**
							(159.83)	(148.40)	(145.11)
Numb_MAs_expost2							-0.01**	-0.00	-0.00
							(-2.50)	(-1.57)	(-1.52)
Sizeclass_Subcat		-0.00***	-0.00***		-0.00***	-0.00***		-0.00***	-0.00**
		(-10.90)	(-10.32)		(-10.25)	(-9.88)		(-10.21)	(-10.32)
Size_Pat		0.00***	0.00***		0.00***	0.00***		0.00***	0.00**
		(5.42)	(5.10)		(5.40)	(5.12)		(5.49)	(4.68)
Firm_size		-0.00	-0.00		-0.00	-0.00*		0.00	-0.00
		(-0.24)	(-1.28)		(-0.21)	(-1.73)		(0.62)	(-0.19)
RD_expense		0.03***	0.03***		0.01	0.00		0.03	0.02
		(2.80)	(3.07)		(0.44)	(0.03)		(1.15)	(1.12)
Tobin_Q		0.00	0.00		0.00	0.00		0.00	0.00
		(1.19)	(1.17)		(1.24)	(1.26)		(1.04)	(1.03)
ROA		-0.00	-0.00		-0.00	-0.00		-0.00	-0.00
		(-0.91)	(-0.27)		(-1.16)	(-0.59)		(-1.50)	(-1.33)
Leverage		0.00***	0.00*		-0.00	-0.00*		0.00	0.00
		(2.81)	(1.90)		(-0.44)	(-1.76)		(1.26)	(1.09)
Firm_logSales		0.00	0.00		-0.00	0.00		-0.00	-0.00
		(0.13)	(0.53)		(-0.05)	(0.60)		(-0.74)	(-0.26)
Number of Cases	33429.00	33429.00	33429.00	33429.00	33429.00	33429.00	30053.00	30053.00	30053.00
R-Squared	0.79	0.79	0.79	0.79	0.79	0.79	0.82	0.82	0.82

* p<0.1, ** p<0.05, *** p<0.01

Table 8 : Impact of number of Mas on Categories diversification

Fixed Effects Models : Number of MAs Impact on Categories/industries diversification

	HHI_Cat i,t			HHI_Cat i,t+1			HHI_Cat i,t+2		
	MA Volume only	Tech & Firm ~1	Year Effects	MA Volume only	Tech & Firm ~1	Year Effects	MA Volume only	Tech & Firm ~1	Year Effects
HHI_Cat_exante1	0.88***	0.81***	0.81***						
	(130.93)	(111.92)	(113.68)						
Numb_MAs	0.00	0.00	0.00	-0.00	-0.00	-0.00	0.00	0.00	0.00
	(1.49)	(1.48)	(1.27)	(-0.24)	(-0.67)	(-0.78)	(0.40)	(0.20)	(0.11)
Numb_MAs_exante1	-0.00	-0.00	-0.00						
	(-0.24)	(-0.53)	(-0.62)						
HHI_Cat				0.88***	0.81***	0.81***			
				(130.94)	(111.25)	(114.32)			
Numb_MAs_expost1				0.00	0.00*	0.00*	-0.01	-0.00	-0.00
				(1.49)	(1.92)	(1.73)	(-1.07)	(-0.91)	(-0.95)
Numb_MAs_expost2							0.00	0.00*	0.00*
							(0.60)	(1.81)	(1.71)
Sizeclass_Cat		-0.03***	-0.03***		-0.03***	-0.03***		-0.02***	-0.02***
		(-13.59)	(-14.41)		(-13.43)	(-14.42)		(-13.68)	(-15.84)
Size_Pat		0.00***	0.00***		0.00***	0.00***		0.00***	0.00***
		(4.10)	(4.00)		(4.03)	(3.94)		(3.49)	(3.50)
Firm_size		0.00***	0.00***		0.00***	0.00***		0.00**	0.00**
		(2.76)	(2.87)		(2.67)	(2.74)		(2.25)	(2.52)
RD_expense		0.00	0.00		-0.02	-0.02		-0.00	0.00
		(0.64)	(0.73)		(-1.04)	(-0.93)		(-0.14)	(0.15)
Tobin_Q		-0.00	-0.00		-0.00	-0.00		-0.00	-0.00
		(-0.63)	(-0.62)		(-0.41)	(-0.39)		(-0.01)	(-0.02)
ROA		0.00	0.00		-0.00	-0.00		-0.00	-0.00
		(0.48)	(0.59)		(-0.34)	(-0.42)		(-0.41)	(-0.63)
Leverage		0.00***	0.00***		0.00**	0.00***		0.00	0.00
		(4.97)	(4.67)		(2.43)	(2.81)		(0.73)	(1.40)
Firm_logSales		0.00**	0.00**		0.00***	0.00***		0.00	0.00
		(2.62)	(2.64)		(2.73)	(2.86)		(0.88)	(0.66)
HHI_Cat_expost1							0.90***	0.84***	0.84***
							(147.49)	(140.98)	(139.28)
Number of Cases	33429.00	33429.00	33429.00	33429.00	33429.00	33429.00	30053.00	30053.00	30053.00
R-Squared	0.77	0.78	0.78	0.77	0.78	0.78	0.80	0.80	0.80

* p<0.1, ** p<0.05, *** p<0.01

Chapter 2

ACQUISITION PREMIUMS, TECHNOLOGICAL DIVERSIFICATION, AND WEALTH CREATION

« Se réunir est un début, rester ensemble est un progrès, travailler ensemble est la réussite ! »

Henry Ford

Résumé

Dans le but d'avancer d'autres arguments sur ce qui pourrait influencer les primes d'acquisition lorsque la technologie entre en jeu, nous nous sommes demandé dans quelle mesure la diversification technologique de la société cible affectait les primes de fusion payées par les acquéreurs et la réaction du marché à la synergie. En créant deux niveaux de diversification à partir des brevets de la base de données NBER, nos résultats montrent que les primes payées par les acquéreurs sont augmentées lorsque la cible est diversifiée au sein de sous-catégories – ou de segments industriels –, alors qu'elles sont sérieusement revues à la baisse lorsque la cible est diversifiée au sein de catégories - ou d'industries -. Néanmoins, la réaction du marché, elle, semble être légèrement sensible à la diversification de la cible au sein de segments industriels, mais en règle générale, les rendements anormaux synergiques semblent être totalement indifférents à la diversification technologique, quel que soit le niveau de diversification.
Au final, il peut s'agir d'une véritable différence de perception de la technologie selon qu'on se positionne par rapport à la réaction du marché ou à la perception des entreprises qui fusionnent.

Mots clés : Primes d'Acquisition, Diversification Technologique, Réaction du Marché.

Abstract

In a willingness to advance other arguments for what could influence the premiums paid when technologies are involved, we wondered to what extent does target's technological diversification impact merger premiums paid by acquirers and the market's reaction to synergy. Creating two levels of diversification from NBER patents database, we found that the premiums paid by bidders are boosted when the target is diversified within subcategories – or industry segments –, while they are seriously adjusted downwards when the target is diversified within categories – or industries –. However, market's reaction seems to be slighly sensitive to target's diversification within industry segments, but as a general rule, synergy CARs appear to be definitely indifferent to technological diversification no matter the level of diversification.
All in all, it may be a difference of perception towards the technology dimension depending on whether we are analyzing the market's reaction or the merging firms' perception.

Keywords: Merger Premiums, Technological Diversification, Market's Reaction

Introduction

With a view to affording the courrier application, Facebook paid an amount greater than the GDP of more than 80 countries or the financing of 40 « stade de France », realizing one of the largest acquisitions ever made in the technology sector and allowing some 55 employees to become millionaires and its founders to weigh billions. On mid-February 2014, Facebook had announced the purchase of WhatsApp mobile messaging for an estimated price at the time of $19 billions. Finally, Facebook has paid nearly 22 billion dollars[87], more than originally planned, for WhatsApp that is neither a factory nor a country, let alone an army, but a web nugget in a booming industry. However, Facebook planned to pay most of the transaction with his own shares, and their share price has risen sharply since then, by around 14%. This acquisition symbolizes a bet on the future role of mobile messaging services over the internet, which are arrousing a tremendous craze due to their potential to disrupt tomorrow's communications. The concrete question raised in this case is: why Facebook paid more than 2000 times the WhatsApp's initial investment?

First, to flirt with teens. Since the younger audience is turning away from Facebook, the social network follows them by appropriating the services and applications that they prefer. WhatsApp is used by nearly 450 million people, mostly young people. It's the same logic that prevailed when Instagram was bought in 2012.

Another reason is getting a foothold in emerging markets and the strong presence of messaging services in Asia, Africa and South America. So many mobile markets promised a strong growth in the coming years, and which Facebook hopes to carve a share.

Third, Facebook is struggling to innovate. Its application for Android smartphone Facebook Home did not convince. With its acquisitions, the social network offers growth drivers, and can control the evolution of its now ex-competitors.

[87] See Figure 1 below (figaro.fr)

Taking the academic world, previous papers found that bidder, target or deal characteristics that involve greater potential synergies or that enhance the potential competition for the target, will engender higher merger premiums. In terms of high-tech firms, Higgins and Rodriguez (2006) worked on 160 pharmaceutical takeovers over the period 1994 – 2001 and found that the lower internal R&D intensity the more pharmaceutical firms are likely to purchase R&D targets to re-think their research knowledge bases. Antoniou et al (2008) found that in 3 and 5 days surrounding merger announcements, high premium paying bidders significantly outperform their low premium paying counterparts. Short term CARs are positively correlated to the level of the premium paid by acquirers. Thus, it seems that high merger premiums paid are « not to blame » for bidders' long-run underperformance and their short-run evidence suggests that merger premiums are a significant indicator of deal synergies between the merging firms.

Based on the neoclassical theories, M&As are defined as a way of asset reallocation between efficient and inefficient firms' reaction to industry shocks. Merger waves take place in industries experiencing fundamental changes [Andrade & Stafford (2004); Harford (2005)]. Arguably, fundamental changes could refer to macroeconomic shocks such as deregulation or law implementation in a specific country; that said, fundamental changes could also allude to microeconomic shocks such as product innovations or changes in production technology. Moreover, behavioral explanations emphasize the role of market imperfections. On one hand, firms possessing overvalued stock might be prone to exchange it for real assets [Shleifer & Vishny (2003)]. On the other hand, irrational managers have a tendency to engage in too many changes and mergers [Roll (1986)]. Taking the assumption that industry clustering is indicative of neoclassical acquisition motives, Szücs (2013) showed that while clustering around countries or stock market is more consistent with behavioral explanations, their findings point to a predominance of neoclassical motives in the constitution of merger waves.

Fundamentally, in the corporations' context, a firm can either develop technologies internally or catch it through an external way. Our study deals with the second alternative since we focus on M&As involving technologies and we want to help explain the premiums paid and market's reaction to merger announcement as part of acquiring technological targets. Most of studies have concentrated on M&As in general, forgetting to specify and explain the wide variation among premiums in

the technology context. In a willingness to advance other arguments for what could influence the premiums paid when technologies are involved, ***we wondered to what extent does target's technological diversification impact merger premiums paid by acquirers and the market's reaction to synergy.*** Our basic intuition comes from Antoniou et al (2008) whose results indicate that « high premiums may better proxy for deal synergies than overpayments ». Starting from these deal synergies, this paper talks about potential technological synergies and its relationships with merger premiums paid. Indeed, when it comes to technology, high premiums should be perceived as a futur gain resulting from combining knowledge bases rather than a waste of money. Basically, industries with firms that are operating companies may drive bidders into truly consider the merger and pay higher premium since such acquisitions could have potential and expected gains that are shared with the target. The premium is pertinent[88] since it represents the payment and the determination of acquirers to get access into target's patrimony. To the question « Why bidding firms might overpay in acquisitions ? », the conflict of interest hypothesis [Jensen & Meckling (1976)] and the hubris hypothesis [Roll (1986)] argue that managers would go after diversification in spite of the negative impact on shareholders and might be ready to pay too much for targets that do not belong to (exactly) the same acquirer's technological field or even to the same industry. Accordingly, managers would diversify the holdings of the firm so as to boost their human capital or in order to ensure the firm's continuity even when a diversification strategy is detrimental to shareholders' wealth. [Amihud & Lev (1981), Lorsh & Donaldson (1983, 1984), Shleifer & Vishny (1990)]. Aside from managers' private interests and decision to diversify, corporate diversification has long been a thorny issue as for its implications on companies' health. Diversification has inherited from one of the oldest ideas in economics that considered corporate diversification as unproductive and inefficient. Previous researchers have demonized diversification by associating the latter to a destruction value within firms and showed that the market reacts negatively to buying growth along with diversified acquisitions strategies [Ravenscraft & Scherer (1987), Morck et al (1990), Lang & Stulz (1994), Servaes (1996)]. However, Kaplan &

[88] The bulk of the empirical works on M&As are content to use CARs around the takeover bid as a proxy for the actual offer premium. That said, CARs remain a biased estimate since they incorporate the probability of bid failure and competition at the offer initial date, and should therefore be estimated on a long-term window to capture the final premium. Thus, to understand how bidders determine the premium, it is better to use the data of the "offer price" directly [Betton, Eckbo, Thorburn (2008)].

Weisbach (1992) found that there is no significant difference between the stock market reactions to diversification announcement and reactions to related acquisitions, while Hyland & Dlitz (2002) found that in the realms of abnormal returns, the mean market returns are positive and statistically significant for diversifying acquisitions for the 1980s and 1990s. That said, a business is part of a huge continuous change in society and the needs of today are not a fortiori the same as yesterday or even tomorrow. Just because a divestiture occurs, does not mean that original acquisition was unsuccessful or a bad investment; you may sell a business that was a source of synergistic gains and new competencies merely because there are no more synergies to benefit from after a certain time [Patel & Pavitt (1997)]. With the birth of new telecommunications, new drugs, new applications, new softwares and hardwares, technological combinations appear at the speed of light and the firms' needs renew themselves day-by-day. Specifically, this suggests that merger premiums and market's sentiment to synergy will be also more pronounced in an industry that promoutes inventions and innovation, that involves combinations and complementary assets, that generates intellectual property and creates its protection through patents. We predict that a firm may offer a high price for a target, that possesses diversified innovations voguing on the trend of the moment or useful for bidders, so as to take advantage of the patent and exploit that very innovation.

We used patents to account for the technological aspect and we put forward a measure of technological diversification so that we assess to what extend does target's technological diversification influence the price paid by bidders and the market's response. Following Hall et al (2001, 2005) classification of each patent by categories and subcategories, while respecting International Patent Classification (IPC), we used the Herfindhal Hirschman Index (HHI) to account for firm's diversification or concentration within categories – or industries – and also within firms' subcategories – or industry segments – (see Appendix 1 for more details)[89]. Our technological diversification is two-headed since it enables to identify both diversifiers and specializers[90]. Due to a positively skewed distribution since we are dealing with patents and extreme values, we decided to use and interpret the median because the arithmetic mean can be affected by strong outliers. The target is

[89] In this paper, we will use the terms « Categories », « industries » and « sectors » interchangeably. On that same way, we will use « Subcategories », « industry segments » and « business lines » interchangeably.
[90] The data from Copustat Industry Segment database are not always reliable about reported increases in a firm's number of segments [Hyland & Dlitz (2002), Villalonga (2004)]

considered to be diversified within subcategories and assigned 1 if its HHI is lower than the HHI_subcategories' median over the whole sample, otherwise it is specialized and assigned 0. We followed the same logic for categories (see section 2 below).

Our analysis of technological diversification complements the existing literature on firm-specific factors that affect merger premiums. Since many papers have concentrated on M&As in general, forgetting to specify and explain the wide variation among premiums in the technology context, our main contribution is to better understand which characteristics influence the premium once the technology enters at stake.

Our goal is to examine how the merger premiums and the markets react depending on three main aspects as follows: 1) whether the target is technological or not; if it so, 2) whether the target is technologically diversified or not; and, 3) whether the acquirer itself is technological or not.

Our results are threefold. First, taking our whole sample of 1493 deals from 1990 to 2006, we observed that merger premiums are less sensitive to target's technological dimension than market's reaction (measured through synergy CARs[91]). At first sight, introducing all control variables and running pooled regressions, it seems that acquirers' technological dimension – whether they posses patents or not – seems to prevail over target's one, while synergy CARs appear to be more receptive to targets' patents portfolio.

However, our second result focuses exclusively on a subsample of technological targets when only the target is technological – no matter if the acquirer possesses patents or not –. Running a fixed effects model controlling for target's 2 SIC digit code and year effects, we found that diversification within subcategories is positively significant at 10% level (5.19) and diversificaion within categories became negatively significant at 5% level (- 5.47). Moreover, once we controlled for target's 4 SIC digit code and year effects, not only both coefficients keep the same opposite signs but also became highly significant at 1% level. On one hand, this indicate that if we go deep in target's SIC, the premiums paid by technological or non-technological acquirers are boosted when the target is diversified within industry segments; on the other hand, they are seriously adjusted downwards when the target is diversified

[91] We measured synergy CARs by taking the product of Acquirers CARs and Targets CARs.

across several categories. As for market's reaction, the synergy CARs appear to be positively related to diversification within subcategories, while there is no significance for the upper level of categories – when we controlled for target's 2 SIC –. Surprisingly, none of our technological diversification is significant, neither the subcategories nor the categories, once we controlled for target's 4 SIC code in terms of synergy CARs.

Third, we concentrated on a subsample when target and acquirer are both technological firms. Regarding merger premiums and the same controls, our results are all-but the same except that the negative impact of industries diversification is slightly more pronounced than the positive impact of industry segments diversification. In any case, these results suggest that, in a context of reciprocal possession of technologies, acquirers still positively perceive diversified targets within business lines but they may be definitely reluctant to pay more for targets that are scattered over various sectors or industries. As for market's sentiment, diversification within industry segments still positively impact the synergy CARs (5%) when controlling for 2 SIC digit code; and no reaction shows up when controlling for target's 4 SIC digit code, whether they be targets' diversification or acquirers' diversification within the two levels.

All in all, the difference in our empirical results is quite glaring between merger premiums and market's sentiment. We must say that it may be a difference of perception towards the technology dimension depending on whether we are analyzing the market's reaction or the merging firms' perception.

The remainder of the paper is organized as follows: we start with an introduction, then section 1 portrays a literature review, section 2 developes hypotheses and describes variables, finally section 3 presents the sample along with empirical results, we close the paper with a conclusion.

Section 1: Literature review

1.1. Merger Premiums

1.1.1. Industry, firms and deal characteristics

With regard to the substantial variation in merger premiums across industries and through time, numerous studies have shown that industry factors may play a crucial role in affecting merger premiums. Thereby, acquirers will have to offer higher premiums for targets that belong to an industry where synergy gains are higher. That said, bidders could also have to pay higher premiums during periods that record larger market performance or that involve new organizational capabilities or even that bring into play new technologies and tendencies [Harford, (2005)]. Based on this neoclassical point of view as the fluctuations in merger activity change among industries and over time, time-varying industry characteristics may account for the variations in expected synergisms or in the competition for targets through time [Harford (2005), Madura et al (2012)]. Actually, merger premiums may be impacted by macroeconomic shocks such as deregulation or law implementation in a specific country [Andrade & Stafford (2004), Harford (2005), Toxvaerd (2008)] ; but also microeconomic characteristics specific to firms as explained further [for our study we will focus on firm's characteristics]. In particular, industries with higher growth outlooks are more likely to generate synergy gains and impel bidders to offer higher premiums. Beginning with an empirical identification of the main industry and macroeconomics factors that impel merger premiums over time, Madura et al (2012) documented a substantial variation in the quarterly premiums paid for targets among industries for a given quarter. They indicate that bidders may have a tendency to pay higher merger premiums in some industries or in some periods in order to acquire targets. Sampling 2479 US completed mergers from 1986 to 2007, Madura et al (2012) measured merger premiums per industry as the average of the premium paid in all mergers in the same industry in a given quarter. Their industry results showed that higher levels of expected growth and R&D within an industry increase merger premiums paid by acquirers. Their macroeconomic results showed that merger premiums are boosted by higher levels of liquidity and volatility in GDP growth.

Starting from the idea that possible synergisms and the competition for targets affect merger premiums across industries and time, many papers have portrayed

firms and deals conditions that may impact synergies and be the source of premium's variations. Asquith (1983), Flanagan & O'Shaughnessy (2003) and Alexandridis et al (2013) have shown that merger premiums are more pronounced when there are multiple bidders and when the acquirer and the target were in related industries. Moeller et al (2004) found that merger premiums varied by size since the average (median) premium paid for US public acquisitions from 1980 to 2001 was 68% (61%) for large companies and 62% (52%) for small companies. In terms of high-tech firms, Higgins and Rodriguez (2006) worked on 160 pharmaceutical takeovers over the period 1994 – 2001 and found that the lower internal R&D intensity the more pharmaceutical firms are likely to purchase R&D targets to re-think their research knowledge bases. Davis and Madura (2017), at a first step, analyzed the target and acquirer growth options and how it affects the premiums paid; and at a second step, they examined the markets' response to the announcement measured in positive or negative AR to the acquirer. Taking a sample of 749 deals from 1986 to 2014, they found that investors react positively to acquisitions of high R&D targets in related transactions by higher GTB and R&D acquirers. However, they note a negative reaction to more highly levered targets and stock deals; suggesting by the way that cash deals reduce premiums and represent positive signal for investors. Their results also show that very low GTB acquirers pay more in premiums to takeover a target and the market's response seems to be one of the most negative announcements returns. In fact, they precise that low GTB acquirers possess the largest R&D intensities but experience serious difficulties in transforming R&D into growth options, hence their low GTB. They suggest that « low GTB acquirers do seek synergies even if potentially acquiring out of desperation ». They conclude by stating that expected synergies increase with the acquisition of low GTB targets, both in premiums and ARs. Bargeron et al (2008) concentrated on differences in the premiums paid by private acquirers versus public acquirers. Their results show a 63% higher premium when bidder is a public company rather than a private equity firm and a 14% higher premium when bidder is public rather than private operating firm. They put forward the operating side of public companies and possible synergies to create. Typically, private equity companies purchase firms for which synergy gains are non existent; therefore, private acquirers will not advance a premium as significant as the premiums paid by public acquirers. On the other hand, since public companies are more often operating firms, takeovers by listed corporations give rise to more

shareholder wealth and improve the odds of producing « synergistic gains to share with the target ».

1.1.2. Other factors that may affect merger premiums

Dimopoulos & Sacchetto (2014) published an original paper that deals with the role played by the preemptive-bidding and the target resistance theories in the price paid by bidders to take control. If the former indicate that an initial bidder could oust a competitor through an expensive offer that informs about a high valuation for the target [Fishman, (1989)[92]], the latter explains that a weak premium may allow target shareholders to easily resist takeover proposals. They start their study by taking a sample of 5477 takeover bids and 5136 contests over the period 1988-2006, and noticed that there is only one bidder in 94% cases and that the average price paid by bidders over the target ex-ante announcement stock is 50%. Using an auction theoretical model with simulated method of moments, they found that despite the high fraction of single-bidder takeovers, the estimated entry costs are relatively small, averaging 2.8 of the target's preacquisition market capitalization. Moreover, bidders are asymmetric with respect to their valuation of the target since the initial and the second bidder assess the target, on average 81% and 61%, respectively above the preacquisition stock price. This indicates that even if the entry costs are small, the initial bidder can prevent the second from entrance with a relatively low initial bid. They also showed that even in the absence of an entry threat by a second bidder, the premium in a single-bidder contests would average 48%. Given that the respective premium observed empirically is 51%, they conclude that the high merger premiums in single-bidder contests reflect more often the need to overcome target resistance instead of potential competition. Their simulation analysis suggets that in 74% of single-bidder contests, the acquisition price is determined by target resistance. This led us to wonder about what motivate bidders to make an offer sufficiently higher to defeat target's resistance.

[92] Fishman, M. (1989) 'Preemptive bidding and the role of the medium of exchange in acquisitions', Journal of Finance, Vol. 44, 1989, 41-58.

Answers to the question « Why bidding firms might overpay in acquisitions? », it is unquestionnable that we must refer to many papers that put forward the role played by acquiring firms' managers. The initial postulate is that managers would go after diversification in spite of the negative impact on shareholders, and we could quote two main reasons the conflict of interest hypothesis [Jensen & Meckling (1976)] and the hubris hypothesis [Roll (1986)]. Basically, the former stipulates that managers definitely set out to build empires and that acquirers' management will lowly take account of the price when it comes to M&As – and pay high premiums –; and the latter argues that managers are tainted by cockiness and overpay for targets because they exaggerate their own ability to run them. Jensen's (1986) Free Cash Flow[93] theory states that managers may have two alternatives to how to use positive cash flows. Either, they can reallocate the cash in the firm, or they can compensate shareholders. This implies that on a self-interest basis, managers will tend to « waste this free cash flow » since they will either disburse the cash to consume prerequisites or disburse it in investments that do not necessary serve shareholders' interests. This theory closely linked to Amihud & Lev (1981) focus on risk-averse behavior among managers. The authors pinpointed managers' priority to engage in self-serving activities at the expense of shareholders meaning that if managers consider their private benefits to go hand in hand with the succes of the firm, they would not hesitate to compel the firm to diversify no matter how detrimental is it to shareholders. Amihud & Lev (1981) underlined that managers systematically keep their career's growth in mind and try to spread their skills in order to be more valuable. Accordingly, managers would diversify the holdings of the firm so as to boost their human capital even when a diversification strategy is detrimental to shareholders' wealth. Moreover, Lorsh & Donaldson (1983, 1984) point out managers' determination to get access into new lines of business in order to ensure the firm's continuity at the expense of shareholder wealth maximization. That said, a manager would also rather to enter new businesses at which he might be better, especially when firm's bad performance poses a serious threat on his job [Shleifer & Vishny (1990)]. Fundamentally, considering these cases, managers might be ready to pay too much for targets that do not belong to (exactly) the same acquirer's technological field or even to the same industry.

[93] Jensen, M. C. (1986). The agency costs of free cash flow: Corporate finance and takeovers. American Economic Review, 76, 323–329.

If we enounced several factors that impact merger premiums and make bidders pay a high price to take control, we must note that many papers blame the overpayments in mergers to be one of the main reasons behind the poor long-run of acquiring firms [(Agrawal et al (1992),]. Asquith (1983) among others, found that acquiring firms earn a significant negative abnormal return during the 3 or 5 years following the merger announcement. Starting from this post merger underperformance puzzle, Antoniou et al (2008) worked on the impact of merger premiums on acquiring firms' long run and announcement period stock returns. Their goal was to analyze whether high merger premiums paid are a key driver of the long-run underperformance of acquiring firms. Studying a sample of 365 successful UK mergers on a long-run basis (396 mergers for short run) from 1985 to 2004, they examined short and long run performance of acquirers. On one hand, their results show that, even after controlling for several characteristics, return differentials between high and low premium subportfolios are small and statistically insignificant. They found no evidence that subportfolios consisting of the highest premium paying acquirers underperform those paying relative low premiums in the 3 years following mergers. On the other hand, in 3 and 5 days surrounding merger announcements, high premium paying bidders significantly outperform their low premium paying counterparts. Short term CARs are positively correlated to the level of the premium paid by acquirers. Thus, it seems that high merger premiums paid are « not to blame » for bidders' long-run underperformance and their short-run evidence suggests that merger premiums are a significant indicator of deal synergies between the merging firms.

1.2. Abnormal returns and corporate diversification

1.2.1. Corporate diversification perceived as negative for acquiring firm's performance

When it comes to firm's diversification, one must not overlook the responsibility and decision made by managers to go on this way of conglomerate takeovers [Amihud & Lev (1981), Lorsh & Donaldson (1983, 1984), Roll (1986), Shleifer and Vishny (1990)]. The commitment into a merger process comes in the

aftermaths of two considerations, among others, that a manager takes into account. On one hand, he looks at his own benefits; and on the other hand, he considers the aftereffects for the firm's market value. Taking the diversification context, it allows the managers to diversify the risk on their human capital and improve, by the way, their job security; in addition to that, they could also assure the firm's long-term growth through the entrance into new line of business. Nevertheless, a manager would prefer to ignore the possible repercussions on firm's market value in the case an investment yield a large private benefit for the manager. On that spirit, Morck et al (1990) analyzed which acquisitions are bad investments for bidding shareholders and tried to determine whether those acquisitions appear to provide personal benefits to bidding managers. Studying 326 US acquisitions from 1975 to 1987, they concentrated on buying growth and diversification acquisition strategies. They used two measures of relatedness as follows: 1) an acquisition is « related » if the merging firms share the same 4-digit industry among the top three segments they operate in, otherwise it is « unrelated »; 2) the correlation coefficient of monthly stock returns between the merging firms over the 3 years ex-ante the acquisition. Their main findings are threefold. First, the market reacts negatively to buying growth and diversified acquisitions strategies. Second, bad managers are synonymous with bad acquirers, suggesting that managers, who experience low performance, would opt for diversification with a view to trying something new. Third, unrelated diversification is much more negatively perceived in the 1980s compared to 1970s, probably due to the wave of hostile bust-up takeovers[94]. Finally, answering their paper, they conclude that bad acquisitions are driven by managerial objectives.

Aside from managers' private interests and decision to diversify, Corporate diversification has long been a thorny issue as for its implications on companies' health. Diversification has inherited from one of the oldest ideas in economics that considered corporate diversification as unproductive and inefficient. Previous researchers have demonized diversification by associating the latter to a destruction value within firms. Ravenscraft & Scherer (1987) showed that 33% of acquisitions in the 1960's and 1970's was later divested, interpeting then the divestiture rates as an evidence that diversified acquisitions are value-destroying rather than value-increasing. Lang & Stulz (1994) insisted also on this diversification's pernicious

[94] The return on unrelated acquisitions was 8.1 % lower in the 1980s than in the 1970s.

impact and argued that diversified firms trade at an average discount relative to single-segment firms. On that same perspective, Servaes (1996) dealt with the value of diversification during the conglomerate merger wave, wondering whether diversification resulted in higher market values during this period. From that point, he also tries to find some reasons to explain this valuation differential. Examining the value of diversification when many corporations started to diversify and whether the benefits of diversification outweigh the costs, he finds no striking evidence about the value of diversified companies. Compared to single segment firms during 1960's, diversified firms were not valued at a premium but instead at a discount. That said, this view of divestitures as a fiasco is not the only reason consistent with high divestiture rates because a business is part of a huge continuous change in society and the needs of today are not a fortiori the same as yesterday or even tomorrow. Just because a divestiture occurs, does not mean that original acquisition was unsuccessful or a bad investment; you may sell a business that was a source of synergistic gains and new competencies merely because there are no more synergies to benefit from after a certain time [Kaplan & Weisbach (1992), Patel & Pavitt (1997)]. Hence, both the original acquisition and the sale could have improved shareholder value. Kaplan & Weisbach (1992) evaluated the extent to which divestitures result from unsuccessful acquitions during the 1980's and use empirical evidences to qualify the idea that divestitures are tantamount to failed acquisitions or bad investments. They found that bidder announcement returns for diversifying acquisitions are mixed. Granted, they found that 43,9 % of the acquisitions have been divested by the end of 1989, still, several divestitures are not disasters. From an expost view, their findings showed that 42 % of divestitures exhibit a gain while 44% report a loss on sale; furthermore, 43% of diversifying and 40% of related divestitures register a gain on sale. Actually, there is no significant difference what with the stock market reactions to diversification announcement and reactions to related acquisitions.

1.2.2. A reexamination of corporate diversification perception

Looking at the other side of diversification, subsequent empirical studies showed that discount appears ex-ante diversification decision and is, actually, merely

a result of sample selection bias [Villalonga (1999), Campa & Kedia (2002)]. Diversification discount seems to fade from view or even turns into a premium once one corrects for this sample selection bias, for all that matters. Following this idea, Graham et al (2002) shows that more than 50% of the discount occurs because firms chose to diversify within segments that are already discounted before their acquisition. Hyland & Dlitz (2002) took a sample of firms from Compustat Industry Segment database that start as single-segment companies and become diversified later. They tried to better understand the roots and consequences of diversification's decision making. With the goal to distinguish between economically meaningful diversification decisions and simple reporting changes for which no fundamental operational change has happened, they studied 173 diversifications including 150 acquisitions and 23 internal growth during 1978 - 1992. They found that only 72% of the reported changes from single to multiple segments are truly economically meaningful diversification cases. That said, their results show that diversifiers may trade at a discount even before they diversify and that, in terms of abnormal returns, the mean market returns are positive and statistically significant for diversifying acquisitions for the 1980s and 1990s. This indicates that additional value destruction seems not to grow or even happen once the firm enters a diversification process. On the same way, Villalonga (2004) raises a new empirical question to test whether segment data will result in a higher or lower discount than other sources. The bottom line is to know whether diversification discount is an artifact of segment datas. She pinpoints the bias that comes from Compustat's segment datas due to the fact that the aggregation of activities into any given segment SIC code differs from firm to firm because segments are self-reported by firms. Previous empirical works that used Compustat classification reported a diversification discount. Instead of this classification, Villalonga (2004) puts forward Business Information Tracking Series (BITS) as an alternative data source to categorize segments and assess the value impact of diversification. Using a sample of 41 203 605 firm-year from BTIS data over the period 1989 – 1996, she finds that diversifiers deal at an average premium of 0.28 compared to single-business firms. During this period, the premium is statistically significant and ranges from 0.11 to 0.43 values. According to her work, this value differential stems first from the fact that « compustat yields a conglomerate discount that is different but consistent with the premium found in BITS for related diversification », and second from managerial latitude in reporting segments through

strategic ways. Basically, the effect of diversification should be taken with a grain of salt since the value of diversification is contingent on data source used.

Arguably, industries with firms that are operating companies may drive bidders into truly consider the merger and pay higher premium since such acquisitions could have potential and expected gains that are shared with the target. Specifically, this suggests that merger premiums will be also more pronounced in transaction that promoutes inventions and innovation, that involves combinations and complementary assets, that generates intellectual property and creates its protection through patents. It makes sense that a firm may offer a high price for a target, that possesses an innovation voguing on the trend of the moment, so as to take advantage of the patent and exploit that very innovation. Intuitively, coping with diversification through M&As, one think of merger as a prominent way to catch external capital markets and benefits from a firm's organizational and/or technological patrimony. However, we must keep in mind the inception of internal capital markets to tackle the information costs related to less-well-developed external capital markets. Hubbard & Palia (1999) reexamined the conglomerate merger wave in the 1960s through an internal capital markets view and tried to shed light an explanation for this conglomerate activity. They analyzed a kind of cross-subsidization that takes place once a financially uncontrained acquirer purchases a financially constrained target and forms therefore an internal capital market. Working on 392 mergers that occur from 1961 to 1970, they used four measures of abnormal returns to the diversified acquirer: 1) the usual « percentage returns », 2) the « percentage returns until date of last revision », 3) the « dollar return », and 4) the « investment return »[95]. They found that financially unconstrained acquiring firms earn the highest returns when they buy constrained target firms. Furthermore, their results indicate that diversifying acquisitions receive statistically significant abnormal returns when they are computed as either « the dollar return » or « the investment return ». However, the usual « percentage returns until date of last revision » show that related acquisitions earn significantly more than diversifying acquisitions. Roughly, firms that diversify earn « generally » positive abnormal returns and do not significantly earn less than related acquisitions in two of the four measures. Basically, since external capital markets suffer from a

[95] Hubbard & Palia (1999) defined their 4 measures as follows. Measure 1) is the standard percentage abnormal returns (CAR [-5 ; +5]). Measure 2) is the percentage abnormal returns using the date of last revision. Measure 3) is the Dollar abnormal returns equal to the product of « Percentage returns » times « Market value ». Measure 4) is the Dollar abnormal returns using date of last bid deflated by the acquisition price.

lack of information distribution in 1960s, they conclude that firms merged to constitute their own internal capital markets and that external capital markets expected information benefits from the inception of these very internal capital markets. Stepping outside US boundaries, Selcuk & Kiymaz (2015) explored the impact of diversifying acquisitions on Turkish shareholders' wealth. They carried out an event study to know whether diversifying and non-diversifying acquisitions differ in the realms of acquirer abnormal returns within the Turkish market. Taking 98 deals made by 72 firms from 2000 to 2011, they found that bidding firms earn positive abnormal returns during various event windows. Their results show that the coefficient estimate for the variable DIVERS is positive and statistically significant at 10% level, suggesting that diversifying acquisitions result in higher abnormal returns in comparison to focused acquisitions. The Turkish market records, therefore, a diversification premium. Morever, they underlined that smaller companies collect higher abnormal returns than larger companies; and that acquirers buying publicly traded earn higher returns.

Figure 6 - Determinants of Merger Premiums

	1	2	3	4
Authors	Bargeron et al (2008)	Madura et al (2012)	Dimopoulos & Sacchetto (2014)	Madura et al (2010)
Sample	453 deals by « private » bidders 1214 deals by « public » bidders	2479 U.S. completed mergers	5477 US takeovers and 5136 contests	749 U.S. deals
Period	1980-2005	1986-2007	1988-2006	1986-2014
Research question	Why are there such differences in the gains to target shareholders between acquisitions by public firms versus private firms?	Why do merger premiums vary across industries and over time?	The role played by the preemptive-bidding and the target resistance theories in the price paid by bidders to take control.	How target and acquirer growth options may affect merger premiums and abnormal returns?
Dependant variable(s)	- Fama-French size - MTB 42 days ex-ante - CAR3	- Merger premium per industry	- Merger premiums at different days	- Premiums (4weeks) - CAAR
Results	• A **63%** higher Merger Premiums when *bidder is a public* rather than a private equity firm. • A **14%** higher Merger Premiums when *bidder is public* rather than private operating firm.	• MP are boosted in *presence of* ***high levels of expected growth and R&D*** within an industry. • MP are boosted in *presence of* ***high levels of liquidity and volatility in GDP growth*****.**	• The estimated entry *costs are averaging* ***2.8*** *of the target's preacquisition* market capitalization. • The initial and the second bidder assess the target, on average **81%** and **61%**, respectively above the preacquisition stock price. • In **74%** of single-bidder contests, *the acquisition price is determined by target resistance.*	• Investors *react* ***positively*** *to acquisitions of high R&D targets in related* transactions by ***higher GTB and R&D acquirers***. • Cash deals reduce premiums and represent positive signal for investors. • Low GTB acquirers do seek synergies even if potentially acquiring out of desperation.
Conclusions	**Public** companies give rise to more shareholder wealth and *improve the odds of producing «* ***synergistic gains to share with the target*** *».*	Bidders may have a tendency to pay higher merger premiums, depending on Industry and Macroeconomics factors	Even if the entry costs are small, *the initial bidder can prevent the second from entrance with a relatively low initial bid.* The high MP in *single-bidder contests reflect more often the need to* ***overcome target resistance*** *instead of potential competition.*	Expected *synergies increase with the acquisition of low GTB targets*, both in MP and AR.

Figure 7 - Abnormal returns and Corporate diversification

	5	6	7	8
Authors	Antoniou et al (2008)	Morck et al (1990)	Hubbard & Palia (1999)	Hyland & Dlitz (2002)
Sample	365 UK mergers (long-run) 396 UK mergers (short-run)	326 US acquisitions	392 US mergers	173 diversifications including 150 acquisitions and 23 internal growth
Period	1985-2004	1975-1987	1961-1970	1978-1992
Research question	How the extent of merger premium paid impacts the long-run performance and announcement period stock returns of acquirers?	Which acquisitions are bad investments for bidding shareholders? Do those acquistions provide private benefits to bidding managers?	A reexamination of the conglomerate merger wave in the 1960s through an internal capital markets view.	To better understand the roots and consequences of diversification's decision making.
Dependant variable(s)	- Premiums 4 weeks - Return differentials	- The ratio of the change in the bidder equity value to the acquisition price.	- 4 measures of Abnormal returns	- Diversified versus Specialized
Results	• **No evidence** that *subportfolios consisting of the highest MP paying acquirers underperform those paying relative low MP* in the 3 years following mergers. • In **3 and 5 days surrounding merger** announcements, *high premium paying bidders significantly outperform their low premium* paying counterparts.	• The ***market*** *reacts* ***negatively*** *to buying growth and diversified acquisitions* strategies. • ***Managers***, who experience low performance, *would opt for* ***diversification*** *with a view to trying something new.* • ***Unrelated*** *diversification is much more* ***negatively*** *perceived in* ***the 1980s*** compared to 1970s.	• *Diversifying acquisitions receive significant abnormal returns* when they are computed as either « **the dollar return** » or « **the investment return** ». • The usual « **percentage returns until date of last revision** » show that ***related*** *acquisitions earn significantly more* than diversifying acquisitions.	• Only **72%** of the reported changes from single to multiple segments are *truly economically meaningful diversification cases*. • *Diversifiers may trade at a* ***discount*** *even before they diversify*. • The *mean market returns are* ***positive*** *and statistically significant for diversifying acquisitions for the* ***1980s and 1990s***.
Conclusions	*High merger premiums paid are « not to blame » for bidders' long-run underperformance.* **MP are a significant indicator of deal synergies.**	*Bad acquisitions are driven by bad managers* and their managerial objectives.	**Firms merged to constitute their own internal capital markets**, and external capital markets expected information benefits from the inception of these very internal capital markets.	***Additional value destruction seems not to grow or even happen*** once the firm enters a diversification process.

Section 2: Hypotheses and variables' description

2.1. Hypotheses Development

Anyone who wants to get something that makes him better would be ready to pay high prices to grab that thing – until he has the means to do so, of course –. On that same perspective, any technological firm that wants to get a technology that makes it more competitive would be ready to pay a high price to possess that technology – until it has enough cash or stocks to do so, of course –. In the corporation's context, a firm can either develop technologies internally or catch it through an external way. Our study deals with the second alternative since we focus on M&As involving technologies and we want to help explain the premiums paid and market's reaction to merger announcement within the framework of acquiring technological targets. Actually, we are interested in merger premium and market's reaction regarding target's diversification within two different level from 1990 to 2006. The first one alludes to horizontal or vertical mergers, a diversification through different subategories – industry segments or business lines – inside one industry, meaning that a target has patents within the subcategory 52 called « Metal working » and within the subcategory 55 called « Transportation » both belonging to the same industry Mechanicals. This suggest that the target has complementary patents in a specific industry or category giving therefore a real competitive advantage. The second level refers to conglomerates, a diversification through different categories – or industries –, meaning that a target has patents within the category 2 called Computers & Communications and within the category 4 called « Electrical » each of which representing a full-fledged industry. (See Appendix 1)

Our basic intuition comes from Antoniou et al (2008) whose results indicate that « high premiums may better proxy for deal synergies than overpayments ». Starting from these deal synergies, this paper talks about potential synergies that would come from target's diversification and its relationships with merger premiums paid. Indeed, when it comes to technology, high premiums should be perceived as a futur gain resulting from combining knowledge bases rather than a waste of money.

APPENDIX 1: *CATEGORIES level and SUBCATEGORIES level from NBER*

CATEGORIES / industries		SUBCATEGORIES / industry segments	
1	***Chemical***	11	***Agriculture, Food, Textiles***
		12	***Coating***
		13	***Gas***
		14	***Organic Compounds***
		15	***Resins***
		19	***Miscellaneous***
2	***Computers & Communication***	21	***Communications***
		22	***Computer Hardware & Software***
		23	***Computer Peripherials***
		24 / 25	***Information Storage***
3	***Drugs & Medicals***	31	***Drugs***
		32	***Surgery & Medical Instruments***
		33	***Genetics***
		39	***Miscellaneous***
4	***Electrical***	41	***Electrical Devices***
		42	***Electrical Lighting***
		43	***Measuring & Testing***
		44	***Nuclear & X-rays***
		45	***Power Systems***
		46	***Semiconductor Devices***
		49	***Miscellaneous***
5	***Mechanicals***	51	***Mat Proc & Handling***
		52	***Metal Working***
		53	***Motors & Engines***
		54	***Optics***
		55	***Transportation***
		59	***Miscellaneous***
6	***Others***	61	***Agriculture, Husbandry***
		62	***Amusement Devices***
		63	***Apparel & Textile***
		64	***Earth Working***
		65 / 66	***Furniture, House Fixtures / Heating***
		67	***Pipes & Joints***
		68 / 69	***Receptacles / Miscellaneous***

Basically, industries with firms that are operating companies may drive bidders into truly consider the merger and pay higher premium since such acquisitions could have potential and expected gains that are shared with the target. Specifically, this suggests that merger premiums will be also more pronounced in an industry that promoutes inventions and innovation, that involves combinations and complementary assets, that generates intellectual property and creates its protection through patents. We predict that a firm may offer a high price for a target, that possesses an innovation voguing on the trend of the moment, so as to take advantage of the patent and exploit that very innovation. We predict that a diversified target is more likely to be suitable with the acquirer's technologies and generate an effective combined invention. Notwithstanding, since we are studying two levels of diversification, we must qualify our predictions. Granted, two different technologies inside the same industry might easily impel two firms to merge, still, two different technologies each of which belongs to different industries might dampen the two firms to merge. Assimilation, managerial, and communication costs are some good reasons that might make bidders reluctant to a possible acquisition and illustrate the latter argument. On that way, we put forward the first two hypotheses as follows:

H1.a: The more diversified within industry segments is the target, the higher will be the merger premium in a significative way.

H1.b: The more diversified within industries is the target, the higher will be the merger premium with some attenuation in comparison with the first level of diversification.

As for market's reaction, the conglomerate merger wave of the 1960s has been associated to a destruction value along with an unproductive and inefficient process. Analyzing the value of diversification when many corporations started to diversify and whether the benefits of diversification outweigh the costs, previous researchers found no striking evidence about the value of diversified companies. Compared to single segment firms during 1960's, diversified firms were not valued at a premium but instead at a discount [Servaes (1996)]. Other researchers interpeted

the divestiture rates as a proof that diversified acquisitions are value-destroying rather than value-increasing [Ravenscraft & Scherer (1987), Lang & Stulz (1994)]. In contradiction with this value-destroying view, Loderer & Martin (1990) and Matsusaka (1993) showed that estimates of abnormal stock returns around the conglomerate takeovers of the 1960s do not suggest that these investments were on average detrimental to shareholder wealth. Fundamentally, this view of divestitures as a fiasco is not the only reason consistent with high divestiture rates because a business is part of a huge continuous change in society and the needs of today are not a fortiori the same as yesterday or even tomorrow. Just because a divestiture occurs, does not mean that original acquisition was unsuccessful or a bad investment; you may sell a business that was a source of synergistic gains and new competencies merely because there are no more synergies to benefit from after a certain time [Kaplan & Weisbach (1992), Patel & Pavitt (1997)]. If the empirical evidence about the 1960s have a tendency to demonize diversification, other empirical studies concentrated on the refocusing wave of the 1980s and the global wave or strategic merger wave of the 1990s. First, the market seems to be fairly fickle and that there is no significant difference what with the stock market reactions to diversification announcement and reactions to related acquisitions [Kaplan & Weisbach (1992), Hubbard & Palia (1999)]. Second, there are results showing that diversifiers may trade at a discount even before they diversify and that, in terms of abnormal returns, the mean market returns are positive and statistically significant for diversifying acquisitions for the 1980s and 1990s, for all that matters [Hyland & Dlitz (2002)].

On one hand, we predict that the market would appreciate more the acquisition of a target that diversifies within the same industry in view of its ability to master its industry. On the other hand, we predict that the market would depreciate the acquisition of a target that ventures into several industries since conglomerates tend to reduce the risk of managerial human capital and to create « business empires » perhaps valued excessively by CEOs. Conglomerate may also reflect an agency problem by the fact that executive compensation showed little sensitivity to firm performance at the time (Jensen & Murphy, 1990). On that way, we put forward the two following hypotheses:

H2: The market would react positively to an acquisition of a diversified target within technological fields inside one industry.

H3: The market would react negatively to an acquisition of a diversified target within several industries.

The hypotheses examined in this paper result from variables that fall into two groups. On one hand, technological diversification (our main independent variable of interest) and another technological variable accounting for number of patents as explained below. On the other hand, firm & deal characteristics, viewed more as control variables.

2.2. Variables' description

2.2.1. Technological diversification and other technological characteristics

We consider a technological firm as a company possessing at least one patent in its portfolio or immaterial capital. In contrast, a non-technological firm has no the least patent in its portfolio. We determined the tecnhological aspect according to NBER database.

From there, we created a dummy variable called Tech_Targ equal to one when the target is technological, and equal to 0 when it is non-technological. Another dummy variable called Tech_Acq follows the same spirit.

- ✓ **Variable of interest : Technological diversification**

Arguably, innovation comes in the aftermaths of recombining existing elements of knowledge into new complementary syntheses (Schumpeter, 1934), and increasingly innovation urge firms from different industries to cooperate together in the realms of technological inventions. In this connection, we first compute HHI within firm's technological fields, and in the second instance, we compute HHI across firm's

industries in which the latter was reported to have at least one patent application during the period 1990-2006. This HHI measure[96] is computed in two steps.

First, we calculated the Revealed Technology Advantage (RTA) measure that gives the relative importance of the firm to each field of technological competence, after taking account of the firm's total volume of competencies (Patel & Pavitt, 1997).

$$\mathbf{RTA}_{i,t} = \frac{\text{Patent Share}}{\text{The firm's aggregate share in all the fields}}$$

Second, we used the Herfindhal Hirschman Index to account for diversification or concentration within firms' subcategories and also within categories. Hall et al (2001, 2005) worked on patents through NBER database[97] and put forward a classification of each patent by categories and subcategories, while respecting International Patent Classification (IPC). Categories refer to sectors or industries and ranges from 1 to 6. Subcategories allude to business lines or industry segments and are referenced by a number from 11 to 69; that said, there are 37 technological fields[98].

For a set of N patents falling into ***k*** *subcategories* ranging from 1 to 37, HHI of patents across the subcategories for target ***i*** in year ***t*** is defined by the following expression:

$$\mathbf{HHI\_Subcat}_{i,t} = \sum_{k=1}^{37} (\mathrm{RTA})^2 \;\; ; \;\; 0 < \mathrm{HHI} < 1$$

[96] Other measures of diversification have been derived from the initial HHI measure depending on the authors and the way they want to adapt this diversification measure to their paper. For example, Leten et al (2007) computed diversification as the inverse of HHI ; Chiu et al (2008) used 1- HHI over 364 technological classes ; and Chen & Chang (2010) worked on the original HHI adapted to firms.

[97] The data from Copustat Industry Segment database are not always reliable about reported increases in a firm's number of segments [Hyland & Dlitz (2002), Villalonga (2004)]

[98] See NBER databases for more details

For a set of N patents falling into ***k*** ***categories*** ranging from 1 to 6, HHI of patents across the categories for target ***i*** in year ***t*** is defined by the following expression:

$$\mathbf{HHI\_Cat}_{i,t} = \sum_{k=1}^{6} (\mathrm{RTA})^2 \quad ; \quad 0 < \mathrm{HHI} < 1$$

In our previous paper, we were interested in the acquirer's degree of technological diversification and its evolution with the advent of new mergers and acquisitions. We have therefore considered the evolution of technological diversification measuring it by a concentration index more commonly known as HHI. As this index is a probability, the closer it gets to 1 the more specialized the firm is, and the closer it gets to 0 the more diversified the firm is.

In this paper, we focus on the impact of the target's technology diversification on merger premium and market's reaction. Here, we are not attempting to know whether the HHI tends to 0 or 1, but whether the diversified or specialized status impacts, one hand, the premium paid by the acquirers or received by the target companies; and on the hand, the market's reaction measured through synergy CARs.

Thus, the question arises of the qualification criterion of a target company as being diversified or specialized. It must be said that to be based on the simple dichotomy; assigning on one hand the status of specialized to any firm having an HHI equal to 1, and on the other the status of diversified to any firm having an HHI other than 1; could skew a lot of our results and not account for the economic reality.

Since our measure is the aggregation of patents held in each technological segment down to all patents in the firm's portfolio; a company with 30 patents in a technology field A and 2 patents in another field B would be considered as diversified with respect to HHI. However, from a realistic point of view, this company appears rather as a specialized or on its way to diversify but in no way as diversified in view of its patent portfolio concentrated at 90% in the technological segment A.

From this point of view, in order to preserve economic wealth, we have created a new binary variable adjusted to the HHI median so as to distinguish two sub-samples corresponding to diversified and specialized companies.

The median is defined as the midpoint of a data set when the data is arranged in ascending or descending order. Half the observations lie above the median and half are below. Since we are dealing with patents and strong outliers, we decided to use and interpret the median because the arithmetic mean can be affected by extremely large or small values. When this occurs, the median is a better measure of central tendency than the mean because it is not affected by strong outliers that may actually be a biaised interpretation of data.

Basically, we create 4 dummy variables accounting for the two levels of acquirers' diversification along with the two levels of targets' diversification. Thereby, when it comes to the 704 acquirers, the HHI within categories has a median of 0.53 and the HHI within subcategories has a median of 0.27. As for the 486 targets' diversification, which is our main variable of interest, the HHI within categories has a median of 0.71 and the HHI within subcategories has a median of 0.45. Accordingly, a target having a HHI_Cat lower than 0.71 is considered as diversified, otherwise it is considered as specialized; on that same perspective, a target having a HHI_Subcat lower than 0.45 is considered as diversified, otherwise it is considered as specialized.

Thresholds' construction: Acquirers' HHI within Subcategories and Categories

variable	N	mean	p50	p25	p75	p99	sd	min	max
Premium4we~n	704	42.21105	39.34	23.785	58.195	98.59	23.60749	0	100
Acquiror~Pat	704	1031.946	50.5	5	419	13903	3847.675	1	36778
Acq~I_Subcat	704	.3752329	.2641553	.1382383	.5226195	1	.3136821	.0003711	1
Acquir~I_Cat	704	.5878128	.5261284	.3395531	.9521342	1	.3052936	.0009937	1

Thresholds' construction: Targets' HHI within Subcategories and Categories

variable	N	mean	p50	p25	p75	p99	sd	min	max
Premium4we~n	486	41.44772	39.37	24.13	57.18	98.59	22.84821	0	100
Acquiror~Pat	486	1207.531	66	7	576	36772	4454.778	0	36778
Target_H~cat	486	.5259408	.4449374	.2454649	1	1	.3532819	.0007305	1
Target_H~Cat	486	.6705233	.706195	.4088184	1	1	.3220805	.0059172	1

Empirically, we will use the following variables' names:

Ω_Divers_Targ = 1 if the target is diversified within Categories – or industries –, and 0 otherwise.

Ψ_Divers_Targ = 1 if the target is diversified within Subcategories – or industry segments –, and 0 otherwise.

We followed the same logic for acquirers with the two variables Ω_Divers_Acq and Ψ_Divers_Acq, based on the median points 0.53 for the former and 0.27 for the latter.

✓ **Number of patents**

Aside from deal and financial characteristics of a firm, one must not overlook a firm's technological characteristics. So as to better know whether the premiums and market's reaction are impacted by the technological diversification or merely the number of patents possessed by the target – and also by the acquirer –. All papers dealing with patents topics used this variable in their models [(Griliches (1990), Lerner (1994), Deng et al (1999), Hirschey et al (2001), Chen et al (2010) among others]

NP_Targ $_{i,t}$ **&** ***NP_Acq*** $_{i,t}$ = Total number of patent applications held by firm i within year t, from 1990 to 2006, it ranges from 1 to 36778.

2.2.2. Control variables for merger premiums and abnormal returns

Since merger premiums might be affected by various parameters, we introduce firms and deal characteristics to control for the impact of technological diversification on the price paid by bidders and the market's response to the merger announcement [Asquith (1983), Flanagan & O'Shaughnessy (2003), Moeller et al (2004), Betton et al (2007), Antoniou et al (2008), Alexandridis et al (2013), Davis & Madura (2017), among others]. Following the literature, we control for deal characteristics using six dummies, namely, Status, Number of Bidders, Attitude, Tender offer, Allcash, and Poison pill (see Appendix 2 for deal variables' description). Following Betton, Eckbo and Thorburn (2007), we must keep in mind that several variables used for an offer premium are themselves endogenous choice variable; to cite them, there are payment method, hostility, and bidder's public status (here we are using exclusively public bidders). As for firm characteristics, we control through R&D[99] intensity, Market value or Relative size (measured by firm's capitalization), performance (measured by market-to-book ratio), profitability (measured by ROA), Leverage, and Run-up.

- ✓ Research and Development

R&D is one of the main channels for high tech companies to generate and improve new growth opportunities. Davis & Madura (2017) found that the market reacts positively to acquisitions of high R&D targets in related transactions by higher R&D acquirers. In terms of merger premiums, Higgins & Rodriguez (2006) showed that low R&D acquirers would pay more for high R&D targets, since some tech firms were able to successfully outsource their R&D through acquisitions. Our first intuition would predict that premiums and CARs will be positively related to the R&D of targets but negatively related to the R&D of acquirers. Roughly, while high R&D targets are

[99] We must keep in mind that firms are not forced to report R&D expenditures which results in a considerable number of missing values in this variable. Since we lose a high percentage of observations due to missing values within control variables, we create a dummy variable equals to one if the R&D information is reported and zero otherwise. Based on this standard practise99, we then replace missing values in R&D expenditures with 0 so as to abtain an homogeneous sample with the same number of observations in our regressions that makes them comparable. [Fernández-Kranz, D., & Santaló, J. (2010)]

eligible for demanding more premiums at acquisition, the higher R&D acquirers would tend to pay less.

- ✓ Market-to-book ratio

Based on literature papers, acquirers have a tendency to pay higher premium for targets with low market valuation; probably because the former consider the latter to be undervalued and therefore more desirable. However, anouncement returns to acquirers remain mitigated. On one hand, bidder announcement returns are highest when acquirers with strong performance acquired poorly performing targets, meaning that acquirers and targets would have opposite signs for MTB. Investors may react positively to a bidder that pays a higher premium if the target's valuation is sufficiently low compared to its acquirer. On the other hand, many authors found a negative relationship between bidder valuation and ARs, and between premiums paid and firm size [Moeller et al (2004), Alexandridis et al (2013)]. We predict MTB to negatively impact premiums and ARs.

- ✓ Market value or Relative Size

Following results of Davis & Madura (2017), there is an inverse relationship between the relative size (Target market value/Acquirer market value) and premiums paid for mergers. This suggest that bidders may be willing to pay more for smallest targets and that ARs become more negative from smallest to largest deals. We must underline that Davis & Madura (2017) use the firm's capitalization as the proxy for size since « the total assets » may bias results in an examination of tech firms. We followed this spirt and took the market value for each of the merging firms separetely. We predict Relative Size to negatively impact premiums and ARs. Concretely, we predict the largest targets relative to their acquirers would receive lower premiums paid and the acquirer would record lower or more negative returns to the acquirer at announcement.

- ✓ Relatedness

Thinking of industry relatedness, one might suggest that acquirers may be willing to pay higher premiums when core-relatedness enters at stake given potential synergies [Flanagan & O'Shaughnessy (2003)]. However, one might also put forward that acquirers may pay higher premiums for unrelated targets, meaning that acquiring firms are looking for new growth opportunities outside their firm's boundaries.

- ✓ Competitive

Many empirical and theoretical papers have shown that the more a deal arrouses attention of multiple bidders, the more the transaction will be competitive and the highest will be the merger premiums paid. We used a dummy variable « Competitive » equal to one when it is a deal with a single bidder, and 0 otherwise.

- ✓ Cash versus Stock

Talking about the method of payment is in some ways inescapable although literature results seem to be mitigated. Do I have to make an equity bid or a cash bid? Many authors took an interest in the method of payment and they all converge to state that the method conveys an important signal regarding the true value of merging firms under asymmetric information. While some papers found that cash deals generate higher premiums [Madura & Ngo (2008)], others showed that cash offers result in lower premiums and that all stock offers reduced ARs to the acquirer [Alexandridis et al (2013), Davis & Madura (2017)]. Myers & Majluf (1984) synthetisized the meaning of the payment method as follows: « If acquiring firm management believes that its shares are undervalued, it is more likely to pay for acquisitions with cash. However, if acquiring firm management perceives its shares as being overvalued, it will prefer to convert these into « real » assets and therefore finance acquisition using stock. » We use two dummy variables to account for all cash (Dummy = 1) and all stock (Dummy = 0) transactions.

Section 3: Sample formation and empirical results

3.1. Sample and data collection

Starting from NBER to gather patents and technological informations, we then extract a sample of deals from SDC and merged it with compustat and CRSP to get financial and abnormal returns informations. We analyzed a sample of all publicly traded US firms from January 1990 to December 2006. Working on the impact of target's technological diversification on merger premiums and CARs, we keep all deals that provide sufficient information for acquirers and targets within SDC, Compustat and CRSP databases. Following Golubov et al (2015), we impose some restictions and requirements as follows:

1- Both bidder and target must be a US publicly[100] listed company.

2- The acquirer must own less than 50% of the target stock before the acquisition and achieve 100% after.

3- The transaction must be at least 1% of the acquirer's market capitalization 11 days before the announcement.

4- The deal value must exceed 1$ million.

5- The acquirer's stock price data for 300 trading days prior to the announcement are available from Center for Research in Security Prices (CRSP), and accounting informations for the year-end immediately ex-ante the announcement is available from Compustat.

Studying the Cumulative Abnormal Returns (CARs), we carried out the standard event study methodology to compute the CARs of the sample over the event window (-2; +2) around the announcement date. We measured our CARs as the return in excess of those predicted by the market model with a benchmark being the CRSP

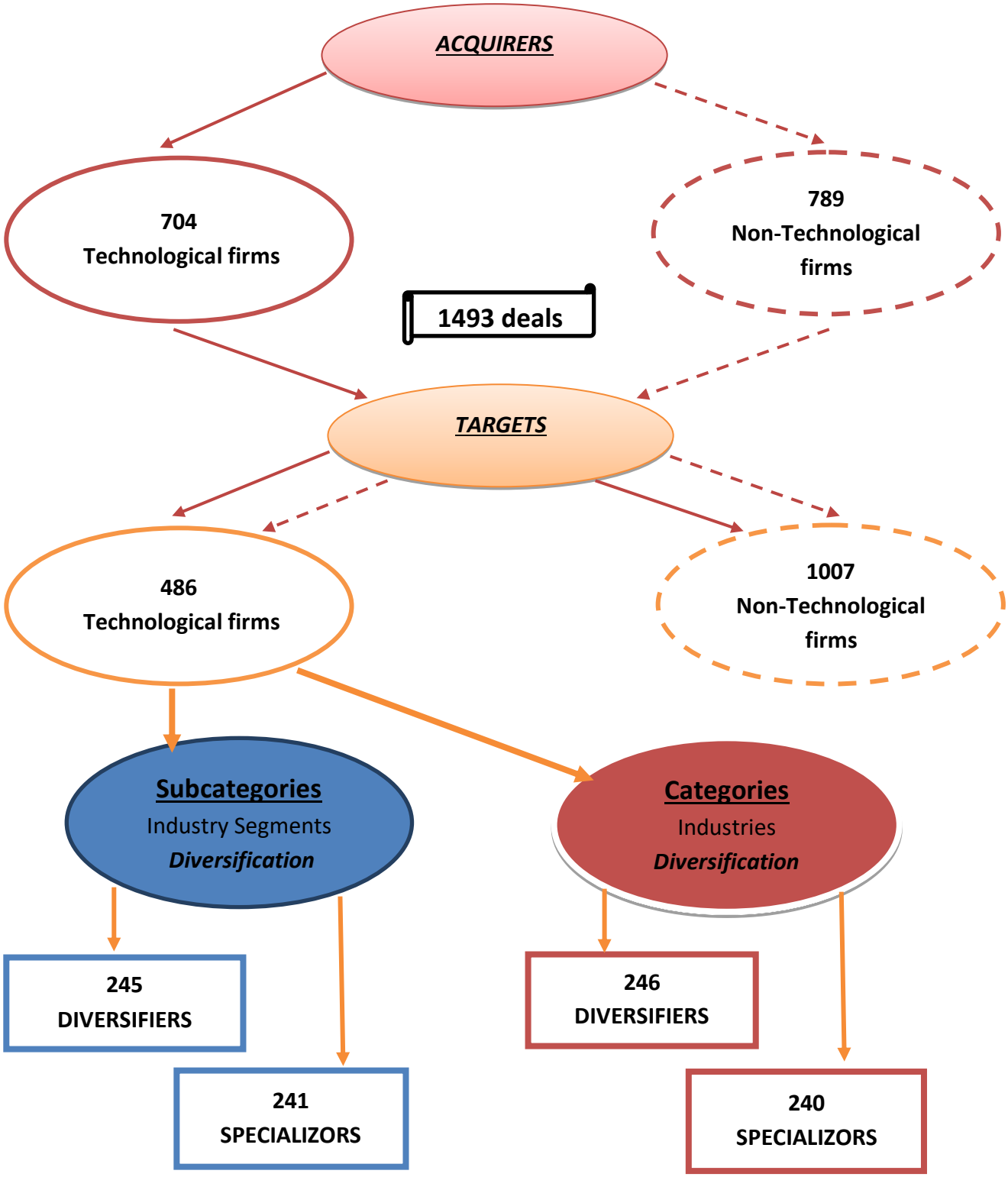
[100] Since public companies are more often operating firms, takeovers by listed corporations give rise to more shareholder wealth and improve the odds of producing « synergistic gains to share with the target » [Bargeron et al (2008)]

value-weighted index and parameters estimated over a period from 300 to 91 days prior the announcement. To understand how bidders determine the premium, it is better to use the data of the "offer price" directly[101] [Eckbo (2007)]. The premium is pertinent since it represents the payment, as a balance, to target shareholders to relinquish control. We take into account the premium as the percentage increase in price calculated from the target market price 4 weeks prior to the announcement to the initial bid price.

Collecting a sample of 7556 deals from SDC for the period 1990 – 2006, we removed firms with missing premium or abnormal returns, firms with missing accounting data, firms with negative premiums to shy away from brankruptcies and firms in extreme distress, and dropping some Penny stock deals leaving us with 1493 deals.
Next step, we merged these deals and firms' characteristics with NBER to take into account the technological aspect of acquirers and targets. We define a technological acquirer or target as a firm having at least one granted patent in their portfolio. On one hand, over 1493 mergers, we have 704 technological acquirers versus 789 non-technological acquirers; and on the other hand, we have 486 technological targets versus 1007 non-technological targets. Since the focus of this paper is technological diversification within two vertical levels, we split the sample of 486 technological targets within each level into two groups that are Diversifiers versus Specializors. Basically, following the categories (or industries) diversification, we have 246 diversifiers versus 240 specializors. Following the subcategories (or industry segments) diversification, we have 245 diversifiers and 241 specializors (See Figure 3 below).

[101] The bulk of the empirical works on M&As are content to use CARs around the takeover bid as a proxy for the actual offer premium. That said, CARs remain a biased estimate since they incorporate the probability of bid failure and competition at the offer initial date, and should therefore be estimated on a long-term window to capture the final premium [Eckbo (2007)]

Figure 8 - Sample of 1493 deals from 1990 to 2006



: Technological Acquiring firms – *Acquirers with at least one granted patent*
: Non-Technological Acquiring firms – *Acquirers with no patents*
: Technological Acquired firms – *Targets with at least one granted patent*

3.2. Descriptive statistics: Merger premiums and Market's reaction

3.2.1. Technological versus non-technological targets

Table 1 shows the descriptive statistics for our whole sample of 1493 observations from 1990 – 2006, regarding the technological dimension of the target. Breaking down our sample into technological targets (Tech_Targ = 1) versus non-technological targets (Tech_Targ = 0), the descriptive statistics show that technological targets receive higher premiums and arrouse more the attention of technological and more diversified acquirers in comparison with non-technological targets. Premiums paid to technological targets have a mean of 41.5 and a median of 39.4, up 4 or 5 percentage points compared with non-technological targets whose mean and median are respectively 37.5 and 34.2.

As for market's reaction, we put forward three different cumulative abnormal returns (CARs), namely, acquirers' CAR, targets'CAR, and synergy CAR. Looking at the mean (median), we observe that the market's reaction is more pronounced when it comes to a technological target. Concretely, acquirer's CAR has a mean of -0.16 (0.10) versus -0.12 (-0.10) for non-technological targets; as for synergies' CAR, the mean is 0.024 (0.019) against 0.020 (0.016).

Table 1 Panel A describes firms & deal characteristics. Technological targets appear in a « better health » than non-technological targets, regarding firms' characteristics. Indeed, technological targets have a median market value (333 090) that is twice as large as the non-technological targets (165 996), and the former have three times as much cash as the latter. Looking at variables' median, technological targets have also higher ROA, MTB, and obviously R&D in comparison with non technological targets. This indicate that beyond making higher investments in R&D, the average technological targets have a tendency to be a much larger firm with higher earnings and cash flow than non-technological targets. Aside from targets' characteristics, Table 1 displays also the acquirers' characteristics depending on wether the target is technological or not. Indisputably, we can see that the median of acquirers' variables is substantially higher for those who purchased technological targets. Actually, when it comes to technological targets, acquirers have higher market value (3 006 947), higher MTB (2.11), more cash (0.13) and more R&D (0.051) than when it comes to non-technological targets whose figures are respectively 1 519 458 ; 1.21 ; 0.045 ;

and 0. However, we must underline that Target_R&D (0.071) is greater than Acquirers_R&D (0.051) confirming Phillips and Zhdanov (2013) who found that large firms prefer not to vie or compete with small firms in an R&D rate race, letting small companies innovate more.

As for the technological aspect of acquirers, Table 1 Panel B displays there are 276 out of 1007 non-technological targets acquired by technological bidders, whereas 428 out of 486 technological targets merged with technological acquirers. Table 1 Panel B also gives us information about acquirers' patents portfolio showing that acquirers of technological targets (of non-technological targets) have a median number of patents of 97.5 (10). Moreover, looking at the original HHI within the two levels, it appears that acquirer's technological diversification is more pronounced for those who merge with technological targets (Acq_HHI_Subcat: median 0.25; Acq_HHI_Cat: median 0.50) than those merging with non-technological targets (Acq_HHI_Subcat: median 0.29; Acq_HHI_Cat: median 0.58). These first descriptive results not only indicate that technological targets draw attention of acquirers that are more active in patenting, but they also attract acquirers that are more diversified within industry segments and within industries in comparison with non-technological targets. Basically, whether the merging firms possess patents or not could influence the merger premiums paid and market's reaction. That said, we must keep in mind that technology is a vast concept. Since the spirit of this paper not only copes with technology through patents' consideration but more precisely with technological diversification at two different levels, we analyzed the premiums and the market sentiment once target's diversification enters at stake.

Table 1 – Panel A : *Technological versus Non-Technological Targets* - Firms & Deal characteristics

Tech_Targ	variable	N	mean	p50	p25	p75	p99	sd	min	max
0	Premium4we~n	1007	37.54906	34.2	20.23	52.34	95.35	22.74573	.16	100
	Acq_CAR	1007	-.0122095	-.0108303	-.0440469	.023243	.1659478	.0679836	-.358922	.4042631
	Targ_CAR	1007	.193642	.1624537	.0693899	.2923144	.7079456	.1767982	-.4065286	1.009276
	Synergy_CAR	1007	.0202569	.0161141	-.0176096	.0493914	.2386191	.0690544	-.2996586	.4697848
	targ_mv	1007	776451.4	165996	62237.5	518777.3	1.28e+07	2345746	2900.35	3.12e+07
	targ_roa	1007	.0696309	.0370762	.020608	.1311896	.3592996	.1125548	-.6800911	.6689201
	targ_mtb	1007	1.48681	1.108453	1.018467	1.503418	6.354918	1.121983	.5750887	16.23232
	targ_cash	1007	.1162003	.0466511	.0201013	.1190872	.7961819	.1721498	0	.952119
	targ_rd	1007	.0156716	0	0	0	.2507083	.056176	0	.5634887
	targ_lev	1007	.1719355	.1268192	.029191	.2575712	.7493669	.1753238	0	.8776633
	targ_fcf	1007	-.001374	0	0	.0303203	.226051	.1085558	-.7896978	.7684441
	targ_RUN_UP	1007	1.092796	1.013514	.8250694	1.238709	2.739921	.5502593	.0399701	8.647387
	acq_mv	1007	9199914	1519458	395592.3	5896440	1.59e+08	2.91e+07	9412	4.76e+08
	acq_roa	1007	.0889788	.0426145	.0260972	.1451216	.4030403	.1021096	-.4033917	.9052992
	acq_mtb	1007	1.820126	1.213991	1.062836	1.741714	10.24835	2.537808	.6304013	58.04093
	acq_cash	1007	.0971222	.0450149	.0236128	.0971809	.6506118	.1375099	0	.9764776
	acq_rd	1007	.0130519	0	0	0	.195553	.0420363	0	.477408
	acq_lev	1007	.1659962	.1371034	.0525867	.2435758	.5809292	.1406988	0	.782738
	acq_fcf	1007	.0141555	0	0	.0359594	.209841	.0812379	-.7552229	.5630256
	acq_RUN_UP	1007	1.120719	1.053719	.8817459	1.249448	2.958116	.4399392	.095869	4.470399
	Status_Dummy	1007	.8947368	1	1	1	1	.3070447	0	1
	TendOff_Du~y	1007	.1171797	0	0	0	1	.3217942	0	1
	Attitude_D~y	1007	.958292	1	1	1	1	.2000205	0	1
	PoisPill_D~y	1007	.0049652	0	0	0	0	.0703243	0	1
	AllCash_Du~y	1007	.203575	0	0	0	1	.4028565	0	1
	NboB_Dummy	1007	.9424032	1	1	1	1	.2330952	0	1
1	Premium4we~n	486	41.44772	39.37	24.13	57.18	98.59	22.84821	0	100
	Acq_CAR	486	-.0167804	-.0105744	-.0535235	.0241065	.1754303	.0815944	-.377482	.3816528
	Targ_CAR	486	.2399824	.2044504	.1055875	.3514193	.8819959	.2099617	-.3873739	.9933205
	Synergy_CAR	486	.0241442	.0190973	-.0152938	.073373	.2417585	.0813743	-.2944042	.3089033
	targ_mv	486	2304908	333090.3	106529.6	1245720	5.08e+07	7596207	2905.15	7.72e+07
	targ_roa	486	.0482941	.1145624	.0028612	.1734851	.3747588	.2433488	-1.950595	.4781679
	targ_mtb	486	2.620619	1.833882	1.26398	2.969766	17.8156	2.580136	.5339603	23.47748
	targ_cash	486	.2804537	.1885972	.0366502	.4826315	.9110214	.2694216	0	.9734219
	targ_rd	486	.1121631	.0718299	.0139453	.146917	.7850371	.1581892	0	1.501724
	targ_lev	486	.1115818	.0472912	.0006012	.1852266	.5374861	.1384267	0	.6350508
	targ_fcf	486	-.0254605	.0196448	-.0151107	.0623797	.197492	.1995921	-2.160341	.3034658
	targ_RUN_UP	486	1.05073	.9055252	.6805685	1.220623	3.801633	.8150789	.1230732	13.65691
	acq_mv	486	2.41e+07	3006947	783720	1.54e+07	2.13e+08	5.14e+07	23456	4.93e+08
	acq_roa	486	.1386028	.1489775	.0934881	.2064671	.4182479	.1308892	-.6165518	.4924845
	acq_mtb	486	2.930721	2.115021	1.504259	3.289486	13.93441	3.084416	.3291293	47.68576
	acq_cash	486	.2022419	.1307967	.0344512	.3000082	.8079417	.2120992	.0000672	.9320403
	acq_rd	486	.076563	.0517625	.0115207	.1001651	.4685331	.1022939	0	1.097673
	acq_lev	486	.0975128	.061887	.0120012	.1409486	.5803999	.1133823	0	.6162414
	acq_fcf	486	.038715	.0504983	.0090246	.0871752	.2055973	.1006848	-.667861	.2512238
	acq_RUN_UP	486	1.128123	1.038154	.8378685	1.266399	3.026088	.5428471	.1995934	7.102462
	Status_Dummy	486	.8744856	1	1	1	1	.3316427	0	1
	TendOff_Du~y	486	.2469136	0	0	0	1	.4316604	0	1
	Attitude_D~y	486	.9074074	1	1	1	1	.2901593	0	1
	PoisPill_D~y	486	.0185185	0	0	0	1	.1349558	0	1
	AllCash_Du~y	486	.3271605	0	0	1	1	.4696598	0	1
	NboB_Dummy	486	.9012346	1	1	1	1	.2986542	0	1
Total	Premium4we~n	1493	38.81814	35.22	21.21	54.63	95.91	22.84469	0	100
	Acq_CAR	1493	-.0136974	-.0108197	-.0466175	.0234235	.1754303	.0726984	-.377482	.4042631
	Targ_CAR	1493	.2087267	.1752033	.0802737	.309777	.7876009	.1894145	-.4065286	1.009276
	Synergy_CAR	1493	.0215223	.0171349	-.0171811	.0556221	.2409436	.0732876	-.2996586	.4697848
	targ_mv	1493	1273993	203035	68534.46	713334.4	2.26e+07	4793803	2900.35	7.72e+07
	targ_roa	1493	.0626854	.0733802	.0202512	.1445623	.3639264	.167009	-1.950595	.6689201
	targ_mtb	1493	1.855886	1.235023	1.040631	1.948556	9.074718	1.815277	.5339603	23.47748
	targ_cash	1493	.1696679	.0613289	.0224209	.2356147	.8863028	.2224984	0	.9734219
	targ_rd	1493	.0470814	0	0	.046638	.4685065	.1109405	0	1.501724
	targ_lev	1493	.1522892	.101695	.0111916	.2375746	.7317861	.1665982	0	.8776633
	targ_fcf	1493	-.0092147	0	0	.0427448	.2178088	.1449928	-2.160341	.7684441
	targ_RUN_UP	1493	1.079103	.9894268	.7727998	1.234056	2.958211	.6484636	.0399701	13.65691
	acq_mv	1493	1.41e+07	1859037	489235.8	8164300	1.95e+08	3.85e+07	9412	4.93e+08
	acq_roa	1493	.1051324	.0975474	.0292923	.1728035	.4182479	.1146306	-.6165518	.9052992
	acq_mtb	1493	2.181646	1.430943	1.095735	2.288495	11.36728	2.77599	.3291293	58.04093
	acq_cash	1493	.1313407	.0565302	.0255886	.155196	.7326278	.1726293	0	.9764776
	acq_rd	1493	.033726	0	0	.0385036	.3105251	.0740215	0	1.097673
	acq_lev	1493	.1437036	.1104143	.0359119	.21695	.5809292	.1362246	0	.782738
	acq_fcf	1493	.0221501	.007272	0	.062676	.209841	.0887565	-.7552229	.5630256
	acq_RUN_UP	1493	1.123129	1.048806	.8677391	1.257724	3.007093	.4757152	.095869	7.102462
	Status_Dummy	1493	.8881447	1	1	1	1	.315294	0	1
	TendOff_Du~y	1493	.1594106	0	0	0	1	.3661812	0	1
	Attitude_D~y	1493	.9417281	1	1	1	1	.2343354	0	1
	PoisPill_D~y	1493	.0093771	0	0	0	0	.0964126	0	1
	AllCash_Du~y	1493	.2438044	0	0	0	1	.42952	0	1
	NboB_Dummy	1493	.929002	1	1	1	1	.2569075	0	1

Table 1 – Panel B : *Technological versus Non-Technological Targets* - Technological dimension of acquirers

Tech_Targ	variable	N	mean	p50	p25	p75	p99	sd	min	max	skewness	kurtosis
0	Premium4we~n	1007	37.54906	34.2	20.23	52.34	95.35	22.74573	.16	100	.6039499	2.666493
	Acq_CAR	1007	-.0122095	-.0108303	-.0440469	.023243	.1659478	.0679836	-.358922	.4042631	-.0552071	8.037066
	Targ_CAR	1007	.193642	.1624537	.0693899	.2923144	.7079456	.1767982	-.4065286	1.009276	.9005005	4.231787
	Synergy_CAR	1007	.0202569	.0161141	-.0176096	.0493914	.2386191	.0690544	-.2996586	.4697848	.574216	8.327229
	Tech_Acq	1007	.2740814	0	0	1	1	.4462719	0	1	1.012974	2.026116
	NP_Acq	276	505.9058	10	2	111	10533	1654.958	1	12776	4.892011	30.53609
	NbS_Acq	276	9.007246	4	2	12	35	9.79313	1	37	1.347842	3.622854
	HHI_S_Acq	276	.4357792	.292298	.1315389	.905	1	.3633662	.0018904	1	.6275958	1.812554
	S_Divers_Acq	276	.4746377	0	0	1	1	.5002634	0	1	.10158	1.010319
	NbC_Acq	276	3.028986	3	1	5	6	1.79268	1	6	.3434487	1.670946
	HHI_C_Acq	276	.6359421	.5856273	.3107346	1	1	.3375421	.0069444	1	-.1660185	1.447686
	C_Divers_Acq	276	.4601449	0	0	1	1	.4993144	0	1	.1599292	1.025577
1	Premium4we~n	486	41.44772	39.37	24.13	57.18	98.59	22.84821	0	100	.3762223	2.533032
	Acq_CAR	486	-.0167804	-.0105744	-.0535235	.0241065	.1754303	.0815944	-.377482	.3816528	-.5181098	6.080563
	Targ_CAR	486	.2399824	.2044504	.1055875	.3514193	.8819959	.2099617	-.3873739	.9933205	.7440804	4.096519
	Synergy_CAR	486	.0241442	.0190973	-.0152938	.073373	.2417585	.0813743	-.2944042	.3089033	-.1558445	4.65563
	Tech_Acq	486	.8806584	1	1	1	1	.324524	0	1	-2.348366	6.514824
	NP_Acq	428	1371.168	97.5	19	806.5	36772	4723.953	1	36778	6.181545	44.07294
	NbS_Acq	428	14.77804	12	5	25	35	10.73416	1	37	.3998905	1.779794
	HHI_S_Acq	428	.336189	.25	.1427289	.4543816	1	.2703058	.0003711	1	1.108197	3.444559
	S_Divers_Acq	428	.5303738	1	0	1	1	.4996606	0	1	-.1217201	1.014816
	NbC_Acq	428	4.14486	5	2.5	6	6	1.795792	1	6	-.5359323	1.841727
	HHI_C_Acq	428	.5567762	.5020462	.3418735	.7636835	1	.2785833	.0009937	1	.1951525	2.067621
	C_Divers_Acq	428	.5280374	1	0	1	1	.4997975	0	1	-.1123263	1.012617
Total	Premium4we~n	1493	38.81814	35.22	21.21	54.63	95.91	22.84469	0	100	.5254237	2.594461
	Acq_CAR	1493	-.0136974	-.0108197	-.0466175	.0234235	.1754303	.0726984	-.377482	.4042631	-.28431	7.318919
	Targ_CAR	1493	.2087267	.1752033	.0802737	.309777	.7876009	.1894145	-.4065286	1.009276	.8814	4.320719
	Synergy_CAR	1493	.0215223	.0171349	-.0171811	.0556221	.2409436	.0732876	-.2996586	.4697848	.2665507	6.693116
	Tech_Acq	1493	.4715338	0	0	1	1	.4993563	0	1	.1140497	1.013007
	NP_Acq	704	1031.946	50.5	5	419	13903	3847.675	1	36778	7.309458	63.59473
	NbS_Acq	704	12.51563	9	3	21	35	10.7448	1	37	.6974798	2.109742
	HHI_S_Acq	704	.3752329	.2641553	.1382383	.5226195	1	.3136821	.0003711	1	.9489862	2.666659
	S_Divers_Acq	704	.5085227	1	0	1	1	.5002828	0	1	-.0340959	1.001163
	NbC_Acq	704	3.707386	4	2	5	6	1.874331	1	6	-.1777728	1.522783
	HHI_C_Acq	704	.5878128	.5261284	.3395531	.9521342	1	.3052936	.0009937	1	.0752049	1.725484
	C_Divers_Acq	704	.5014205	1	0	1	1	.5003535	0	1	-.0056818	1.000032

3.2.2. Technological diversification: two levels

On this basis, Table 2 shows the price paid by bidders and market's reaction with regard to the target technological diversification. In Table 2, Panel A, we parse our sample of 486 technological targets by diversification within technological fields where Ψ_Divers_Targ = 1 means diversified and 0 means specialized ; and we can notice that the more diversified is the target, the higher is the premium since diversified targets have a median (mean) of 41.62% (43.46%) or 4 points more than specialized targets whose median (mean) is 37.67% (39.41%). This clearly, indicate that targets' technological diversification within industry segments may increase the premium paid by bidders. Furthermore, we note that the median (mean) acquirers' CAR are still negative and higher when the target is diversified, -0.015 (-0.017) compared to specialized targets, -0.007 (-0.015). On the contrary, with the highly positive targets CAR, the median (mean) synergy CAR is positive and enough higher when the target is diversified, 0.021 (0.029) in comparison with specialized targets, 0.014 (0.018). By the way, the number of Patents is substantially higher for diversified targets (median = 16; p(75) = 49) than for specialized targets (median = 4 ; p(75) = 13). On that same perspective, acquirers merging with diversified targets (N = 218) are more active in patenting with a median (mean) of NP_Acq variable equal to 126.5 (1196.6) compared to those (N = 210) merging with specialized with a patents' numebr of 76 (1553) – the mean is pulled to the right by extreme values –. Moreover, looking at the original HHI_S_Acq, it appears that the former themselves are more diversified within subcategories than the latter (HHI_S_Acq: median (mean) = 0.20 (0.28) versus HHI_S_Acq: median (mean) 0.28 (0.38)). NbS_Acq is a variable taking into account the number of subcategories in which acquirers possess patents and we can note that the former is active in 15 different subcategories while the latter have a median of 9, clearly indicating that targets diversified within subcategories attract more diversified acquirers than specialized targets.

The second and upper level of diversification, namely categories or industries, is displayed in Panel B. Based on the sample of 486 technological targets, we can see that targets diversifying within categories record either the same or lower premiums than specializors targets. Looking at descriptive statistics, diversified targets have a median (mean) premium of 38.5% (41%) while specializors targets have a median (mean) of 40% (41%). This implies that unlike technological fields diversification, the

more diversified target within categories the lower is the premium paid. The preceding suggests that depending on the level of diversification, the target technological diversification aspect is differently taken into account in the premiums paid. Regarding the CARs, they seem to be on the lines of the previous level of diversification given that the synergy CARs remain highly positive for diversified targets with a median (mean) of 0.022 (0.029) compared to 0.012 (0.019) when the target is specialized. However, we can note that based on the median, the acquirers' CARs are definitely the same no matter if the target is diversified within industries or not – around -0.010 –. As for technological variable of targets and acquirers, we have the same tendency as in Panel A suggesting that diversified targets within categories draw more the attention of diversified acquirers than specialized targets.

Table 2 – Panel A : Diversified Targets versus Specialized Targets – Subcategories/Industry segments

S_Divers_Targ	variable	N	mean	p50	p25	p75	p99	sd	min	max	skewness	kurtosis
0	Premium4we~n	241	39.4061	37.67	24.13	53.42	95.65	21.50182	.43	100	.423442	2.706928
	Acq_CAR	241	-.0159843	-.0071881	-.0535235	.0258027	.1403226	.0824543	-.3486993	.3816528	-.5091265	6.974884
	Targ_CAR	241	.2351431	.2033419	.1032588	.3378558	.8189374	.2101042	-.2371651	.9933205	.9260592	4.161027
	Synergy_CAR	241	.0187258	.0140815	-.019305	.0648004	.1772204	.0781294	-.2944042	.2540846	-.5422202	5.268663
	NP_Targ	241	26.3527	4	2	13	472	95.75531	1	969	7.177109	60.8415
	NP_Acq	210	1553.424	76	12	803	36772	5271.056	1	36778	5.612473	36.08223
	NbS_Acq	210	13.5619	9	4	24	34	11.09974	1	37	.5674395	1.843943
	HHI_S_Acq	210	.3876486	.2860782	.1754647	.5632766	1	.2911166	.0004422	1	.8670825	2.705026
	S_Divers_Acq	210	.4761905	0	0	1	1	.5006262	0	1	.0953463	1.009091
1	Premium4we~n	245	43.456	41.62	25.31	60.02	98.92	23.97388	0	100	.2982788	2.365003
	Acq_CAR	245	-.0175634	-.0150219	-.0534486	.0224064	.196978	.0809007	-.377482	.2146856	-.5285966	5.128505
	Targ_CAR	245	.2447426	.2102903	.1210135	.3566045	.8819959	.2101424	-.3873739	.9270535	.5663191	4.068006
	Synergy_CAR	245	.0294742	.0217674	-.012815	.0784251	.2569258	.0842643	-.2112746	.3089033	.1191583	4.049887
	NP_Targ	245	109.0163	16	6	49	1566	365.7488	2	3972	6.917405	61.73889
	NP_Acq	218	1195.601	129.5	28	835	23881	4133.854	1	36778	6.886802	55.5393
	NbS_Acq	218	15.94954	15	7	25	35	10.25941	1	35	.2688145	1.80483
	HHI_S_Acq	218	.2866177	.2057537	.1200047	.3891006	1	.2389932	.0003711	1	1.347063	4.536398
	S_Divers_Acq	218	.5825688	1	0	1	1	.4942702	0	1	-.3348729	1.11214
Total	Premium4we~n	486	41.44772	39.37	24.13	57.18	98.59	22.84821	0	100	.3762223	2.533032
	Acq_CAR	486	-.0167804	-.0105744	-.0535235	.0241065	.1754303	.0815944	-.377482	.3816528	-.5181098	6.080563
	Targ_CAR	486	.2399824	.2044504	.1055875	.3514193	.8819959	.2099617	-.3873739	.9933205	.7440804	4.096519
	Synergy_CAR	486	.0241442	.0190973	-.0152938	.073373	.2417585	.0813743	-.2944042	.3089033	-.1558445	4.65563
	NP_Targ	486	68.02469	9	3	30	1504	271.1989	1	3972	9.070763	108.2099
	NP_Acq	428	1371.168	97.5	19	806.5	36772	4723.953	1	36778	6.181545	44.07294
	NbS_Acq	428	14.77804	12	5	25	35	10.73416	1	37	.3998905	1.779794
	HHI_S_Acq	428	.336189	.25	.1427289	.4543816	1	.2703058	.0003711	1	1.108197	3.444559
	S_Divers_Acq	428	.5303738	1	0	1	1	.4996606	0	1	-.1217201	1.014816

Table 2 – Panel B : Diversified Targets versus Specialized Targets – Categories/Industries

C_Divers_Targ	variable	N	mean	p50	p25	p75	p99	sd	min	max	skewness	kurtosis
0	Premium4we~n	240	41.22829	39.99	24.79	56.395	98.59	21.96584	.43	100	.2968032	2.541058
	Acq_CAR	240	-.0157962	-.010822	-.0553985	.0232817	.2134205	.0818211	-.3486993	.3816528	-.126846	6.591538
	Targ_CAR	240	.2454515	.2112379	.1034878	.3625553	.8189374	.2152666	-.2371651	.9422705	.7983896	3.628238
	Synergy_CAR	240	.0190958	.0127773	-.0212968	.0634552	.2417585	.0814352	-.278047	.3089033	-.0695865	4.676265
	NP_Targ	240	21.7125	3.5	2	11.5	431	81.49336	1	969	8.352564	85.53375
	NP_Acq	211	1850.199	74	12	851	36778	6199.434	1	36778	4.991611	27.6736
	NbC_Acq	211	3.744076	4	2	6	6	1.944688	1	6	-.1744023	1.44651
	HHI_C_Acq	211	.6386557	.6212279	.4263769	.9341425	1	.2765462	.0044964	1	-.089844	1.837327
	C_Divers_Acq	211	.4028436	0	0	1	1	.4916362	0	1	.3961769	1.156956
1	Premium4we~n	246	41.66179	38.675	23.49	57.38	96.84	23.72029	0	100	.4324962	2.494596
	Acq_CAR	246	-.0177405	-.0105744	-.0504228	.0241065	.1714604	.0815279	-.377482	.196978	-.9043718	5.539897
	Targ_CAR	246	.2346466	.1980973	.1170109	.3455209	.8819959	.2049522	-.3873739	.9933205	.6747781	4.607981
	Synergy_CAR	246	.0290696	.022991	-.0096376	.07606	.2172866	.0811776	-.2944042	.3056813	-.2413902	4.701739
	NP_Targ	246	113.2073	18.5	6	52	1566	367.379	2	3972	6.790296	60.13939
	NP_Acq	217	905.3825	136	28	627	11581	2511.447	1	23881	5.586046	41.11642
	NbC_Acq	217	4.534562	5	4	6	6	1.545589	1	6	-.8830736	2.652123
	HHI_C_Acq	217	.4771606	.4390601	.2905446	.6275341	1	.2571972	.0009937	1	.4524836	2.668129
	C_Divers_Acq	217	.6497696	1	0	1	1	.478145	0	1	-.6279094	1.39427
Total	Premium4we~n	486	41.44772	39.37	24.13	57.18	98.59	22.84821	0	100	.3762223	2.533032
	Acq_CAR	486	-.0167804	-.0105744	-.0535235	.0241065	.1754303	.0815944	-.377482	.3816528	-.5181098	6.080563
	Targ_CAR	486	.2399824	.2044504	.1055875	.3514193	.8819959	.2099617	-.3873739	.9933205	.7440804	4.096519
	Synergy_CAR	486	.0241442	.0190973	-.0152938	.073373	.2417585	.0813743	-.2944042	.3089033	-.1558445	4.65563
	NP_Targ	486	68.02469	9	3	30	1504	271.1989	1	3972	9.070763	108.2099
	NP_Acq	428	1371.168	97.5	19	806.5	36772	4723.953	1	36778	6.181545	44.07294
	NbC_Acq	428	4.14486	5	2.5	6	6	1.795792	1	6	-.5359323	1.841727
	HHI_C_Acq	428	.5567762	.5020462	.3418735	.7636835	1	.2785833	.0009937	1	.1951525	2.067621
	C_Divers_Acq	428	.5280374	1	0	1	1	.4997975	0	1	-.1123263	1.012617

These descriptive results could be explained by two different reasons.

First, conglomerate waves and an entrance into new category or industry have been perceived as detrimental for the company since it implies different costs and risks.

The second reason is that « A Jack of all trades is a master of none! ». Merging with a technological firm is most of the time motivated by the desire to get access to targets patents portfolio and above all by the will to grab a new know-how that can improve or complement acquirers' technologies. It goes without saying that it is easier to create synergies when two firms belong to the same category, since the merging firms have similarities in their knowledge bases, in their knowledge of market's demand, and in their knowledge vocabulary. Based on Bena & Li (2014) paper, they showed that acquirers are more innovative firms as measured by the quantity of innovation output, while acquired firms are less innovative as measured by the declining rate of growth in innovation output. On this basis, we can assume that acquiring firms would look for a target that possesses a specific technology in the same business line as the acquirer, or in another business line but inside the same category as the acquirer. Thereby, we can explain these descriptive statistics suggesting that acquirers could be reluctant to acquire a technological target that is dispersed within several categories because of diversification and assimilation costs, but also due to the fact that « a Jack of all trades is a master of none! »

Section 4: Empirical results -– Merger Premiums; Market's reaction –

4.1. Empirical results: Target's Technological Diversification impact on Merger Premiums

4.1.1. Pooled/Linear regressions

Table 3 shows pooled regressions over the whole sample of 1493 deals and the impact of technological dimension on the premiums paid from 1990 – 2006. In column 1, we run a univariate regression to test whether the target's technological aspect palys a role in the price paid by the acquirer. The results show that the dummy Tech_Targ (equal to one if target has at least one patent and 0 otherwise) is positive and highly significant at 1% level. However, once we controlled for firms & deal characteristics in column 2 and introduced the acquirer's technological aspect in column 3, the dummy variable Tech_Targ became non-significant in both columns and even negative (-1.37) in column 4 when all variables are gathered. Moreover, the dummy Tech_Acq appears positive and highly significant at 1% level in column 3, and still significantly positive at 5% level in column 4 (3.78), indicating that acquirers' technological aspect could also impact the premiums paid and erase target's one. Nevertheless, regarding the whole sample, we must keep in mind that the information relative to the 486 technological targets could be drowned among several other informations relative to non-technological targets and non-technological acquirers.

In order to examine to what extent does target's technological diversification impact merger premiums, we estimate the following empirical model in our baseline OLS regressions:

$$\textbf{\textit{Premium}}_{i,t} = \alpha_0 + \alpha_1\, \Omega\_Divers\_Targ_{i,t} + \alpha_2\, \Psi\_Divers\_Targ_{i,t} + \alpha_3\, Targ\_Size_{i,t} + \alpha_4\, \Omega\_Divers\_Acq_{i,t} + \alpha_5\, \Psi\_Divers\_Acq_{i,t} + \alpha_6\, Acq\_Size_{i,t} + \alpha_7\, X_{i,t} + \alpha_8\, Z_{i,t} + \varepsilon_{i,t} \quad \textbf{(1)}$$

Where i indexes deal number and t indexes the year. The $\textbf{Premium}_{i,t}$ term is the dependent variable and calculated 4 weeks prior to announcement. At the right side, the $\Omega\_Divers\_Targ_{i,t}$ is equal to one when the target is considered to be diversified within categories and 0 when it is specialized as we explained above in Section 2.

Table 3: Technology dimension impact on Premiums_4_weeks

	(1) Target only	(2) Firm & Deal	(3) Target & Acqui~r	(4) All
Tech_Targ	3.90***	0.09	0.01	-1.37
	(3.09)	(0.06)	(0.00)	(-0.82)
Tech_Acq			6.42***	3.78**
			(4.34)	(2.39)
Status_Dummy		-1.20		-1.20
		(-0.56)		(-0.56)
TendOff_Dummy		8.42***		7.65***
		(4.52)		(4.04)
Attitude_Dummy		-4.16		-4.23
		(-1.45)		(-1.49)
PoisPill_Dummy		2.36		2.85
		(0.43)		(0.53)
AllCash_Dummy		-1.72		-1.96
		(-1.14)		(-1.30)
NboB_Dummy		-2.01		-1.82
		(-0.82)		(-0.75)
acq_mv		-0.00		-0.00
		(-0.05)		(-0.29)
acq_RUN_UP		1.38		1.31
		(1.00)		(0.95)
acq_roa		13.83**		11.82*
		(2.06)		(1.77)
acq_mtb		-0.20		-0.23
		(-0.74)		(-0.86)
acq_lev		-5.80		-4.65
		(-1.07)		(-0.86)
acq_cash		-1.25		-1.43
		(-0.27)		(-0.31)
acq_rd		18.25*		15.15
		(1.80)		(1.50)
targ_mv		-0.00***		-0.00***
		(-3.26)		(-3.39)
targ_RUN_UP		-1.12		-1.20
		(-0.65)		(-0.69)
targ_roa		2.63		1.73
		(0.51)		(0.34)
targ_mtb		-0.72		-0.72
		(-1.52)		(-1.52)
targ_lev		5.95		5.15
		(1.29)		(1.13)
targ_cash		8.95**		8.35**
		(2.13)		(2.00)
targ_rd		9.60		7.98
		(1.10)		(0.91)
Constant	37.55***	42.45***	35.79***	42.06***
	(52.38)	(11.09)	(45.79)	(11.06)
Number of Cases	1493.00	1493.00	1493.00	1493.00
R-Squared	0.01	0.06	0.02	0.06

The Ψ_Divers_Targ $_{i,t}$ refers to diversification within subcategories – or industry segments – and is equal to one when the target is diversified and 0 otherwise. The Targ_SizePat is a technological variable controlling for the target's number of patents. On that same way, the three following variables with respectively coefficients α_4, α_5, α_6 allude to acquirer's technological diversification within the two levels and its number of patents. As for $X_{i,t}$, it refers to deal characteristics as enounced in the hypotheses and explained in Section 2. Acquirer's and target's firm characteristics are represented by $Z_{i,t}$ and defined in appendix 2. Working on diversification within industry segments, we ran a fixed effects model controlling for industries characteristics by including target's 2-SIC digit code and target's 4-SIC digit code along with year fixed effects (respectively in Table 5 and Table 6).

On that perspective, in Table 4, we run a new linear regression focusing exclusively on technological targets and the impact of their diversification within the two levels on the price paid by acquirers. Actually, the first two columns deal with a subsample of 486 transactions when only the target is technological, while columns 3 and 4 show results when both the target and the acquirer are technological through a subsample of 428 deals. The univariate regression in column 1 shows that target diversification within industry segments (Ψ_Divers_Targ) has a positive coefficient of α_2 = 6.19 and highly significant at 1%, while target diversification across industries (Ω_Divers_Targ) has a negative coefficient of α_1 = – 3.22 but non-significant. The results are quite the same once we controlled for firms & deal characteristics in column 2, excpet that Ψ_Divers_Targ remains significant only at 5%. Furthermore, columns 3 and 4 improve our results since the variable Ψ_Divers_Targ remains positive and significant at 1% and 5% after controlling respectively for acquirer's technological diversification (6.68) and firms & deal characteristics (6.59). Another interesting result is the one showing that Ω_Divers_Targ remains negative but gain in significance at 10% level once we introduce acquirers' technological diversification (– 4.70) and at 5% level when all variables are put together (-5.52), respectively in columns 3 and 4.Thus, diversification across different industries seems to pose a serious and significant threat for premiums when also the acquirer possesses patents.This result may strenghten the descriptive statistics in Table 2, indicating that premiums paid by acquirers are slightly lower for diversified targets across categories in comparison with those that are specialized. As for acquirers' diversification, none

of the levels is significant but their number of patents conveys some noise on premiums with a negative sign.

Table 4: Technological Diversification impact on Premiums_4_weeks

	(1) Target TD	(2) Firms & Deal	(3) Acquirer & Tar~D	(4) All
C_Divers_Targ	-3.22	-4.18	-4.70*	-5.52**
	(-1.36)	(-1.62)	(-1.86)	(-2.06)
S_Divers_Targ	6.19***	6.10**	6.68***	6.59**
	(2.62)	(2.42)	(2.73)	(2.52)
NP_Targ	-0.00	0.00	-0.00	0.00
	(-0.61)	(0.64)	(-0.43)	(0.60)
C_Divers_Acq			2.80	1.60
			(1.00)	(0.56)
S_Divers_Acq			-0.42	-1.64
			(-0.15)	(-0.57)
NP_Acq			-0.00*	-0.00**
			(-1.68)	(-2.26)
Status_Dummy		0.13		0.80
		(0.04)		(0.20)
TendOff_Dummy		8.54***		7.12**
		(3.05)		(2.31)
Attitude_Dummy		0.12		-0.51
		(0.03)		(-0.11)
PoisPill_Dummy		9.63		8.52
		(1.44)		(1.10)
AllCash_Dummy		0.15		2.36
		(0.06)		(0.80)
NboB_Dummy		-2.24		-1.99
		(-0.59)		(-0.48)
acq_mv		0.00		0.00*
		(1.05)		(1.86)
acq_RUN_UP		-0.83		-0.78
		(-0.38)		(-0.35)
acq_roa		1.42		-2.11
		(0.13)		(-0.19)
acq_mtb		-0.68*		-0.68*
		(-1.95)		(-1.87)
acq_lev		-7.29		-5.25
		(-0.66)		(-0.33)
acq_cash		-8.23		-7.57
		(-1.19)		(-0.99)
acq_rd		32.84***		35.03***
		(2.87)		(3.03)
targ_mv		-0.00***		-0.00***
		(-3.10)		(-2.86)
targ_RUN_UP		-0.08		-0.17
		(-0.04)		(-0.07)
targ_roa		8.51		7.22
		(1.19)		(0.97)
targ_mtb		-0.25		-0.21
		(-0.51)		(-0.39)
targ_lev		19.11*		21.10*
		(1.80)		(1.78)
targ_cash		5.53		3.21
		(0.92)		(0.51)
targ_rd		13.48		10.60
		(1.19)		(0.93)
Relatedness_S~4		-0.76		-0.26
		(-0.35)		(-0.11)
Constant	40.08***	38.08***	39.83***	38.51***
	(26.73)	(5.66)	(19.87)	(5.07)
Number of Cases	486.00	486.00	428.00	428.00
R-Squared	0.01	0.10	0.02	0.10

* p<0.1, ** p<0.05, *** p<0.01

4.1.2. Fixed effects model

Dealing with technology and different industries, we introduced fixed effects to our regressions and controlled for target's SIC and year effects. Table 5 portrays a fixed effects model on the sample of 486 technological targets and controlling for target's 2-SIC digit code[102]. Columns (1) to (3) display results when only the target is technological – no matter if the acquirer possesses patents or not –, and shows that diversification within industry segments is positively significant at 10% level in a univariate regression. That said, once we control for firms and deal characteristics along with year effects, diversification within subcategories is still positively significant at 10% level (α_2 = 5.34) but diversificaion within categories became negatively significant at 5% level (α_1 = – 5.35) in column 3. This suggests that premiums paid by technological or non-technological acquirers have a tendency to increase when the target is diversified within industry segments while target's diversification across industries will tend to decrease the merger premiums. That said, we can observe that Tenderoffer_dummy is positive and significant in column 2 at 5% level; while Allcash_dummy is also positively significant but at 10% level in column 3. Most of the time, premiums are indifferent to either the presence of a target hostility or target poison pill [Eckbo (2007)].

Columns (4) to (6) show results of a sample of 428 deals when target and acquirer are both technological firms. If the variable Ψ_Divers_Targ is still positive it is no more significant when we introduced acquirers' technological information. However, the coefficient of target's diversification within industries (Ω_Divers_Targ) remains negative but definitely became significant at 5% level (α_1 = – 6.05) in column 6 meaning that technological acquirers appear to be more warned about the variable Ω_Divers_Targ than Ψ_Divers_Targ and may be reluctant to pay more for targets that diversify across industries. In any case, this result indicates that, in a context of reciprocal possesion of technologies, the premiums paid by technological acquirers will be revised downward when targets are scattered over various categories.

[102] Introducing fixed effects, many papers controlled acquirer's SIC digit code. Nonetheless, our main interest here lies in the technological diversification of the target and the potential it can generate through its environment and therefore mainly its sector. Thereby, we have chosen to control for target's 2-SIC and target's 4-SIC, respectively in Table 5 and Table 6. That said, we have discussed some results controlling for acquirers' SIC code in robustness checks.

Table 5: Fixed effects : Technological diversification on premiums_4_weeks - Controlled - Target_2_SIC

	(1) Target TD	(2) Firms & Deal	(3) Year effects	(4) Acquirer & Tar~D	(5) All	(6) Year effects
C_Divers_Targ	-4.49	-4.97	-5.35*	-5.61*	-5.53	-6.05**
	(-1.66)	(-1.65)	(-1.91)	(-1.80)	(-1.68)	(-2.08)
S_Divers_Targ	5.52*	5.55*	5.34*	5.58	5.35	5.51
	(2.00)	(1.76)	(1.82)	(1.69)	(1.44)	(1.60)
NP_Targ	-0.00	0.00	0.00	-0.00	0.00	0.00
	(-1.57)	(0.25)	(0.87)	(-1.38)	(0.44)	(1.19)
C_Divers_Acq				3.65	2.66	2.22
				(1.07)	(0.98)	(0.95)
S_Divers_Acq				-0.89	-2.97	-1.26
				(-0.24)	(-0.86)	(-0.45)
NP_Acq				-0.00***	-0.00***	-0.00***
				(-3.94)	(-4.15)	(-4.72)
Status_Dummy		1.57	2.44		2.54	3.20
		(0.48)	(0.92)		(0.67)	(1.16)
TendOff_Dummy		6.55**	0.97		5.56*	0.05
		(2.17)	(0.33)		(1.74)	(0.02)
Attitude_Dummy		-1.24	-2.26		-1.47	-1.90
		(-0.29)	(-0.56)		(-0.41)	(-0.51)
PoisPill_Dummy		10.35	7.11		10.16	7.60
		(1.40)	(0.83)		(1.49)	(0.91)
AllCash_Dummy		0.98	6.52*		3.04	7.92*
		(0.33)	(1.96)		(0.84)	(1.99)
NboB_Dummy		-2.28	-4.16		-1.16	-3.51
		(-0.52)	(-1.11)		(-0.29)	(-0.99)
acq_mv		0.00	0.00		0.00***	0.00***
		(1.52)	(0.79)		(4.87)	(3.19)
acq_RUN_UP		-0.53	-1.21		-0.22	-1.01
		(-0.25)	(-0.67)		(-0.09)	(-0.48)
acq_roa		-1.03	-5.61		-5.03	-9.46
		(-0.10)	(-0.54)		(-0.70)	(-1.15)
acq_mtb		-0.66***	-1.00***		-0.67**	-0.86**
		(-3.23)	(-3.51)		(-2.39)	(-2.60)
acq_lev		-8.41	-6.85		-8.71	-8.94
		(-0.82)	(-0.67)		(-0.50)	(-0.51)
acq_cash		-12.18**	-10.25		-12.58**	-10.58
		(-2.45)	(-1.68)		(-2.59)	(-1.60)
acq_rd		30.84**	20.69		33.85***	22.47
		(2.65)	(1.45)		(2.99)	(1.53)
targ_mv		-0.00***	-0.00**		-0.00***	-0.00***
		(-4.60)	(-2.46)		(-3.88)	(-3.67)
targ_RUN_UP		-0.66	-0.21		-1.01	-0.63
		(-0.26)	(-0.08)		(-0.39)	(-0.23)
targ_roa		7.04	3.95		5.75	2.56
		(1.12)	(0.66)		(0.80)	(0.37)
targ_mtb		-0.15	-0.02		-0.13	-0.26
		(-0.45)	(-0.06)		(-0.28)	(-0.53)
targ_lev		16.42	14.86		20.38*	17.30*
		(1.48)	(1.49)		(1.83)	(1.72)
targ_cash		3.53	8.86*		1.36	7.29
		(0.85)	(1.70)		(0.39)	(1.37)
targ_rd		12.18	5.33		10.59	3.91
		(1.56)	(0.50)		(1.12)	(0.32)
Relatedness_SIC_2		1.60	1.78		2.20	1.98
		(0.61)	(0.65)		(0.87)	(0.77)
Number of Cases	486.00	486.00	486.00	428.00	428.00	428.00
R^2-within	0.01	0.08	0.17	0.02	0.11	0.18
R^2-between	0.01	0.21	0.30	0.01	0.05	0.22

* p<0.1, ** p<0.05, *** p<0.01

Regarding firms' characteristics, acquirers_mtb has a negative coefficient in columns (2), (3), (5) and (6) significant at 1% and 5% levels, while the acquirers&targets market value significant at 1% but with a nil coefficient and opposed signs. This in line with our prediction and many authors who found a negative relationship between premiums paid and firm size [Moeller et al (2004), Alexandridis et al (2013)]. On that way, acquirers_cash is also negatively related to premiums in columns (2) and (5), both at 5% level. However, acquirers R&D has a positively significant coefficient at 5% in column (2) and at 1% in column (5) with high coefficient of 33.85. Actually, in terms of merger premiums, Higgins & Rodriguez (2006) showed that low R&D acquirers would pay more for high R&D targets, since some tech firms were able to successfully outsource their R&D through acquisitions. Moreover, Target_leverage is positively related to the price paid by bidders and significant at 10% level in columns (5) and (6). Although high debt may not appear attractive during a merger or acquisition, Trigeorgis and Lambertides (2014)[103] found that « more highly levered firms have higher stock returns », and this could promote and improve expected synergy gains.

The International Patent Clasification (IPC) tallies each patent to a subcategory – we called business lines or industry segments – belonging itself to a category that encompasses several subcategories. IPC used a clasification based on a letter for a category, followed by 2 numbers to assign the subcategory, followed by classes and so on and so far, meaning that the longer is your code better will be your patent description. With this in mind, we generate new results of technological diversification's impact on merger premiums controlling for target's 4-SIC digit code for more accuracy about the targets' fields.

Table 6 displays a fixed effects model over a sample of 486 technological targets controlling for target's 4-SIC digit code. Again, columns (1) to (3) show empirical results when only the target is technological. We can immediately note the univariate regression in column 1 recording a positive coefficient (α_2 = 6.92) and highly significant at 1% for Ψ_Divers_Targ variable, along with a negative coefficient (α_1 = – 6.46) and significant at 5% for Ω_Divers_Targ. Moreover, once we introduced firms & deal characteristics and year effects, not only both coefficients keep the same

[103] Trigeorgis, L., & Lambertides, N. (2014). The role of growth options in explaining stock returns. Journal of Financial and Quantitative Analysis, 49(3), 749–771.

opposite signs but also became highly significant at 1% level. On one hand, this indicate that if we go deep in target's SIC, the premiums paid by technological or non-technological acquirers are boosted when the target is diversified within industry segments; on the other hand, they are seriously adjusted downwards when the target is diversified across the upper level of categories. As for deal characteristics, only allcash_dummy is positively significant at 1% level in column (3) in line with Madura & Ngo (2008). Firms characteristics shedlight on acquirers_mtb that has a negative coefficient significant from 10% to 5% in columns (2) and (3).

In columns (4) to (6), we control for both target and acquirer are technological. It goes without saying that going deep in Target's SIC digit code gives a paramount significance to our main variables' Ω_Divers_Targ and Ψ_Divers_Targ both of them highly significant at 5% in column (5) and at 1% in column (4) and (6). Results are all-but the same except that Ψ_Divers_Targ has a slightly lower coefficient ($\alpha_2 = 7.19$) than Ω_Divers_Targ. When it comes to a merger between two technological firms, columns (4) to (6) show that the negative impact of industries diversification ($\alpha_1 = -8.26$) is slightly more pronounced than the positive impact of industry segments diversification. In an improving perspective of Table 5, these results suggest that acquirers are more sensitive diversified targets within industry segments and would be able to increase the premiums paid. However, targets active in patenting across several categories could have a true negative influence on the price paid by bidders. Control variables follow the same results as those discussed in Table 5 but with less significance.

All in all, these empirical results validate Hypothesis 1 but definitely not Hypothesis 2 since technological diversification within industries has not a mitigated impact compared to industry segments but definitely the inverse effect. Basically, two different technologies inside the same industry might easily impel two firms to merge and make the premiums soar, while, two different technologies each of which belongs to different industries might seriously decrease the price paid by bidders. Assimilation, communication and other managerial costs may frighten acquirers and weigh negatively on the will to go beyond firms' boundaries or any expansion through another industry.

Table 6: Fixed effects : Technological diversification on premiums_4_weeks - Controlled - Target_4_SIC

	(1) Target TD	(2) Firms & Deal	(3) Year effects	(4) Acquirer & Tar~D	(5) All	(6) Year effects
C_Divers_Targ	-6.46**	-7.35***	-8.42***	-7.10***	-7.32**	-8.26***
	(-2.46)	(-2.61)	(-3.82)	(-2.69)	(-2.32)	(-3.12)
S_Divers_Targ	6.92***	8.10***	8.46***	6.23***	6.80**	7.19***
	(3.13)	(2.92)	(3.74)	(3.14)	(2.53)	(3.05)
NP_Targ	-0.00	0.00	0.00	-0.00	0.00	0.00
	(-0.85)	(0.77)	(1.08)	(-0.38)	(0.49)	(0.82)
C_Divers_Acq				6.26**	4.77*	3.76
				(2.13)	(1.74)	(1.57)
S_Divers_Acq				-3.79	-6.51**	-3.68
				(-1.32)	(-2.34)	(-1.25)
NP_Acq				-0.00***	-0.00***	-0.00***
				(-2.73)	(-4.32)	(-4.32)
Status_Dummy		1.81	3.14		1.98	3.06
		(0.41)	(0.78)		(0.45)	(0.70)
TendOff_Dummy		4.94	-1.26		4.37	-1.33
		(1.56)	(-0.39)		(1.08)	(-0.34)
Attitude_Dummy		-6.53	-7.24		-6.29	-6.94
		(-1.26)	(-1.41)		(-1.30)	(-1.37)
PoisPill_Dummy		7.28	3.36		7.15	3.86
		(1.12)	(0.50)		(0.99)	(0.51)
AllCash_Dummy		1.33	9.10***		2.93	10.00**
		(0.45)	(2.77)		(0.79)	(2.58)
NboB_Dummy		-3.58	-6.10		-3.09	-5.20
		(-0.72)	(-1.43)		(-0.62)	(-1.17)
acq_mv		0.00	0.00		0.00***	0.00***
		(0.96)	(0.81)		(3.12)	(2.74)
acq_RUN_UP		-1.17	-1.73		-0.64	-1.19
		(-0.55)	(-0.86)		(-0.29)	(-0.51)
acq_roa		-2.09	-11.98		-13.85	-21.23*
		(-0.17)	(-1.13)		(-1.09)	(-1.96)
acq_mtb		-0.53*	-0.78**		-0.70*	-0.79**
		(-1.82)	(-2.47)		(-1.96)	(-2.07)
acq_lev		-3.76	-6.34		-11.99	-10.27
		(-0.35)	(-0.62)		(-0.70)	(-0.58)
acq_cash		-11.07	-11.95		-14.99	-13.53
		(-1.39)	(-1.31)		(-1.56)	(-1.34)
acq_rd		27.65**	20.25		28.12**	20.34
		(2.57)	(1.51)		(2.15)	(1.24)
targ_mv		-0.00***	-0.00**		-0.00**	-0.00**
		(-2.63)	(-2.36)		(-2.27)	(-2.27)
targ_RUN_UP		0.07	0.41		-0.03	0.25
		(0.04)	(0.22)		(-0.02)	(0.13)
targ_roa		5.03	2.70		3.08	0.28
		(0.54)	(0.35)		(0.36)	(0.04)
targ_mtb		-0.11	-0.02		0.07	-0.11
		(-0.22)	(-0.05)		(0.11)	(-0.17)
targ_lev		12.65	14.20		18.15	19.82
		(0.82)	(0.96)		(1.08)	(1.18)
targ_cash		0.34	4.44		-2.02	2.05
		(0.05)	(0.70)		(-0.33)	(0.33)
targ_rd		8.34	3.33		7.77	2.28
		(0.75)	(0.30)		(0.71)	(0.20)
Relatedness_SIC_4		1.09	1.64		2.55	2.68
		(0.43)	(0.67)		(0.69)	(0.77)
Number of Cases	486.00	486.00	486.00	428.00	428.00	428.00
R^2-within	0.02	0.09	0.20	0.03	0.12	0.20
R^2-between	0.00	0.07	0.13	0.00	0.03	0.09

* p<0.1, ** p<0.05, *** p<0.01

4.2. Empirical results: Target's Technological diversification influence on Market's reaction

4.2.1. Pooled regressions

To speak truth, the root of this paper was to study the merger premium and how it would evolve once technological aspects come into play. Then came the idea to analyze also the reaction of the market to a merger that involves technological companies and by therefore, potential synergies. It is in this spirit that we have chosen to focus specifically on synergy CARs, measured by the product of acquirers CARs and targets CARs, in our regressions. However, we have discussed results when acquirers CARs are taken as dependant variable in robustness checks.

For the sake of comparibility between the impact of target's technological diversification on merger premiums on the one hand, and the synergy CARs on the other hand, we preferred to keep the same numbering of tables by adding Bis for the CARs. For instance, Table 5 Bis adopts the same requirements as Table 5 relative to premiums except that in the former is relative to market's reaction. Thereby, it will be easier to compare directly the two different dependant variables and strip away any ambiguity.

Table 3 Bis portrays linear regressions over the whole sample of 1493 deals during the period 1990 – 2006 and the impact of technological dimension on market's sentiment measured by synergy CARs. Granted, the univariate regression in column 1 has no significant results, still, column 3 records significant coefficient with opposed signs for Tech_Targ (0.01) and Tech_Acq (– 0.01), both at 10% level. Nevertheless, once we control for firms & deal characteristics in columns (2) and (4), the variable Tech_Acq is no longer significant while the coefficient of Tech_Targ rises (0.02) and became highly significant at 1% level. We must glance at results we found in premiums Table 3 since this is the very opposite of these results. Indeed, in premiums Table 3, the variable Tech_Targ is highly significant at 1% level in the univariate regression and no more significant once we introduced Tech_Acq and firms & deal characteristics. We explained that point arguing that the information about the 486 technological targets might be crowded by other informations. With this contrast, we must say that it may be a difference of perception towards the technology dimension depending on whether we are analyzing the market's reaction or the merging firms' perception.

Table 3 Bis: Technology dimension impact on Market's reaction to synergy

	(1) Target only	(2) Firm & Deal	(3) Target & Acqui~r	(4) All
Tech_Targ	0.00	0.01***	0.01*	0.02***
	(0.91)	(2.62)	(1.76)	(2.72)
Tech_Acq			-0.01*	-0.00
			(-1.92)	(-0.84)
Status_Dummy		-0.00		-0.00
		(-0.13)		(-0.13)
TendOff_Dummy		0.02***		0.02***
		(2.66)		(2.73)
Attitude_Dummy		-0.04***		-0.04***
		(-3.30)		(-3.30)
PoisPill_Dummy		-0.03		-0.03
		(-1.45)		(-1.48)
AllCash_Dummy		0.01***		0.01***
		(3.04)		(3.08)
NboB_Dummy		0.00		0.00
		(0.48)		(0.45)
acq_mv		-0.00**		-0.00**
		(-2.33)		(-2.22)
acq_RUN_UP		-0.01		-0.01
		(-1.35)		(-1.34)
acq_roa		-0.06**		-0.06*
		(-1.99)		(-1.91)
acq_mtb		0.00		0.00
		(0.78)		(0.82)
acq_lev		0.01		0.01
		(0.75)		(0.66)
acq_cash		0.00		0.00
		(0.20)		(0.21)
acq_rd		-0.12**		-0.11**
		(-2.11)		(-2.01)
acq_fcf		-0.01		-0.01
		(-0.20)		(-0.20)
targ_mv		-0.00		-0.00
		(-0.65)		(-0.59)
targ_RUN_UP		-0.00		-0.00
		(-1.00)		(-0.96)
targ_roa		0.08***		0.08***
		(2.96)		(2.99)
targ_mtb		-0.01**		-0.01**
		(-2.53)		(-2.54)
targ_lev		-0.01		-0.01
		(-0.89)		(-0.82)
targ_cash		0.00		0.00
		(0.23)		(0.29)
targ_rd		0.04		0.04
		(1.23)		(1.28)
targ_fcf		-0.02		-0.03
		(-1.03)		(-1.09)
Constant	0.02***	0.07***	0.02***	0.07***
	(9.31)	(4.75)	(9.73)	(4.81)
Number of Cases	1493.00	1493.00	1493.00	1493.00
R-Squared	0.00	0.09	0.00	0.09

* p<0.1, ** p<0.05, *** p<0.01

Going on the CAR Table 3 Bis, a tender offer and an all cash transaction have both a positive impact on synergy CAR and highly significant at 1% level, while attitude has a negative coefficient (-0.04) but also significant at 1%. If an acquirer does not feel self-assured about the target's real value, it would be more cautious to pay with equity so as to share potential negative returns and thus minimizing the problem of adverse selection [Sudarsanam & Mahate (2003)]. On the flip side, a cash payment gives the acquirers' shareholders an opportunity to reap future gains from the merge. Following Jensen (1986), acquiring a target through a cash offer mitigates likely agency problems by releasing excess free cash flows. Not to mention that acquirers' R&D became negatively related to market's reaction at 5%, merging firms' profitability appears to play an inverse role since acquirers_ROA has a negative sign (-0.06) at 10% level while targets_ROA has a positive sign (0.08) highly significant at 1% level.

With a view to examining to what extent does target's technological diversification influence market's reaction, we estimate the following empirical model in our baseline OLS regressions:

$$\textbf{\textit{Synergy\_CARs}}_{i,t} = \beta_0 + \beta_1\, \Omega\_Divers\_Targ_{i,t} + \beta_2\, \Psi\_Divers\_Targ_{i,t} + \beta_3\, Targ\_Size_{i,t} + \beta_4\, \Omega\_Divers\_Acq_{i,t} + \beta_5\, \Psi\_Divers\_Acq_{i,t} + \beta_6\, Acq\_Size_{i,t} + \beta_7\, X_{i,t} + \beta_8\, Z_{i,t} + \varepsilon_{i,t} \quad (1)$$

Where i indexes deal number and t indexes the year. $\textbf{\textit{Synergy\_CARs}}_{i,t}$ term is the dependent variable and is measured by taking the product of Acquirers Cars and Targets CARs. Actually, it represents the market's sentiment towards potential technological synergy gains. At the right side, the $\Omega\_Divers\_Targ_{i,t}$ is equal to one when the target is considered to be diversified across categories and 0 when it is specialized as we explained above in Section 2, II, 1. The $\Psi\_Divers\_Targ_{i,t}$ refers to diversification within subcategories – or industry segments – and is equal to one when the target is diversified and 0 otherwise. The Targ_SizePat is a technological variable controlling for the target's number of patents. On that same way, the three

following variables with respectively coefficients β_4, β_5, β_6 allude to acquirer's technological diversification within the two levels and its number of patents. As for $X_{i,t}$, it refers to deal characteristics as enounced in the hypotheses and explained in Section 2. Acquirer's and target's firm characteristics are represented by $Z_{i,t}$ and defined in appendix 2, except that we add free cash flow control variable following the literature. Working on diversification within industry segments, we ran a fixed effects model controlling for industries characteristics by including target's 2-SIC digit code and target's 4-SIC digit code along with year fixed effects (respectively in Table 5 Bis and Table 6 Bis).

Starting from this positive and significant impact of target's technological dimension on synergy CARs, it might be interesting to go deeper in the concept of technology and examine whether the technological diversification definitely influence the market's sentiment towards acquirer and target synergies. Table 4 Bis tackles this issue and concentrates on the 486 technological targets. We run new pooled regressions taking into account as variables of interest, the target's diversification within the two levels and introducing acquirers' tecnhlonogical aspect in columns (3) and (4). The verdict is unequivocal: there is no significance in our technological diversification variables for any column. Neither the industry segments level nor the industry level has a significant coefficient, whether they be targets or acquirers. Actually, regarding linear regressions run in Table 3 bis and Table 4 bis, the results indicate that if the synergy CAR seems to be sensitive to the target's technological dimension, they seem indifferent to technological diversification levels.

Once again, we note a difference with premiums results in Table 4 where target's diversification particularly within technological fields is highly significant and does impact the price paid by bidders. We are, therefore, eligible to ask whether is there a misleading information regarding the market's reaction?

Table 4 Bis: Technological Diversification impact on Market's reaction to synergy

	(1) Target TD	(2) Firms & Deal	(3) Acquirer & Tar~D	(4) All
C_Divers_Targ	0.01	-0.00	-0.00	-0.01
	(0.68)	(-0.23)	(-0.16)	(-0.63)
S_Divers_Targ	0.01	0.01	0.01	0.01
	(0.86)	(0.73)	(0.98)	(1.03)
NP_Targ	-0.00	-0.00	-0.00	-0.00
	(-1.31)	(-0.78)	(-0.91)	(-0.14)
C_Divers_Acq			0.01	0.00
			(1.05)	(0.27)
S_Divers_Acq			0.00	-0.00
			(0.49)	(-0.19)
NP_Acq			-0.00***	-0.00***
			(-3.09)	(-3.20)
Status_Dummy		-0.01		-0.01
		(-0.68)		(-0.94)
TendOff_Dummy		0.01		0.01
		(1.47)		(0.73)
Attitude_Dummy		-0.04**		-0.02
		(-2.47)		(-1.40)
PoisPill_Dummy		-0.02		0.00
		(-0.60)		(0.08)
AllCash_Dummy		0.01		0.01*
		(1.37)		(1.69)
NboB_Dummy		0.02		0.01
		(1.33)		(0.82)
acq_mv		-0.00		-0.00
		(-1.03)		(-0.36)
acq_RUN_UP		-0.02**		-0.02**
		(-2.03)		(-2.26)
acq_roa		-0.11*		-0.10
		(-1.68)		(-1.40)
acq_mtb		0.00		-0.00
		(0.01)		(-0.11)
acq_lev		0.05		0.07
		(1.02)		(1.21)
acq_cash		-0.05*		-0.05
		(-1.76)		(-1.57)
acq_rd		-0.08		-0.08
		(-1.20)		(-1.15)
acq_fcf		-0.00		0.00
		(-0.07)		(0.05)
targ_mv		-0.00		-0.00
		(-0.02)		(-0.67)
targ_RUN_UP		-0.00		-0.00
		(-0.63)		(-0.51)
targ_roa		0.05*		0.06*
		(1.75)		(1.81)
targ_mtb		-0.00		-0.00
		(-1.27)		(-0.84)
targ_lev		-0.05		-0.05
		(-1.54)		(-1.39)
targ_cash		-0.00		0.00
		(-0.03)		(0.24)
targ_rd		0.03		0.03
		(0.79)		(0.94)
targ_fcf		-0.03		-0.03
		(-1.06)		(-1.19)
Relatedness_S~4		0.01		0.01
		(1.29)		(1.14)
Constant	0.02***	0.10***	0.01	0.09***
	(3.28)	(4.43)	(1.44)	(3.34)
Number of Cases	486.00	486.00	428.00	428.00
R-Squared	0.01	0.15	0.01	0.14

* p<0.1, ** p<0.05, *** p<0.01

4.2.2. Fixed effects model

Since we are coping with several technological industries, the market could react differently depending on the target's line of business purchased by acquirers. From there, we introduced, in Table 5 Bis, fixed effects controlling for target's 2 SIC digit code and year effects over the 486 technological targets. Columns (1) to (3) show results when only the target is technological and we can see that nothing significant happens for our main variables in columns (1) an (2). However, once we control for year effects in column (3), the Ψ_Divers_Targ became significant at 10% level. Moreover, when we complement with acquirers' technological variables, the Ψ_Divers_Targ variable became significant at 5% level in column (6) suggesting that the synergy CAR might be impacted by diversification within industry segments once we control for acquirers' diversification, firms & deal characteristics, target's 2 SIC and year effects. Regarding Ω_Divers_Targ, there is no significance in any columns. That said, we must note that targets and acquirers' number of patents are significant but at an unstable way and with a nil coefficient. Also, attitude and payment method characteristics seem to play some significant role in column (2), (3) and (5) at different levels. The choice of the method depends on whether the acquirer discerns valuation risk or not and may be partially guided by agency cost consideration. Basically, stock offers are widely perceived as a negative information signal while cash offers are believed to convey positive information. Intuitively, an equity offer is tantamount to a risk-distribution since the stock-offered value is closely linked to the ex-post performance of the joint entity. As for firms' characteristics, target_ROA and leverage are both significant in columns (3) (5%) and column (5) (10%), showing a positive coefficient for the former (0.05; 0.07) and a negative one for the latter (-0.08; -0.07). It seems that the market does not perceive target_leverage in the same way as premiums. In addition, acq_RD has a highly significant and negative coefficient in columns (2), (3), (5) and (6). Our first intuition would predict that CARs will be positively related to the R&D of targets but negatively related to the R&D of acquirers. Roughly, while high R&D targets are eligible for demanding more premiums at acquisition, the higher R&D acquirers would tend to pay less. Probably, the market reacts negatively to acquirers' R&D considering that looking for a merger with technological target diminish the credibility of acquirers' R&D patrimony. This

argument could be better explored with a complementarity measure [Ang & Wu (2011), Bena & Li (2014)].

Table 5 Bis: Fixed effects : Technological diversification on Market's reaction to synergy - Controlled - Target_2_SIC

	(1) Target TD	(2) Firms & Deal	(3) Year effects	(4) Acquirer & Tar~D	(5) All	(6) Year effects
C_Divers_Targ	-0.00	-0.01	-0.01	-0.01	-0.01	-0.01
	(-0.05)	(-1.07)	(-0.85)	(-0.53)	(-1.18)	(-1.02)
S_Divers_Targ	0.01	0.01	0.01*	0.02	0.01*	0.01**
	(1.16)	(1.45)	(2.00)	(1.52)	(1.85)	(2.05)
NP_Targ	-0.00**	-0.00**	-0.00**	-0.00**	-0.00	-0.00
	(-2.67)	(-2.23)	(-2.30)	(-2.75)	(-1.52)	(-0.73)
C_Divers_Acq				0.01	0.00	0.01
				(0.81)	(0.22)	(1.03)
S_Divers_Acq				0.00	-0.00	-0.01
				(0.26)	(-0.44)	(-1.13)
NP_Acq				-0.00	-0.00**	-0.00*
				(-1.59)	(-2.52)	(-1.79)
Status_Dummy		-0.01	-0.02		-0.02	-0.02
		(-1.46)	(-1.47)		(-1.25)	(-1.61)
TendOff_Dummy		0.01	0.02**		0.01	0.02**
		(1.15)	(2.25)		(0.82)	(2.17)
Attitude_Dummy		-0.04***	-0.04**		-0.03**	-0.02
		(-2.85)	(-2.10)		(-2.22)	(-1.42)
PoisPill_Dummy		-0.03	-0.02		-0.01	-0.01
		(-1.04)	(-0.81)		(-0.31)	(-0.19)
AllCash_Dummy		0.01*	0.00		0.01**	0.01
		(1.74)	(0.64)		(2.10)	(0.82)
NboB_Dummy		0.01	0.02*		0.01	0.02*
		(1.31)	(2.01)		(0.84)	(1.72)
acq_mv		-0.00	-0.00		-0.00	-0.00
		(-1.12)	(-1.09)		(-0.31)	(-0.17)
acq_RUN_UP		-0.02	-0.02		-0.02	-0.02*
		(-1.37)	(-1.46)		(-1.56)	(-1.86)
acq_roa		-0.11*	-0.11		-0.10	-0.10
		(-1.73)	(-1.35)		(-1.33)	(-1.05)
acq_mtb		0.00	-0.00		0.00	-0.00
		(0.10)	(-0.11)		(0.04)	(-0.23)
acq_lev		0.04	0.04		0.07*	0.07***
		(1.30)	(1.66)		(2.04)	(3.16)
acq_cash		-0.03*	-0.02		-0.02	-0.01
		(-1.76)	(-1.19)		(-1.34)	(-0.67)
acq_rd		-0.09**	-0.10*		-0.09**	-0.11**
		(-2.11)	(-1.87)		(-2.57)	(-2.61)
acq_fcf		0.01	-0.01		0.01	-0.01
		(0.17)	(-0.09)		(0.11)	(-0.07)
targ_mv		-0.00	0.00		-0.00	-0.00
		(-0.04)	(0.28)		(-0.82)	(-0.47)
targ_RUN_UP		-0.00	0.00		-0.00	0.00
		(-0.43)	(0.33)		(-0.47)	(0.40)
targ_roa		0.05**	0.04		0.07*	0.06
		(2.15)	(1.45)		(1.96)	(1.30)
targ_mtb		-0.00	-0.00		-0.00	-0.00
		(-1.57)	(-1.62)		(-1.18)	(-1.01)
targ_lev		-0.08**	-0.07***		-0.07*	-0.05
		(-2.64)	(-3.05)		(-1.76)	(-1.32)
targ_cash		0.00	0.01		0.01	0.02
		(0.04)	(0.39)		(0.24)	(0.74)
targ_rd		0.02	-0.00		0.03	0.01
		(0.63)	(-0.02)		(1.04)	(0.17)
targ_fcf		-0.02	-0.02		-0.03	-0.03
		(-0.96)	(-0.84)		(-1.01)	(-0.90)
Relatedness_SIC_2		0.00	-0.00		-0.00	-0.00
		(0.16)	(-0.15)		(-0.19)	(-0.39)
Number of Cases	486.00	486.00	486.00	428.00	428.00	428.00
R^2-within	0.01	0.14	0.19	0.02	0.14	0.20
R^2-between	0.00	0.00	0.04	0.12	0.05	0.13

* p<0.1, ** p<0.05, *** p<0.01

With a view to add more accuracy about the target's line of business and since we are using the international patent clasification for our technological diversification measures, we generated new empirical results controlling for target's 4 SIC digit code. Table 6 Bis shows a fixed effects model over a sample of 486 technological targets. Panel A and Panel B follow the same requirements as in Table 5 Bis, respectively only target is technological and both are technological. The empirical evidence is clear and fast: none of our technological diversification is significant, neither the subcategories nor the categories; whether they be targets or acquirers, and within both Panel A and Panel B. The synergy CARs are absolutely not impacted by target's diversification. To conclude, these empirical results relative to synergy CARs validate in some mitigated way our Hypothesis 3 since the synergy CAR might be impacted by diversification within industry segments once we control for acquirers' diversification, firms & deal characteristics, target's 2 SIC and year effects (Table 5 bis). But as a general rule, synergy CARs are not sensitive to technological diversification no matter the level of diversification and invalidate Hypotheses 3 and 4 (Table 4 bis and Table 6 bis). It seems to be in line with Kaplan and Weisbach (2002) showing that there is no significant difference what with the stock market reactions to diversification announcement and reactions to related acquisitions.

But once again, the difference is glaring in comparison to our previous empirical results relative to merger premiums. Indeed, premiums Table 5 and Table 6 shows that the price paid by bidders is considerably sensitive to target's technological diversification, no matter if only the target is technological or both target and acquirer possess patents. First, Table 5 shows that merger premiums tend to increase when the target is diversified within industry segments while the price paid by technological acquirers will be revised downwards when the target spread over different categories – once we control for target's 2 SIC digit code and year effects –. Second, Table 6 shows highly significant coefficient at 1% level for both industry segments and industries with the same opposed signs, indicating that the premiums paid by technological or non technological bidders soar when target is diversified within industry segments and seriously adjusted downwards within industries – once we control for target's 4 SIC digit code and year effects –.

This brings up questions about the potential asymetric information between merging firms and market's reaction, but also about the market's ability to detect

possible technological synergy gains. Actually, some strategic decisions could came in the aftermaths of a visionary outlooks; and due to new inventions generated from diversified technologies combinations, it would not necessarily be aberrant to pay a very heavy price to scrounge new industry segments and anticipate a future competitive advantage. Our study ends at 2006 because the available data from NBER stops at 2006; however, in the last two decades, we observed various companies going through acquisitions or even internal inventions with a line of business that is definitely different from their original or initial ones – Samsung, LG, Phillip Morris, among others. Future researches and complementary technological measures could be interesting to explore the potential asymetric information between merging firms and market's reaction, but also about the market's ability to detect possible technological synergy gains.

Table 6 Bis: Fixed effects : Technological diversification on Market's reaction to synergy - Controlled - Target_4_SIC

	(1) Target TD	(2) Firms & Deal	(3) Year effects	(4) Acquirer & Tar~D	(5) All	(6) Year effects
C_Divers_Targ	0.01	0.00	0.00	0.00	-0.00	0.00
	(0.41)	(0.09)	(0.31)	(0.09)	(-0.12)	(0.16)
S_Divers_Targ	0.01	0.01	0.02	0.01	0.01	0.01
	(1.40)	(1.45)	(1.56)	(1.36)	(1.42)	(1.39)
NP_Targ	-0.00**	-0.00*	-0.00	-0.00*	-0.00	-0.00
	(-2.11)	(-1.83)	(-1.63)	(-1.95)	(-1.41)	(-0.93)
C_Divers_Acq				0.01	0.00	0.01
				(0.60)	(0.27)	(1.11)
S_Divers_Acq				-0.00	-0.01	-0.01
				(-0.04)	(-0.45)	(-1.09)
NP_Acq				-0.00	-0.00**	-0.00
				(-1.23)	(-2.01)	(-1.58)
Status_Dummy		-0.01	-0.02		-0.02	-0.02
		(-0.78)	(-1.01)		(-0.78)	(-1.12)
TendOff_Dummy		0.02	0.03**		0.01	0.02*
		(1.17)	(2.13)		(0.61)	(1.77)
Attitude_Dummy		-0.05**	-0.05*		-0.03	-0.03
		(-1.99)	(-1.70)		(-1.21)	(-1.05)
PoisPill_Dummy		-0.05	-0.04		-0.02	-0.02
		(-1.29)	(-1.31)		(-0.45)	(-0.52)
AllCash_Dummy		0.00	0.00		0.01	0.00
		(0.46)	(0.03)		(0.80)	(0.07)
NboB_Dummy		0.02	0.03**		0.01	0.02
		(1.37)	(1.98)		(0.71)	(1.39)
acq_mv		-0.00	0.00		0.00	0.00
		(-0.13)	(0.05)		(0.63)	(0.62)
acq_RUN_UP		-0.01	-0.01		-0.02	-0.02
		(-1.14)	(-1.01)		(-1.54)	(-1.49)
acq_roa		-0.17***	-0.18**		-0.15**	-0.14
		(-2.75)	(-2.03)		(-2.24)	(-1.53)
acq_mtb		0.00	0.00		0.00	0.00
		(0.33)	(0.01)		(0.32)	(0.03)
acq_lev		0.02	0.03		0.04	0.04
		(0.48)	(0.59)		(0.66)	(0.72)
acq_cash		-0.04	-0.03		-0.03	-0.02
		(-1.34)	(-1.35)		(-0.96)	(-0.75)
acq_rd		-0.12***	-0.13***		-0.12***	-0.14***
		(-3.23)	(-3.40)		(-3.27)	(-4.28)
acq_fcf		0.05	0.05		0.02	0.01
		(0.84)	(0.54)		(0.36)	(0.14)
targ_mv		-0.00	0.00		-0.00	-0.00
		(-0.41)	(0.28)		(-0.84)	(-0.34)
targ_RUN_UP		-0.00	0.00		-0.00	0.00
		(-0.47)	(0.42)		(-0.54)	(0.39)
targ_roa		0.04	0.02		0.04	0.02
		(0.89)	(0.35)		(0.93)	(0.41)
targ_mtb		-0.01*	-0.01*		-0.00	-0.00
		(-1.68)	(-1.87)		(-1.41)	(-1.42)
targ_lev		-0.07	-0.06		-0.06	-0.06
		(-1.47)	(-1.32)		(-1.31)	(-1.19)
targ_cash		0.01	0.02		0.00	0.01
		(0.28)	(0.66)		(0.00)	(0.40)
targ_rd		0.01	-0.02		0.01	-0.01
		(0.24)	(-0.43)		(0.33)	(-0.32)
targ_fcf		-0.02	-0.01		-0.02	-0.01
		(-0.58)	(-0.21)		(-0.69)	(-0.39)
Relatedness_SIC_4		0.02**	0.02**		0.02*	0.02*
		(2.29)	(2.24)		(1.79)	(1.69)
Number of Cases	486.00	486.00	486.00	428.00	428.00	428.00
R^2-within	0.01	0.15	0.21	0.01	0.14	0.21
R^2-between	0.00	0.04	0.05	0.00	0.04	0.05

* p<0.1, ** p<0.05, *** p<0.01

Conclusion

Using a panel data of patents for targets and acquirers over the period 1990 – 2006, we examined 1493 deals once technology enters at stake. Considering a target as technological when it has at least one patent in its portfolio, we worked on a subsample of 486 technological targets. Following Hall et al (2001, 2005) patents clasification from NBER database, we created two variables of technological diversification at two different levels. On one hand, diversification within subcategories – or industry segments –, and on the other hand, diversification within categories – or industries –.

In a willingness to advance other arguments for what could influence the premiums paid when technologies are involved, we wondered to what extent does target's technological diversification impact merger premiums paid by acquirers and the market's reaction to synergy. This paper studied both impacts so as to compare the perception regarding the merging firms and the market.

Talking about potential technological synergies and its relationships with merger premiums paid, high premiums should be perceived as a futur gain resulting from combining knowledge bases rather than a waste of money.

First, taking our whole sample of 1493 deals from 1990 to 2006, we found that merger premiums are less sensitive to target's technological dimension than market's sentiment; it seems that acquirers' technological dimension – whether they posses patents or not – seems to prevail over target's one, while synergy CARs appear to be more receptive to targets' patents portfolio.

Nevertheless, our second and third results concentrate exclusively on a subsample of 486 technological targets controlling for target's 2 SIC digit code, target's 4 SIC digit code and year effects. We found that diversification within subcategories is positively and significantly related to merger premiums, while diversificaion across categories is definitely negative and highly significant. On one hand, this indicate that the price paid by technological or non-technological bidders are boosted when the target is diversified within technological industry segments; on the other hand, they are seriously adjusted downwards when the target is diversified within technological industries. The negative impact of categories diversification is even more pronounced than the positive impact of subcategories diversification – for all that matters –.

Third, as for market's reaction, diversification within industry segments appear to positively impact the synergy CARs (5%), while there is no significance for the upper level of categories – when we controlled for target's 2 SIC –. Surprisingly, no reaction shows up when controlling for target's 4 SIC digit code, whether they be targets' diversification or acquirers' diversification within the two levels.

Future researches and complementary technological measures could be interesting to explore the potential asymetric information between merging firms and market's reaction, but also about the market's ability to detect possible technological synergy gains.

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Appendix 2 : Variables' measurement

Variables	***Measurement***
A - Firm's characteristics :	
Firm size	Ln of firm's market capitalization on day – 42
Market-to-book ratio	log [(total Assets – Common Equity + MV of common shares outstanding) / (Total Assets)]
R&D intensity	R&D / (Total Assets)
Return on Assets	Operating Income / (Total Assets)
Leverage	(Total Debts – Cash) / (Total Assets)
Run-up	Ln (p_{-1}/p_{-42}); where p is the stock price
Firm Sales	ln (Sales)
Relatedness_2_SIC	1 if both target and acquirer share the same 2-digit SIC code; and 0 otherwise [we did the same for 4_SIC]
B - Deal characteristics :	
Status	1 if Completed ; and 0 otherwise
Competitive	1 if multiple bidders; and 0 if single bidder
Payment Method	1 if all cash; and 0 if stock or mixed
Attitude	1 if Friendly; and 0 if hostile
Tender offer	1 if Tender offer; and 0 otherwise
Poison Pill	1 if Poison Pill; and 0 otherwise

Chapter 3

TECHNOLOGICAL PROXIMITY AND TAKEOVERS' IMPACT ON RIVAL FIRMS

« Pas de progrès sans concurrence, et par conséquent sans luttes industrielles. »

Gustave Le Bon

Résumé

Dans le but d'approfondir la réaction du marché aux fusions et acquisitions technologiques, nous nous sommes demandé dans quelle mesure la proximité technologique renforçait les entreprises fusionnantes et nuisait aux rivaux des acquéreurs. Ce papier analyse la proximité de deux entreprises innovantes à deux niveaux, mesurée par le nombre de brevets répartis par industrie et par segment industriel, et son impact sur le sentiment du marché mesuré par les rendements anormaux cumulés.

Concernant l'impact de la proximité technologique, nos résultats montrent une corrélation entre les entreprises en fusion et les concurrents des acquéreurs. Premièrement, plus la proximité technologique entre brevets d'une même industrie est élevée, et plus la réaction du marché sera positive et significative pour sociétés fusionnantes, mais également pour les concurrents de l'acquéreur. Cela suggère un effet « in-play » créé dans les rendements anormaux des concurrents en réponse à une fusion impliquant une proximité technologique. Deuxièmement, la proximité technologique entre différents secteurs a une influence négative sur la réaction du marché aux entreprises qui fusionnent, mais également à leurs rivaux. Ainsi, le marché considère que la proximité technologique au-delà des frontières des entreprises menant à un processus de conglomérat est préjudiciable à l'ensemble de l'industrie.

Au fond, nos résultats ne concordent pas avec la collusion prévue par la théorie du pouvoir sur le marché, mais concordent amplement avec la théorie des droits de propriété ainsi que l'effet d'information positif prédit par la théorie de l'efficacité productive.

Mots clés : Fusions/Acquisitions, Proximité Technologique, Réaction du Marché.

Abstract

With a view to advancing arguments for what could influence the market's reaction to technological M&As, we wondered to what extent does technological proximity strenghten the merging firms and harm acquirers' rival firms. Analyzing the closeness of two innovative firms, using patent counts in different technology classes, and its impact on market's sentiment measured by cumulative abnormal returns, we examine the consequences on competitors when patents of acquirers & targets are « related » (horizontal/vertical merger) or « unrelated » (conglomerate merger). We found a positive correlation between merging firms and acquirers' rivals regarding the impact of technological proximity. First, the higher technological proximity within one specific industry between the merging firms, the more positive will be market's reaction to merging firms, but also to acquirers' rivals. This suggests an « in-play » effect created in the competitors' abnormal returns in response to a merger involving technological proximity. Second, the technological proximity across different industries between the merging firms has a negative influence on market's response to merging firms, but also to acquirers' rivals. This suggests that technological proximity beyond firms' frontiers leading to a conglomerate process is perceived by the market as being detrimental to both the acquirer and its identified rivals.

All in all, our results are inconsitent with the collusion predicted by the market power theory but consistent with the property rights theory and the positive information effect predicted by the productive efficiency theory.

Keywords: Corporate Takeovers, Technological Proximity, Market's Reaction

Introduction

Buying a company for 63% above the closing price of its shares is what Google did by acquiring Motorola on August 15, 2011 for $12.5 billion[104]. After acquiring service companies such as Doubleclik and YouTube in 2006, Google bought Motorola, an equipment company with a portfolio of 17,000 patents of which 15,200 are related to mobile telephony. The internet and software giant that acquires a hardware company in deceleration, has raised various market's reactions and has generated a real anguish among rivals (Microsoft, Apple, Nokia) but also among other partners (Samsung, LG, HTC). Moreover, on August 16, 2011, the NYSE recorded a 6.54% decline in Google's stock price and a rise in the value of Microsoft and Nokia. Nonetheless, the most surprising comes in 2014 when Google sells Motorola for only $ 2.91 billion to the world's largest PC maker, Lenovo.

To speak truth, Google sells exclusively Motorola's design and manufacturing business to Lenovo but retains 15,000 of the 17,000 patents. Basically, the "scam" that can be thought of the purchase and sale of Motorola, conceals in fact a foolproof legal protection, potential gains of synergies, and especially a significant competitive advantage. Acquiring Motorola is "boosting the Android ecosystem by creating a broad portfolio of patents", Mr. Page said.

Firstly, seizing 17,000 patents at once can accelerate development in mobile telephony without investing in several years of R&D. Google can better consider the Chinese market and impose its Android system. "We think this is a competitive transaction," David Drummond, the company's chief legal officer said. "This is not a horizontal transaction, Google has not materially been in the handset business."

Secondly, despite the sale, Google "will retain control of the majority of patents and will continue to use them to defend Android". It also allows the American giant to put a brake on the multiple lawsuits brought by the manufacturers to all those who designed Android mobiles. Google offers Android for free but has indicated that this system relies on some of its patents. The Goliath of the internet has been determined to attack any manufacturer, who uses this system without negotiating a license agreement, for the violation of intellectual property.

[104] Source : dealbook.nytimes.com

By acquiring Motorola and its 17,000 patents, Google protects its baby Android by preventing builders from migrating to another system for fear of prosecution.
Bet successful: Google equips 82% of smartphones against 51% in 2011. “Our acquisition of Motorola will increase competition by strengthening Google’s patent portfolio, which will enable us to better protect Android from anticompetitive threats from Microsoft, Apple and other companies,” Mr. Page said.

The industrial economy has often put at the heart of its questions the market power of companies and their ability to strengthen it. Market power being a key driver for the sustainability of companies, the latter will need to think ahead and establish relevant strategies to deal with the entry’s barriers, the product differentiation, the supply’s degree of concentration and the actual competition. To amplify and/or maintain this market power, the company can use various means, including the creation of an agreement, the differentiation of products or the process of mergers and acquisitions (M&As).
The formation of an agreement mainly refers to the hypothesis of collusion in which companies in a market enter into an agreement to make profits in excess of the normal profits they should achieve in a competitive situation. Whether explicit or tacit, collusion stipulates that the firms in an industry derive the majority of these monopolistic rents, and this assumption predicts positive abnormal returns for the merging firms but also for the buyer's rivals. Collusion[105] is above all a good way to increase market concentration and get rid of industrial competition. Nevertheless, it must be borne in mind that this practice is prohibited and punishable by law. Moreover, to fight against high prices and explicit agreements that reduce the intensity of competition, the American Congress has passed two Antitrust laws[106] to punish cartels.

Although cartel formation remains an illegal practice, there are still other perfectly legal means of improving the market power of companies and industrial competition. In this paper, we concentrate on one of the best legal way to increase firm’s performance, namely Mergers and Acquisitions (M&As). Indeed, the merger

[105] An anticompetitive merger raises the product price and thus benefits the non-merging competitors as well. One could well assume that, in a competitive environment, firms enjoy a competitive advantage and de facto maximize their profit. However, the formation of a cartel is often very tempting because less risky than a competitive situation. In a cartel, firms pay more attention to the interaction of their respective decisions and their impact on the profits of others.
[106] First, « Sherman Antitrust Act » (1890). Second, « Federal Trdae Commission Act » (1914).

eases the competition and strengthens the market power of the merging companies. It is a solid channel to reduce costs and improve productive efficiency. It is an opening towards new markets, new geographical zones, and towards an optimization of the factors of production. That said, it is above all a practical solution for increasing dynamic efficiency, namely the acquisition and the combination of complementary assets thus making it possible to reinforce the innovation capacity of companies. Fundamentally, product differentiation and the M&As process refer more to the theory of productive efficiency whereby reduction of costs and optimization of undervalued resources have a positive impact on merging firms but mixed on competing companies. This theory predicts a two-sided industry wealth effect of a merger announcement. On one hand, the announcement of a merger may convey a positive information about the resources' value of the industry and those controlled by rival firms. Arguably, two merging firms with complementary assets will gain more efficient production, resulting in higher infra-marginal rents and positive impact on the expected total synergy gain to both acquirer and target shareholders [Ahuja & Katila (2001), Sevilir & Tian (2011), Ang & Wu (2011)]. However, the increased volume of M&As within an industry may reveal a high synergistic industry but also a high demand for resources owned by other companies, leading to a positive re-evaluation of these rival firms. Actually, acquiring another firm could easily be considered as a call for help, and a disability to keep up to date with the industrial speed; this may suggest that competition is strong and that rival firms are too competitive. Basically, the increased demand may result in expectations of future merger activity, giving birth to a positive « in-play » effect on rival firms from the announcement of a merger, for all that matters [Eckbo (1983), Schumann (1993), Fee & Thomas (2004)]. On the other hand, productive efficiency theory predicts that rival firms may suffer from more competition in the industry due to a new more-efficient combined firm [Eckbo (1985)]. Actually, a scale-increasing efficient merger have a tendency to negatively impact the industry's equilibrium product price, which harms competitors and by itself causes a negative industry wealth effect. Moreover, a conglomerate or an acquisition of a firm belonging to another industry may strenghten the new firm through an increase of its skills' diversification and knowledge bases' richness. This possible technological competitive advantage could definitely harm rival firms' performance and result in negative abnormal returns for competitors [Aktas et al (2006), Akdogu (2009), Chung et al (2014), Stahl (2010), Grimpe & Hussinger (2008)].

That said, any merger does not go hand in hand with success or strategic efficiency. The principle of sub-additivity perfectly illustrates this idea that a merger is only successful if the productive performance of the merging companies is greater than the sum of their individual productive performance taken independently. Investing within nearest technological fields is usually proned to stronger internal selection due to duplicate opportunities [Vassolo[107] et al (2004)]; however, one must keep in mind the true distinction between technologies and final products since the latter could require several and different technologies belonging to the same industry and sometimes the same industry segment. Property Rights theory, notably through the work of Oliver Hart (1990, 1995), introduced a notion of complementarity more commonly known as "Synergy" in industrial economics. Indeed, the absence of synergies greatly reduces the competition of merging companies, making them less aggressive on the market. This could result in market shares of the new structure being less than the sum of pre-merger market shares. Accordingly, regarding these theories, one could expect a positive market's reaction to a merger involving technological proximity and potential synergy gains.

In this perspective, we raised the question of the interaction between the merging firms' knowledge bases and the impact on market's reaction measured by cumulative abnormal returns. As things stand right now, innovations, technologies, and the patents race arrouse a tremendous craze among firms of every technological industry. Beyond the Property Rights, the knowledge economy has also contributed to this by emphasizing the intangible side characterized by collegiality and the proliferation of knowledge within companies. Idriss Aberkane (2015) enounced three rules that govern this concept of knowledge economy and insisted on the third[108] rule stipulating that knowledge exchanges are not linear. This means that combining two immaterial assets or knowledges will generate at worst a nil innovation and at best a groundbreaking innovation. Mathematically, I. Aberkane (2015) puts forward a simple inequation where 1 pound of knowledge plus 1 pound of knowledge is equal to 3 pounds of knowledge since knowing A and B together is worth more than knowing A and B separately: $\boxed{K(A \cap B) > K(A) \cap K(B)}$; where K is knowledge, A and B are two Immaterial goods.

[107] Taking the context of alliance portfolios, Vassolo et al (2004) showed that when a firm invests in several new ventures within a proximate defined industrial segment, the aggregate growth value of its investments is inferior to the sum of each venture's individual growth value (sub-additivity effect).

[108] The two other ones are : 1) Exchanges are a positive-sum game, 2) Exchanges are not immediate.

In a willingness to advance other arguments for what could influence the market's reaction to technological M&As, ***we wondered to what extent does technological proximity strenghten the merging firms and harm acquirers' rival firms.*** Concretely, the object of this study is to examine the consequences on competitors when patents of acquirers & targets are « related » (horizontal or vertical mergers) or « unrelated » (conglomerate mergers). Thus, we analyze the closeness of two innovative firms using patent counts in different technology classes and its impact on market's sentiment measured by predicted abnormal returns for merging firms (Synergy_CAR) and rival firms (Rivals_CAR). The goal of this paper is to show that patents' proximity between acquirers and targets could reverse the trend; and that the higher is patent portfolios' proximity between merging firms, the higher is the noxious impact on acquirers' competitors. Our basic intuition comes from Hart (1995) whose works indicate that a merger between companies having complementary technologies is value-enhancing, while a merger including companies having independent technologies is value-reducing. A moderate degree of overlap in the acquirer and target knowledge bases are likely to create synergies and a positive impact on the acquiring firm's subsequent innovation output. Thereby, the synergies generated by the mergers give birth to a new and more powerful entity, able to lower its prices, to offer more efficient products and specially to position itself as a major competitor.

We used patents to account for the technological dimension and we put forward a measure of technological proximity so that we assess to what extend does acquiring external patents harm rival firms. Following Hall et al (2001, 2005) classification of each patent by categories and subcategories, while respecting International Patent Classification (IPC), we used the Jaffe's measure (1986) to account for technological proximity at two different levels: Vertical mergers versus Horizontal mergers. The former refers to a technological proximity within firms' categories – or industries –, and the latter refers to subcategories – or industry segments – (see Appendix 1 for more details)[109]. Then, we created two variables of interest portraying, first, the closeness of two innovative firms using patents across 6

[109] In this paper, we will use the terms « Categories », « industries » and « sectors » interchangeably. On that same way, we will use « Subcategories », « industry segments » and « business lines » interchangeably.

main industries, and second, through 37 industry segments[110]. Each of these two variables ranges between 0 and 1; where 1 means identical technological patterns of innovative activity, and 0 means no potential to benefit from each other's research activities.

Our analysis of technological proximity complements the existing literature about M&As effects on rival firms since many papers have concentrated on M&As in general, forgetting to specify and explain the crucial role played by technologies. Most of studies showed that the relationship between abnormal returns and the merger proposal is inconsistent with the collusive hypothesis but consistent with the productive efficiency theory [Stillman (1983), Eckbo (1983), Fee & Thomas (2004), Becher et al (2008)]. Since this paper deals with technological proximity once within related and unrelated (conglomerate) takeovers, there are arguably no market power effects [Betton & Eckbo (2000)]. Therefore, this paper is widely impressed of Productive efficiency and Property rights theories.

Our paper's main contributions are threefold. First, we help to better understand M&As impact on competitors through the market's response to a merger announcement involving technological interaction between acquirers and targets. Second, we focus on innovation output not through patent counts or citations but through technological proximity when it comes to horizontal mergers but also to vertical mergers. We carry out a cross sectional study that analyses technological proximity between merging firms across 37 subcategories (horizontal mergers) and 6 different categories (vertical mergers) as reported by NBER classification of patents [Hall et al (2001)]. Third, we help to know whether there is a difference in the impact on rivals, depending on the nature of the merger and the industrial proximity among merging firms.

Studying 428 deals where both acquirer and target have at least one patent from 1990 to 2006, we found empirical evidence that can be displayed in three points. First, our empirical results indicate a correlation between merging firms and acquirers' rivals regarding the impact of technological proximity on predicted abnormal returns since this impact on acquirers' competitors goes hand in hand with the one on merging fims. On one hand, the higher Subcategories technological proximity (Tech_Prox_S) between the acquirer and the target, the more positive will

[110] The data from Copustat Industry Segment database are not always reliable about reported increases in a firm's number of segments [Hyland & Dlitz (2002), Villalonga (2004)]

be market's reaction to merging firms, but also to acquirers' rivals. On the other hand, the higher Categories technological proximity between the acquirer and the target, the more negative will be market's response to merging firms, but also to acquirers' rivals.

This led to our second result showing that the closeness of two innovative firms, using patent counts in different industry segments inside one specific industry (Tech_Prox_S), has a positive impact on predicted abnormal returns albeit it is higly significant at 5% or 1% for merging firms and at 10% level or even nonsignificant for rival firms. This suggests that the increased demand may result in expectations of future merger activity, giving birth to a positive « in-play » effect created in the competitors' abnormal returns in response to a merger involving technological proximity between targets and acquirers.

Third, the closeness of two innovative firms, using patent counts across several industries (Tech_Prox_C), has a negative impact on predicted abnormal returns albeit it is higly significant at 5% for merging firms but slighly significant at 10% for rival firms. This suggests that technological proximity beyond firms' frontiers leading to a conglomerate process is perceived by the market as being detrimental to merging firms but also to rival firms. Basically, a conglomerate takeover may put forward an underperformance of a specific industry since acquirers merge with targets from another industry. This could lead to a negative wealth effect on that specific industry and other stakeholders belonging to.

All in all, our results are inconsitent with the collusion predicted by the market power theory but consistent with the property rights theory and the positive information effect predicted by the productive efficiency theory.

The rest of the paper proceeds as follows. We review the literature in section 1. We develop our hypotheses and describe our variables in Section 2. We display our sample and data collection in Section 3. We report our empirical results regarding linear and fixed effects regressions in Section 4. Finally, the paper ends with the conclusion.

Section 1: Literature review

1.1. Why corporate takeovers occur?

Regarding the craze and the abundant literature on M&As activity, it implies the importance of this phenomenon for academics and the economic world as well. It is all the more rewarding as literature from various areas put forward explanations to justify M&As.

The theoretical industrial organisation literature pinpoints efficiency gains through economies of scale and scope, along with the motivation to reach and/or beef up market power (Maksimovic & Phillips (2001), Harford (2005)). The strategic management literature underlines the desire to get access to distribution channels and to gain entry into new markets through pecuniary economies, namely monopoly and/or monopsony, and diversification economies, namely portfolio management and/or risk reduction (Lubatkin (1983), Balakrishnan (1988), Fee & Thomas (2004), Shahrur (2005)). The corporate control studies suggest M&As are used as a tool to take incompetent target management, agency problems and/or hubris (Jensen & Ruback (1983), Roll (1986)). The corporate and market finance explain M&As throuh technological ink in the same industry (Coase (1937), Rhodes-Kropf & Robinson (2008)), but also through bull markets that may drive acquirers into purchasing undervalued targets with their overvalued stock (Shleifer & Vishny (2003), Rhods-Kropf (2003), Rhodes-Kropf & Viswanathan (2004)).

Finally, the innovation literature implies and proves that an important motive for undertaking M&As is acquiring innovation so as to enhance firm's technological investments, and above all, to grow its knowledge bases through « grafting » new technological skills and know-how, new scope in research, new patents, and so on (Cohen & Levinthal (1989), Huber (1991), Ahuja & Katila (2001), Sevilir & Tian (2011)). Notwithstanding, as Lubatkin (1983) emphasized, the fact that an acquirer (target) gains or loses from M&As is depending on three conditions: competitive strenghts (1), the growth rate of its markets (2), the fitting of (1) and (2) of the target (acquirer). Accordingly, the better is the strategic fit what with the acquiring firm and the acquired firm, the greater should be the subsequent output of the merger. It would seem, therefore, that mergers and acquisitions have undergone a remarkable

boom with the advent of new technologies and the need to remain in the race for innovation.

The twenty-first century definitely marks the transition to a new era: that of knowledge economy. This is evidenced by the exponential growth in the number of patents from $ 50 billion in 1994 to $ 200 billion in 2008[111]. If in a material economy, the protection of your property can be done in a bunker, a safe or under your mattress; in the knowledge economy, only secrecy or intellectual property is a real shield for your inmmaterial goods. At a time when knowledge doubles every 9 years in quantity since the 1980s, and when the volume of M&As reached $ 4,123 billion in 2007 and the all-time record of $ 4,590 billion in 2015[112], we realize that mergers have become a formidable weapon to gain innovation and develop a competitive advantage. That said, the biggest deals are mainly in the US and in the technological fields. Among them we can mention Google, Facebook, Pfizer, ... All of them are intensive R&D companies in search of new patents and new technologies.

Intuitively, to assess the pace of an inventive step, researchers and analysts tend to refer to the number of patents filed for a company in a given period. However, Hirschey et al (2001) point out that the number of patents is an imperfect indicator of innovative activities since it does not capture the true economic value of innovation. In fact, innovation varies considerably depending on the technological and/or economic value, and the distribution of this value is therefore "distorted". Thus, the measurement of the number of patents is by nature limited since it can not erase this heterogeneity. In addition, reluctance has been brought about the informational relevance of patents, thus giving a perception of the patent as a deceptive tool. In his study of 173 biotechnology companies, Lerner[113] (1994) emphasized that not all patents are perceived in the same way by investors; it depends on the field based on the patent classification plan. Lerner (1994) insists on the assessment of the patent, which must go through economic indicators that better reflect the quality of the patent.

Studies on the value of patents took as a starting point that, for investors, patent quality indicators were more useful than purely accounting information. Thus, patent data are relevant insofar as they convey useful information to investors and predict

[111] Source: World Intellectuel Property Organization.
[112] https://www.amkeo.fr/1087-2/
[113] "The Importance of Patent Scope: An Empirical Analysis," Rand Journal of Economics, 25 (Summer 1994): 319-333

share prices. Most of the work on patent quality considers the latter to be a non-financial indicator that compensate for the lack of information from the financial statements. This means that investors, in the case of companies with intensive patents, will have to supplement the available accounting information with extra-accounting data. They will thus be able to better anticipate the future benefits that would flow from the scientific research of companies.

1.2. Patent quality as a relevant indicator of innovation

Grilliches (1990) raised the question « What can one use patent statistics for? » and stated that Patents are an effective indicator of R&D output. As previously said, a major problem is the identification along with the measurement of innovations and inventiveness, the benefits a company receives from R&D activity. One way to tackle this issue is to use information on patenting by patent's technological class « to cluster firms into common technological activity clusters and looking whether a firm's variables are related to the overall activity levels of its cluster ». A wide body of academic papers highlight the strong relationship between R&D and patents number, suggesting that the latter are a good indicator of differences in activity across firms [Grilliches (1990)]. However, using patents as a proxy for the pace of innovation output poses a serious threat on the economic reality and reliability. Patent Scope depends on the linkage between inventions and the extent to which innovations require a diversity of technical and non technical inputs. Some patents are essential to the design of the final marketable product, while others interven only at a milestone or an intermediate step of the industrial process. Basically, there is no one-to-one relationship between R&D expenses and patenting activity. [Grilliches et al (1989)].

Several academic works have focused on this notion of patent quality and have attempted to create or improve statistical variables that reflect more a qualitative aspect of patents. These empirical studies clearly highlight the presence of a patent, which goes hand in hand with a rich and exhaustive documentation that financial markets can imbibe to evaluate the quality of companies' scientific and technological activities. Thus, before exposing our patent quality variables, a non-exhaustive review of the various measures developed and their use in the literature would help to better understand the notion of quality and to see a little more clearly.

Science and technology as "predictors" of stock market performance, is what Deng et al (1999) pointed out. The latter insist on the quotations in the deposition, which refer to previous inventions ("backward citations"); but also, and especially on the citations of this same patent by entities wanting to use this invention ("forward citations"). In addition, Deng et al (1999) specify that citations in a patent application also allow analysis of the scientific link that derives from patents. For this purpose, they analyze the references to scientific works/papers, conferences, and other studies (but in no case to patents), which the company used to build its patent. Finally, these authors highlight the Rapidity of innovation through the time elapsed between two generations of patents. These references or quotations therefore allow the investor to appreciate the novelty of the invention. Basically, citing a patent indicates the quality of the patent and its ability to bring new technological improvements. Thus, companies with frequently cited patents have a greater probability of success, both in the sustainability of the product and in the financial markets [compared to companies whose patents are not mentioned, or not at all].

Hirschey et al (2001) wanted to show that, even beyond the relationship between the market value and the number of patents filed, there was also a significant association with the quality of patents. In the course of the work of Deng et al (1999), they then introduced a quantity indicator and three quality indicators, respectively as follows: PATENTS which reports on the number of patents filed; the Current Impact Index, which measures the quality of patents through the number of patent citations of the last 5 years compared to all patents in the US system; Science Linkage which indicates the link with the scientific world; the Technology Cycle Time which measures the time between two generations of patents. On the one hand, the authors show that the quality of patents, related to R&D investments, positively influences the stock market valuation of the company. On the other hand, they stress that the quality of patents is of great value to investors. This allows them to conceive of a positive association between scientific efforts and the added value of R&D expenditures. Nevertheless, there is a negative correlation between speed of innovation and market value.

In this sense, Chen & Chang (2010) are also interested in the relationship between patent quality and market value. In a study of 37 US pharmaceutical companies, they then adopted four original patent quality measures, each as interesting as the next. The first variable is the Relative Patent Position (RPP) which defines the leader in a

technological field as being the company with the highest number of patents in this field. The second variable is the Revealed Technology Advantage (RTA) which represents an advantage developed by the company in a particular technological field. Mathematically, it is the ratio between the proportion of patents in a particular field and the total number of patents in all areas of the firm. The third variable is the Herfindahl-Hirschman Index of Patents (HHI) which measures the degree of concentration of patents and technological fields. As the fourth and last quality variable, Chen & Chang (2010) use Patent Citations that measure both the quality of patents and the knowledge flows generated by the company. In parallel with previous studies, the authors emphasize the positive correlation and the significantly different coefficient of 0 (1%) between patent citations and market value.

In addition, Callen et al (2010) studied the complementary relationship that could exist between financial and non-financial information. The authors highlight 3 non-financial indicators. The first is the Profitability of the Portfolio of Medicines in Construction. The second is the Collaboration Number. The third is the number of patents / patent citations. As a first step, Callen et al seek to know if the financial information is relevant to their sample, and then try to show if the non-financial information is complementary or rather substitutable for the financial information. Their results show that the coefficients of the financial indicators (book value of equity and profits), taken separately, are positive and significantly different from zero; financial information is therefore relevant for companies rich in R&D. Also, their results show that the information related to the 3 non-financial indicators are statistically and economically valuable-relevant for investors, especially as investors react positively to the acceptance of a patent.

1.3. Complementarity versus « Independency »

An acquisition is a resources redeployment so as to improve the productivity of assets. Not only will the acquiror benefit from internal and external target's environment, but also from a decrease of duplication in research and a cost reduction. That said, the long-standing debate around technological M&As boils down to complementarity versus independency among technological assets.

Hart (1995) starts from the basic idea that firms arise in situations where writing good contracts is complicated, making the allocation of power or control something

tremendous. He defined ownership as having residual rights of control or power over « the machine »; this suggets that buying the machine is more profitable than just rent it. Furthermore, the boundaries of firms are drawn so as to obtain power optimally amid the parties to a transaction. From that, the property rights approach underlines that « a party is more likely to own an asset if she has an important investment decision ». Typically, highly complementary assets should be under common ownership while independent assets should be separately owned. Basically, a merger between firms with highly similar assets is value-enhancing while a merger between firms with dissimalar assets is value-reducing. Moreover, integration should be urged when the industry contains a small number of firms due to the fact that complementarities between the bidder and the target are significant.

Following the same spirit, Hoberg & Phillips (2010) examined the impact of product market relatedness on merger-pairing and ex-post performance. Strating from the companies' product description in 10K reports from the SEC Edgar website, they introduced a variable called « product market relatedness » and implemented it to 49 908 firm-observations over the period 1997-2006. They found that bidders purchase targets that are more broadly similar[114] to all firms in the economy rather than those that are more similar to their local rivals. Also, long-term real outcomes are better when the merging firms are similar; the latter are even more significant when the merger allows the acquirer to stand out from its rivals. Definitely, product market relatedness plays a crucial role ex-ante and ex-post the transaction.

Ahuja & Katila (2001) concentrated on 72 global chemicals industry and studied the impact of an acquisition[115] on the ex-post innovation performance – measured by number of patents – of acquirers from 1980 to 1991. They showed a nonlinear relation between the merging firms' knowledge bases and post-acquisition innovation, implying that the relatedness of the target's knowledge base will be curvilinearly related to the subsequent innovation output of the acquiror. They argue that a merger that puts technological overlaps at stake are likely to impact positively and significantly the acquiring firm's subsequent innovation output, for all that matters. Nonetheless, they urge firms to pay attention to the relative difficulty of integration.

[114] In their paper, Hoberg &Phillips (2010) defined « similar » as close to each other in distance in this product location space.

[115] They distinguished two kinds of acquisition : technological acquisition – where technology is an asset of acquired firm –, and non technological acquisition –where nontechnological component is involved

On that same perspective, Sevilir & Tian (2011) investigated the relation between M&A volume and innovativeness over 105 314 firm-observations from 1990 to 2006. They tried to put forward evidence of a significant positive association what with M&A activity of a firm and its innovation output measured as the number and the novelty of the firm's patents obtained after M&A activity. Their results showed that the target's ex-ante R&D intensity and patent activity are positively associated with the acquirer's contemporaneous as well as ex-post innovation. Statistically, an increase of 10% in the target's number of patents in the 3-year before acquisition is tantamount to an increase of 2.23% in the acquirer's number in the year after the transaction. Roughly, they found that M&A activity has a positive effect on subsequent innovation outcome and that acquistions including R&D intensive targets result in positive and significant announcement returns.

Based on Hart's approach, Bena & Li (2014) focused on the existence of synergies between firms in the realms of innovation and their influence on corporate acquisition. Thereby, they wondered wheteher merger partners possess complementary technologies prior to the transaction and –if so – which characteristics of overlaps impact M&As decisions. Through 4 measures of innovation overlaps[116], they showed that technological complementarities what with bidder and target innovation activities have positive and significant effect on merger-pairing. Technological complementarities and/or proximity can help downplay information asymetry. If the merging firms are familiar with each other's technologies, then information asymetry between them is reduced. In conclusion, they argued that technological overlaps or product market synergies - and not both - led firms to merge or acquire new companies. Essentially, firms can increase their innovation output by acquiring firms with higher R&D intensity and a rich patent portfolio; they still emphasize technologies and complementary assets.

1.4. Corporate Takeovers' effect on rivals

Grimpe & Hussinger (2008) studied reasons of pre-empting technological competion through M&As. On that perspective, they wondered whether firms' acquisition(s) aim at creating barriers to entry in technology markets. Through 657 European target firms (and horizontal acquisition) over the period 1997 – 2003, they

[116] Technological proximity; Knowledge Base Overlap ; Acquirer's/Target's Base Overlap Ratio ; Acquirer's/Target's Cross-Cites Ratio

put forward a measure that pre-empts behavior in technology markets[117] and could be defined as the ratio of [number of prior art and referenced documents forward citations] and [number of citations]. They found that firms tend to acquire targets with potentially blocking patents. Their statistical results revealed that an increase of 0.01 in the blocking potential of the target's portfolio results in an increase of 13% in the deal value (approximately $37 millions euros).

Ang & Wu (2011) concentrated on a specific source of synergy through a combination of two complementary firms in the realms of technological capital. They defined mergers as being a connection of skills with a view to improving innovation by internalizing issues related to property rights and technology transfer. Besides acquiring innovation and getting new research pipelines, mergers help to pre-empt competition in technology markets. They showed that technological synergy is a positive determinant of merger premium and positively impacts the expected total synergy gain to both acquirer and target shareholders. More specifically, studying 2626 horizontal acquiitions from 1977 to 2004, they found that 1 citation by acquirer's competitors of targets' patents leads to an increase of 0.2 million in acquisition premium.

In addition to that, Stahl (2010) carried out an empirical study to analyse the relationship between innovation and merger decisions through distinguishing two scenarios: on one hand, a merger as a tool to graft innovative information spillovers, and on the other hand, a merger as a meaning to dampen rivalry in innovation. Controlling for total patents and citations counts, she studied the number of internal citations made by 864 merger-pairing before and after they merge – once the merger occurs. Stahl found that firms cite one another 40% less annually after the merger (window: -5 years; +5 years) during the period 1974–2005. She concluded that there is an innovation race within the 5 years ex-ante the merger and a reduction in competition within the 5 years ex-post.

Therefore, the race to obtain a competitive advantage has been assessed through the increase in a merger premium paid to a target that could dampen acquirer's rival firms. That said, other studies have focused on rivals' abnormal returns following a merger proposal announcement. Eckbo (1983) indicate that rivals record small but significantly positive abnormal returns at the time of merger proposal announcement.

[117] This measure is based on Harhoff et al (2005a and 2005b)

On that way, Schumann (1993) found that rival firms earn positive and significant returns at the proposal announcement. Studying a subsample of 97 competitors from 1981 – 1987, he showed that competitors located in the smallest market-share quartile have the largest abnormal returns and significantly positive.

A contrario, other papers, put forward a negative effect on rivals' abnormal returns around the merger announcement. Becher et al (2008) focused on US electric utilities and report a significantly negative industry wealth effect in their sample of 384 horizontal mergers between 1980 – 2004.

Competition within Telecommunications Industry has also been adressed by M&A studies. Akdogu (2009) worked on the announcement effects of all acquisitions through the telecom wave on both the acquirers and their industry rivals. The goal of his study was to examine rival returns as a guide to causes and effects of takeovers, precisely to those that come after an industry shock and through an intensive period of M&As. Akdogu (2009) based his research on three different hypotheses, specifically the market power, the competitive advantage, and the information spillovers. Then, separating the sample into horizontal and non-horizontal acquisitions, he studied 178 horizontal deals and 97 non-horizontal, which means 275 acquisitions announcements in all. Testing effects on 176 rivals of acquisitions run by firms with the SIC code of 4813 (Phone Communication except Radiotelephone over the period 1996 – 2005. His findings are threefold. First, there is a negative impact on the industry competitors by focusing on non-horizontal acquisitions. Higher market power prevents rivals from experiencing positive returns. Second, competitors that are closest to the acquirer in the realms of size and services suffer from a worse impact than the average rivals. Third, this negative impact is moderated for competitors that made prior acquisitions.

More recently, Chung et al (2014) focused on IT innovations and studied the impact of a company's software patents on rivals' market value. They put forward two countervailing forces, namely market-stealing and spillover effects. The former effect makes software patents generating property rights that give a competitive advantage over rivals, increasing efficiency for the focal firm. The latter one states that software patent may result in a greater technological opportunity for competitors, enhancing the rival firm's market value. Based on these two effects and through 1251 observations from 420 firms from 1998 to 2006, they wondered whether a focal firm's software patents have a positive or negative impact on competitors' market value.

Further, they examined whether the focal firm's hardware patents attenuate the impact of its software patents on competitors' market value. Their results show that an increase of 1% in a focal firm's software patent stock is tantamount to a decrease of 0.03% in competitors' market value, which means that market-stealing effect dominates spillover effect. Also, they showed a negative interaction between software and hardware, which implies that hardware patents play a role of complementary assets to software patents, beefing up market-stealing effect rather than spillover effect. Basically, in case of IT innovations, firms are more likely to benefit from a stronger competitive advantage from IT-based innovations including both hardware and software patents, compared to those concentrating solely on either hardware or software components.

Beyond USA frontiers, Eckbo (1992) and Aktas et al (2006) report that same negative industry wealth effect in response to the merger announcement, respectively in Canada and European Union.

Figure 10 - Patent Quality as a relevant indicator of Innovation

	1	2	3	4
Authors	Lerner (1994)	Deng et al (1999)	Hirschey et al (2001)	Chen & Chang (2010)
Sample	173 biotechnological firms	388 firms from 4 technological industries	199 high-tech companies.	37 U.S. pharmaceutical firms
Period	1973-1992	1985-1995	1989-1995	1997-2006
Research question	The impact of patent scope on market value	Do patents' citations improve innovation and stock performance?	Is there any complementarity between nonfinancial and financial information for high-tech companies? Is there a different degree of *value-relevance* between them?	The association between patent quality and market value.
Dependant variable(s)	- Log (Market Value)	- Future stock returns - MTB ratio	- Market value - Future stock-market returns	- Market value
Results	• **Patent scope** has a *significant* ***impact*** *on the value of the firm.*	→ ***Patent counts*** → ***Patent citations*** → ***Science linkage*** are **positively** and significantly **correlated** to future stock-market returns and MTB ratio.	• ***Patent statistics*** *appear to have a* ***beneficial*** *marginal influence on* ***current stock prices.*** • **No discernable influence** from **patent statistics** on **subsequent stock-price** performance, except TCT.	→ ***Relative Patent Position*** → ***Patent Citations*** are **positively** and significantly **related** to market value. → ***HHI of patents*** is **detrimental** to market value.
Conclusions	**Patents are misleading tools.**	Those **indicators assess patent quality** and draw *a link with stock performance.*	An important ***complementary relation between traditional financial information and nonfinancial data in the high-tech*** sector.	Roughly, ***patent quality has a positive effect on market value***.

Figure 11 - Technological Complementarity versus Independency

	5	6	7	8
Authors	Ahuja & Katila (2001)	Hoberg & Phillips (2010)	Sevilir & Tian (2011)	Bena & Li (2014)
Sample	72 global chemicals firms (30 Euro, 26 Am, 16 Jp)	49 908 firm-observations	105 314 firm-observations (All U.S. public firms)	1135 merger-pairing (2572 acquirers, 1744 targets)
Period	1980-1991	1997-2006	1990-2006	1984-2006
Research question	The impact of acquisition on post acquisition innovation performance.	The impact of product market relatedness on merger-pairing and ex-post performance	The relation between M&A activity and the innovativeness of the firm.	Are acquisitions driven by technologically advanced firms or by technology laggards? Do merger partners possess complementary technologies prior to the transaction?
Dependant variable(s)	- Nb of patents obtained	- Profitability and Sales	- Ln (innovation) ↳ Ln (nb of patents) ↳ Ln (cites/patents)	- *Binary variable*: 1 if merger-pairing, and 0 otherwise
Results	• ***Technological acquisitions*** ↳ Absolute size of the acquired knowledge base ↗ *innovation output* ↳ Relative size of the acquired knowledge base ↗ *innovation output* • Nonlinear relation between A&T knowledge bases and innovation output. • Nontechnological acquisitions don't impact significantly post-acquisition innovation performance	• ***Bidders purchase targets that are more broadly similar to all firms in the economy*** rather than those that are more similar to their local rivals. • *Long-term real* ***outcomes are better*** *when the merging* ***firms are similar*** • Outcomes are better when acquirers reside in ex ante competitive product markets.	• Firms with **greater M&A volume generate more patents** than lower M&A volume • Increasing *M&A activity* by **10%** ⇒ ↗ **1.01%** *in the nb of filed patents* in the first year • **Positive** association between M&A activity and innovation – stronger for large and mature firms –. • An increase of **10%** in the *target's nb of patents* in **acq–3years** ⇒ ↗ **2.23%** in the *acquirer's nb of patents* in **acq+1year**	• ***Acquiring firms*** are: ↳ More innovative firms as measured by the quantity of *innovation output* • ***Aquired firms*** are: ↳ Less innovative as measured by the declining rate of growth in *innovation output* • ***Technological synergies*** *between merging firm's innovation activities* have a **Positive and significant** *impact on merger-pairing.*
Conclusions	**Acq**uiring technological assets and internalizing them ⇒ ↗ *Innovation* **Dis**tantly related, unrelated, or closely linked deals ⇒ *poor innovation*	Product market relatedness has a **positive impact** on profitability and sales.	Post-acquisition patents of the *Acquirer* are **positively related** to the R&D intensity of the *Target* and its patents ex-ante the merger.	**Technological complementarities** are a *specific and tremendous* ***source*** *that drives* ***acquisitions.***

Figure 12 - Corporate Takeovers' effect on Rival firms

	9	10	11	12
Authors	Akdogu (2009)	Stahl (2010)	Ang & Wu (2011)	Chung et al (2014)
Sample	275 acquisitions announcements in Telecoms industry (SIC 4813)	864 mergers pairing	2626 U.S. horizontal acquisitions	1251 observations from 420 IT firms
Period	1996-2005	1974-2005	1977-2004	1998-2006
Research question	The announcement effects of all acquisitions through the telecom wave on both the acquirers and their industry rivals.	Do firm i's (j's) patents cite firm j's (i's) patents more frequently after the merger than they did before they merge?	The value of synergy from combining two technological complementary firms	Do a firm's software patents influence its rivals' market value? Do a firm's hardware patents moderate the former influence?
Dependant variable(s)	- CAR of rivals	- Annual number of internal citations	- $ acqu premium - $ value synergy gain as CAR	- Rivals' Tobin's Q
Results	• ***Negative impact on the industry competitors*** by focusing on non-horizontal acquisitions. • Effect is **worse for closer rivals** *defined as having similar size and same service area* as acquirer. • This ***negative impact is moderated*** *for competitors that made prior acquisitions.*	• **Firms cite** one another **40% less** *annually* ***after*** *merging.* • ***Innovation race*** → **5** years ***before*** transaction • ***Reduction in competition*** → **5** years ***after*** transaction	• An increase of **1 cross-citation** *between Acquirer & Target* ⇒ ↗ **$1 million** in Premiums • An increase of **1 co-citation** *of A&T to a common patent* ⇒ ↗ **$0.3 million** in Premiums • **1 co-cited by the 3rd parties** *to the patents of merging firms* ⇒ ↗ **$0.1 million** in Premiums • **1 citation by acquirer's competitors** *of target's patents* ⇒ ↗ **$0.2million** in Premiums	• An increase of **1%** in *a focal firm's software patent stock* **0.03%** in *the rivals' market vaue.* • *Hardware* ***patent stock increase negative impact*** on rivals' market value. • The *competitive* ***intensity of the industry mitigates the competitive impact*** *of software patent* stock.
Conclusions	**Competitor returns are positively correlated with those of the acquirers**, thus *negative impact on rivals is drivern by acquisitions in which acquirer itself is earning negative abnormal returns.*	Firms may choose to **merge so as to capture information spillovers but also to dampen competition** in innovation.	**Technological Synergies** are a **Positive** *determinant of merger premium*. **Technological Synergies positively impact** *the expected total synergy gain to shareholders.*	*Hardware play role of complementary assets to software patents*, **strengthning market-stealing rather than spillover effect.**

Section 2: Hypotheses, variables and rivals' description

2.1. Hypotheses development

The literature has always been emphasizing innovation as a sharing process in the sens that new innovative outputs come in the aftermaths of existing elements of knowledge recombined into new products [Schumpeter, (1934)]. In the corporation's context, a firm can either develop technologies internally or catch it through an external way. Our study deals with the second alternative since we focus on M&As involving technologies and we want to analyze the impact on acquirers' rivals. Actually, we are interested in technological proximity between the merging firms and its wealth effect respectively on acquirers and their rivals from 1990 to 2006. In this perspective, the synergies generated by the mergers give birth to a new and more powerful entity, able to lower its prices, to offer more efficient products and specially to position itself as a major competitor. Fundamentally, product differentiation and the M&A process refer more to the theory of productive efficiency whereby reduction of costs and optimization of undervalued resources have a positive impact on merging firms but mixed on competing companies.

Talking about industrial economy, one must keep in mind that industry wealth effect of a merger is two-sided.

On one hand, the effect is positive. Indeed, the announcement of a merger may convey a positive information about the resources' value of the industry and those controlled by rival firms. Arguably, two technological merging firms with complementary assets will gain more efficient production, resulting in higher infra-marginal rents to these very firms. Regarding the productive efficiency and property rights theories, one could expect a positive market's reaction to a merger involving technological proximity and potential synergy gains. However, the increased volume of M&As within an industry may reveal a high synergistic industry but also a high demand for resources owned by other companies, leading to a positive re-evaluation of these rival firms. Actually, acquiring another firm could easily be considered as a call for help, and a disability to keep up to date with the industrial speed. This may suggest that competition is strong and that rival firms are too competitive, for all that matters. Basically, the increased demand may result in expectations of future merger

activity, giving birth to a positive « in-play » effect on rival firms from the announcement of a merger.

On the other hand, the effect is negative. Productive efficiency theory predicts that rival firms may suffer from more competition in the industry due to a new more-efficient combined firm [Eckbo (1983)]. Actually, a scale-increasing efficient merger have a tendency to negatively impact the industry's equilibrium product price, which harms competitors and by itself causes a negative industry wealth effect. Moreover, a conglomerate or an acquisition of a firm belonging to another industry may strenghten the new firm through an increase of its skills' diversification and knowledge bases' richness. This possible technological competitive advantage could definitely harm rival firms' performance and result in negative abnormal returns for competitors. Nevertheless, there is a counter-argument. Granted, two different technologies inside the same industry might easily impel two firms to merge, still, two different technologies each of which belongs to different industries might dampen the two firms to merge. Assimilation, managerial, and communication costs are some good reasons that might make the market reacts negatively to such acquisition and illustrate the latter argument. The conglomerate merger wave of the 1960s has been associated to a destruction value along with an unproductive and inefficient process, for all that matters [Ravenscraft & Scherer (1987), Lang & Stulz (1994), Servaes (1996)]. If the empirical evidence about the 1960s have a tendency to demonize diversification, other empirical studies concentrated on the refocusing wave of the 1980s and the global wave or strategic merger wave of the 1990s. They found that the market seems to be fairly fickle and that there is no significant difference what with the stock market reactions to diversification announcement and reactions to related acquisitions [Kaplan & Weisbach (1992), Hubbard & Palia (1999) Hyland & Dlitz (2002)].

Consequently, a merger can have direct and/or indirect effects on rival firms and economic efficiency in the markets.

The Competitive Advantage hypothesis states that the combined resources of the merging firms generate a fiercer and more powerful adversary unless rivals can replicate the investment, for all that matters. This suggests that the new merged firm creates value for the acquirer and the target while hurting their competitors; and then predicts positive abnormal returns for the acquirer and negative abnormal returns for rivals [Eckbo (1983)]. Thereby, acquiring a target whose innovation is a land of plenty

could give the acquiring firm more potential advantages. We then put forward the two-following hypothesis:

H1 a: The higher subcategories technological proximity between the merging firms, the more positive will be market's reaction to acquirers.

H1 b: The higher subcategories technological proximity between the merging firms, the more negative will be market's reaction to rival firms.

According to the property rights theory of Hart (1995), a merger between companies having complementary technologies is value-enhancing, while a merger including companies having independent technologies is value-reducing. A moderate degree of overlap in the acquirer and target knowledge bases are likely to create synergies and a positive impact on the acquiring firm's subsequent innovation output. We predict that the market would depreciate the acquisition of a target that ventures into several industries since conglomerates tend to reduce the risk of managerial human capital and to create « business empires » perhaps valued excessively by CEOs [Roll (1986)]. Conglomerate may also reflect an agency problem by the fact that executive compensation showed little sensitivity to firm performance at the time [Jensen & Murphy (1990)]. We then hypothesize that:

H2 a: The higher Categories technological proximity between the merging firms, the more negative will be market's reaction to merging firms.

H2 b: The higher Categories technological proximity between the merging firms, the more positive will be market's reaction to rival firms.

2.2. Variables' description

2.2.1. Technological Proximity and other technological characteristics

✓ **Variable of interest: Technological Proximity**

Indisputably, technological collaboration has become ubiquitous in the business world, and it is no coincidence that large companies are expanding their skills and know-how in many technological fields. Based on Hart's approach, Bena & Li (2014) emphasized the existence of synergies between technology companies and the influence they could play in the M&A process. Aside from other innovation measures, they introduced Technological Proximity to measure the proximity of two firms' innovation activities in the technological space by using a number of patents in different technological classes.

Originally, technological proximity was introduced by Jaffe (1986) in order to measure the closeness of two innovative firms using patent counts in different technology classes. Through 49 technological fields, technological proximity is computed as the angular separation between two vectors of technological position. The measure ranges between 0 and 1; 1 means identical technological patterns of innovative activity, and 0 means no potential to benefit from each other's research activities. The angular separation between acquirer (acq) and target (targ) is calculated as follows:

(1)
$$\textit{Tech prox} = \frac{F_{acq} * F'_{targ}}{(F_{acq} * F'_{acq})^{1/2} * (F_{targ} * F'_{targ})^{1/2}}$$

(1.1) Where

$$F_{acq} = (F_{acq,1}\ ;\ \ldots\ ;\ F_{acq,k}) \quad ;\ \text{where } k \in (1, k) \text{ is the technology index.}$$

(1.2) Where

$$F_{acq,k} = \frac{\text{Nb of awarded patents in tech class k with application year -4 to -1}}{\text{Total nb of awarded patents in all tech classes applied over the same 4-years}}$$

There are several ways to determine technological classes, and then the two technological vectors [Jaffe (1986), Grimpe & Hussinger (2008), Aldieri (2012), Bena & Li (2014), Stellner (2014)] ... A patent is assigned to at least one classification by the patent examiner but usually a patent is assigned to more than one patent class.

For our part, this uncentered correlation will be computed at two different levels of patent classification following NBER[118] working papers from Hall et al (2001, 2005). The latter put forward different levels of patent classification: 6 main Categories, 37 Subcategories, 400 main (3-digit) patent classes, 120 000 patent subclasses. We consider a technological firm as a company possessing at least one patent in its portfolio or immaterial capital. In contrast, a non-technological firm has no the least patent in its portfolio. We determined the technological aspect according to NBER database.

From there, using « foreach » and « forvalues » commands on Stata, we created several loops to account for the proximity between merging firms within each industry (Categories) and each industry segment (Subcategories) in which the latter were reported to have at least one patent application during the period 1990-2006 (see Appendix 1). Therefore, we generated two different variables based on Jaffe's measure (1986) and accounting for technological proximity within two different levels of classification as follows:

Tech_Prox_S = Proximity between merging firms within each of 37 subcategories.

- It will account for the number of patents belonging to each target and located in an industry segment shared by the acquirer.
- This is the technological proximity between acquirer and the target inside one specific industry – horizontal and vertical mergers –.

Tech_Prox_C = proximity between merging firms within each of 6 Categories.

- It will account for the number of patents belonging to each target and located in an industry shared by the acquirer.
- This is the technological proximity between acquirer and the target across several industries – Conglomerate view –.

[118] The data from Copustat Industry Segment database are not always reliable about reported increases in a firm's number of segments [Hyland & Dlitz (2002), Villalonga (2004)]

APPENDIX 1: *CATEGORIES level and SUBCATEGORIES level from NBER*

CATEGORIES / industries		SUBCATEGORIES / industry segments	
1	***Chemical***	11	***Agriculture, Food, Textiles***
		12	***Coating***
		13	***Gas***
		14	***Organic Compounds***
		15	***Resins***
		19	***Miscellaneous***
2	***Computers & Communication***	21	***Communications***
		22	***Computer Hardware & Software***
		23	***Computer Peripherials***
		24 / 25	***Information Storage***
3	***Drugs & Medicals***	31	***Drugs***
		32	***Surgery & Medical Instruments***
		33	***Genetics***
		39	***Miscellaneous***
4	***Electrical***	41	***Electrical Devices***
		42	***Electrical Lighting***
		43	***Measuring & Testing***
		44	***Nuclear & X-rays***
		45	***Power Systems***
		46	***Semiconductor Devices***
		49	***Miscellaneous***
5	***Mechanicals***	51	***Mat Proc & Handling***
		52	***Metal Working***
		53	***Motors & Engines***
		54	***Optics***
		55	***Transportation***
		59	***Miscellaneous***
6	***Others***	61	***Agriculture, Husbandry***
		62	***Amusement Devices***
		63	***Apparel & Textile***
		64	***Earth Working***
		65 / 66	***Furniture, House Fixtures / Heating***
		67	***Pipes & Joints***
		68 / 69	***Receptacles / Miscellaneous***

✓ **Number of patents**

Aside from deal and financial characteristics of a firm, one must not overlook a firm's technological characteristics. So as to better know whether the premiums and market's reaction are impacted by the technological diversification or merely the number of patents possessed by the target – and also by the acquirer –. All papers dealing with patents topics used this variable in their models [(Griliches (1990), Lerner (1994), Deng et al (1999), Hirschey et al (2001), Chen et al (2010) among others]

NP_Targ $_{i,t}$ **&** ***NP_Acq*** $_{i,t}$ = Total number of patent applications held by firm i within year t, from 1990 to 2006, it ranges from 1 to 36778.

2.2.2. Deal and firm's control variables

Following the literature, we control for deal characteristics using six dummies, namely, Status, Number of Bidders, Attitude, Tender offer, Allcash, and Poison pill (see Appendix 2 for deal variables' description). As for firm characteristics, we control through R&D [119] intensity, Market value or Relative size (measured by firm's capitalization), performance (measured by market-to-book ratio), profitability (measured by ROA), Leverage, and Run-up – see Appendix 2 for more details –.

[119] We must keep in mind that firms are not forced to report R&D expenditures which results in a considerable number of missing values in this variable. Since we lose a high percentage of observations due to missing values within control variables, we create a dummy variable equals to one if the R&D information is reported and zero otherwise. Based on this standard practise119, we then replace missing values in R&D expenditures with 0 so as to abtain an homogeneous sample with the same number of observations in our regressions that makes them comparable. [Fernández-Kranz, D., & Santaló, J. (2010)]

Section 3: Sample formation and empirical results

3.1. Sample, data collection and rival's identification

In order to form our sample, we start with all announced & completed US M&As with announcement dates from January 1st, 1990 to December 31st, 2006 covered by the Mergers and Acquistions database of the Thomson Financial's SDC database[120]. We analyse all deals coded as a merger, an acquisition of majority interest, or an acquisition of assets. Thereby, we only keep an acquisition if the acquirer controls (if any) less than 50 % of the target's shares before the announcement, obtains at least 51% after the deal, and controls greater than 90% of the target after the deal completion. We require that 1) tansaction value be greater than $1 million and at least 1% of the acquirer's market capitalization 11 days before the announcement; 2) neither the acquirer nor the target be from the financial sector (SIC 6000 – 6999); 3) both the acquirer and the target be public firms and covered by Compustat and CRSP for financial information along with firm characteristics. Collecting 7556 deals from SDC and tallying them with Compustat and CRSP for financial informations, we generate 1493[121] deals where all informations for acquirers and targets are covered by WRDS[122].

Studying the Cumulative Abnormal Returns (CARs), we carried out the standard event study methodology to compute the CARs of the sample over the event window (-2; +2) around the announcement date. Following Golubov et al (2015), we measured our CARs as the return in excess of those predicted by the market model with a benchmark being the CRSP value-weighted index and parameters estimated over a period from 300 to 91 days prior the announcement.

When it comes to rival's identification, several researchers tackled this issue and most of them selected the competitor following SIC codes [Excko (1983), Fee & Thomas (2004), Shahrur (2005), Akdogu (2009), Ang & Wu (2011)]. For each merger, a horizontal competitor of the acquirer around the merger proposal announcement is identified from a list of all firms on the CRSP file associated with

[120] We begin from 1990 because the information in SDC is less reliable before 1990 and end in 2006 because the patent data available in the NBER Patent Data Project ends in 2006.
[121] We removed firms with missing abnormal returns, firms with missing accounting data, firms in extreme distress, and dropping some Penny stock deals leaving us with 1493 deals.
[122] To merge SDC with WRDS, we use cusip and DataYearFiscal corresponding to the acquirer and the target

the same SIC code assigned to the acquirer. Therefore, in line with previous papers, the rivals are defined based on overlapping 5-digit SIC code.

As for patents, we use the NBER Patent Data Project that provides data about all utility patents[123] awarded by the US Patent and Trademark Office over the period 1976 – 2006[124]. Using papers from Hall et al (2001) and Bessen (2009), we matched patent assignees by names to firms in Compustat and get the gvkey for each patent. From that point, we sorted patents by gvkey, application year [according to Hall et al (2001), the application year should be used as the realistic time placer for a patent], citations (allcites), a technology class (icl_class), and so on. We then make dataset of summary statistics[125] in order to summarize the number of patents per technology class corresponding to each gvkey and obtain 308 066 observations. Finally, we matched these summary statistics to our deal and firms' characteristics so that we compute our innovation variables regarding our sample's requirements. We define a technological acquirer or target as a firm having at least one granted patent in their portfolio. On one hand, over 1493 mergers, we have 704 technological acquirers versus 787 non-technological acquirers; and on the other hand, we have 486 technological targets versus 1007 non-technological targets.

Since we are focusing on technological proximity between two technological firms, namely acquirers and targets, we must work exclusively on deals involving firms with at least one patent in their portfolio. Accordingly, looking for deals where both acquirer and target possess patents, we found 428 deals corresponding to our requirements and allowing us to compute a technological proximity between the technological merging firms. On that perspective, we identified and selected 428 rivals of the acquiring firms

[123] In our analysis we dropped firms that does not have utility patents (firms whose Pdpass is negative) because utility is a necessary requirement for patentability (US Patent Law).

[124] The NBER is a database of 3 279 509 observations/patents and contains for each patent, an application year, a grant year, a unique patent number, a patent assignee number, and a patent's technology class (according to IPC system) ; among others.

[125] We used the command collapse (sum) on Stata

Figure 13 - Construction of the 1990-2006 sample of Acquisitions

Databases	**Acquirers**	**Targets**
SDC	7556 deals	
SDC + Compustat + CRSP	1493 deals	
NBER		
Technological	704 firms	486 firms
Non-Technological	787 firms	1007 firms
Final Sample	**428 technological acquirers & targets deals**	

3.2. Descriptive statistics: Technological Proximity and market's response

Table 1 shows descriptive statistics for our technological sample of 428 observations from 1990 – 2006, where both acquirer and target have at least one patent.

Studying the impact of technological proximity on merging firms and rivals' abnormal returns, we put forward different cumulative abnormal returns (CARs), namely, Synergy_CAR (combined abnormal returns) and Rivals_CAR. Looking at the mean (median), we observe that the market's response is positively pronounced when it comes to merging firms and negative for rival firms. Concretely, Synergy_CAR has a mean of -0.020 (0.018) versus -0.18 (-0.12) for Rival_CAR.

Table 1 describes firm & deal characteristics. Technological acquirers appear in a « better health » and much larger firm than technological targets, regarding firms' characteristics. Indeed, technological targets have a median market value (358 533) while acquirers have a median that is almost tenfold (3 578 995). Looking at variables' median, technological acquirers have also higher ROA, MTB, and FCF in comparison with technological targets. However, we can note that targets have more R&D intensity (0.080) than acquirers (0.058), and that the former have twice as much

cash as the latter. This indicate that beyond making higher investments in R&D, the average technological targets have a tendency to be a much larger firm with higher earnings and cash-flow. This is consistent with Phillips and Zhdanov (2013) who found that large firms prefer not to vie or compete with small firms in an R&D rate race, letting small companies innovate more.

As for the technological proximity between merging firms, Table 1 displays the variable Tech_Prox_S that reports the closeness of two innovative firms using patent counts in 37 subcategories or industry segments as referenced in NBER. Ranging from 0 to 1, this variable has a mean of 0.30 and a median of 0.22 showing that proximity among technological segments is well pronounced and that merging firms have a minimum of closeness regarding their patents clasified by subcategories. On the other hand, there is the variable Tech_Prox_C dealing with the closeness of technological merging firms across 6 main diffrerent categories or industries – meaning a conglomerate view –. Ranging from 0 to 1, the variable has a mean of 0.10 and a median of 0.04 suggesting that proximity is slighly present among merging firms belonging to different industries. These descriptive statistics do not sound spooky since it is easier to find more technological proximity between firms belonging to the same industry or between two large firms each of both having a true range of patents across several industries.

Table 1: Technological sample of 428 deals from 1990 – 2006, where both acquirer and target have at least one patent

variable	N	mean	p50	p25	p75	p99	sd	min	max
Rivals_CAR	428	-.0182801	-.0120012	-.0537702	.0214861	.1754303	.0809136	-.377482	.3816528
Synergy_CAR	428	.0200022	.0180881	-.0183317	.0640643	.2417585	.0805808	-.2944042	.3089033
tech_Prox_S	428	.2955594	.2238538	.0427072	.4958439	.9110214	.2734382	0	.9734219
tech_Prox_C	428	.1060351	.0426072	.0004128	.1740212	.5374861	.137286	0	.6350508
targ_mv	428	2308504	358533.3	110247.5	1293628	5.06e+07	7548555	2905.15	7.72e+07
targ_roa	428	.0417028	.1136515	-.006435	.1701148	.3747588	.2520671	-1.950595	.4781679
targ_mtb	428	2.690526	1.871283	1.297335	3.221716	14.84565	2.558679	.5339603	23.47748
targ_rd	428	.1194454	.080114	.0218957	.1559566	.7850371	.1639106	0	1.501724
targ_fcf	428	-.0313956	.0184291	-.0168666	.0623663	.197492	.2094241	-2.160341	.3034658
targ_RUN_UP	428	1.05071	.9004782	.6709778	1.214907	3.801633	.8493417	.1230732	13.65691
acq_mv	428	2.67e+07	3578995	896409.8	2.04e+07	2.13e+08	5.40e+07	23456	4.93e+08
acq_roa	428	.1425096	.1532065	.0940354	.2130371	.4182479	.1306601	-.597858	.4924845
acq_mtb	428	3.045471	2.220391	1.582555	3.533436	13.93441	3.218554	.3291293	47.68576
acq_cash	428	.2120484	.1347187	.0369318	.3228492	.8079417	.2158044	.0004334	.9320403
acq_rd	428	.0822902	.0580021	.0190138	.1026443	.4685331	.1050877	0	1.097673
acq_lev	428	.0837982	.057291	.0097998	.1214966	.3754335	.0937857	0	.6162414
acq_fcf	428	.0417138	.0528431	.010413	.0897159	.2055973	.0981683	-.6237365	.2512238
acq_RUN_UP	428	1.124579	1.034216	.8389937	1.26866	2.995888	.5312803	.1995934	7.102462

Section 4: Models, empirical evidences and discussion

4.1. Linear regressions: Technological Proximity's influence on Market's response

4.1.1. Models and methodology

Starting from the crescent impact of technologies on cumulative abnormal returns, it might be interesting to go deeper in the concept of technology and examine whether the technological proximity between the acquirer and the target influence the market's sentiment towards the merging firms, on one hand, and the rival firms, on the other hand. Table 2 tackles this issue and concentrates on the 428 deals involving both acquirer and target as technological firms and allowing us to compute the technological proximity between those latter.

With a view to examining to what extent does technological proximity between merging firms influences predicted abnormal returns of the latter and those of their rivals, we estimate the following empirical model in our baseline OLS regressions:

$$\textbf{\textit{Synergy\_CARs}}_{i,t} = \alpha_o + \alpha_1 \text{Tech\_Prox\_S}_{i,t} + \alpha_2 \text{Tech\_Prox\_C}_{i,t} + \alpha_3 \text{Targ\_Size\_Pat}_{i,t} + \alpha_4 \text{Acq\_Size\_Pat}_{i,t} + \alpha_5 X_{i,t} + \alpha_6 Z_{i,t} + \varepsilon_{i,t} \quad \textbf{(1)}$$

$$\textbf{\textit{Rivals\_CARs}}_{i,t} = \beta_o + \beta_1 \text{Tech\_Prox\_S}_{i,t} + \beta_2 \text{Tech\_Prox\_C}_{i,t} + \beta_3 \text{Targ\_Size\_Pat}_{i,t} + \beta_4 \text{Acq\_Size\_Pat}_{i,t} + \beta_5 X_{i,t} + \beta_6 Z_{i,t} + \varepsilon_{i,t} \quad \textbf{(2)}$$

Where i indexes deal number and t indexes the year. ***Synergy_CARs*** $_{i,t}$ term is the dependent variable accounting for combined abnormal returns and is measured by taking the product of Acquirers Cars and Targets CARs. Actually, it represents the market's sentiment towards potential technological synergy gains. ***Rivals_CARs*** $_{i,t}$ is the second dependent variable dealing with identified rivals of each acquirer and their

predicted abnormal returns. At the right side, the Tech_Prox_S $_{i,t}$ is the technological proximity computing the closeness of two innovative merging firms using patent counts over 37 subcategories as defined by Hall et al (2001). The measure ranges between 0 and 1; 1 means identical technological patterns of innovative activity, and 0 means no potential to benefit from each other's research activities – as we explained above in Section 2. The Tech_Prox_C $_{i,t}$ refers to the technological proximity measuring the closeness of two innovative merging firms using patent counts over 6 main categories as defined by Hall et al (2001). The NP_Targ $_{i,t}$ and NP_Acq $_{i,t}$ are technological variables controlling, respectively, for the target's number of patents and acquirer's number of patents. As for X $_{i,t}$, it refers to deal characteristics as enounced in the hypotheses and explained in Section 2. Acquirer's and target's firm characteristics are represented by Z $_{i,t}$ and defined in appendix 2. Working on technological proximity within industries and industry segments, we ran a fixed effects model controlling for industries characteristics by including acquirer's 2-SIC digit code and acquirer's 4-SIC digit code along with year fixed effects (respectively in Table 3 and Table 4).

4.1.2. Linear regressions – Subcategories and Categories

Table 2 portrays linear regressions over our sample of 428 technological deals during the period 1990 – 2006 and the wealth effect of technological proximity on market's sentiment measured by Synergy_CAR and Rivals_CAR. We run new pooled regressions taking into account as variables of interest, the technological proximity within the two levels in columns (1) to (4). On one hand, we regress the two Technological proximity variables on Synergy_CAR in columns (1) and (2) ; and on the other hand, we regress these two variables on Rivals_CAR in columns (3) and (4). The univariate regression in column (1) shows a highly significant impact with opposite sign depending on whether the proximity is within one specific industry or across several ones. Thereby, Tech_Prox_S has a positive and significant coefficient (α_1 = 0.04) at 1% level in column (1), Tech_Prox_C shows a negative and significant coefficient (α_2 = – 0.03) at 1% level in this very univariate regression. Moreover, once we introduce firms and deal characteristics in column (2), the former stays positive (α_1 = 0.06) but less significant at 10% while the latter remains negative (α_2 = – 0.02) but less significant at 5% in column (2).

As for Rivals_CAR, technological proximity keeps the same signs but definitely loses in significativity. The univariate regression in column (3) reports the same signs as column (1). However, it shows a nil and nonsignificant coefficient β_1 of Tech_Prox_S, while Tech_Prox_C has a negative and significant coefficient at 10% level ($\beta_2 = -0.02$) suggesting that the Rivals' abnormal returns are correlated to merging firms' abnormal returns but significativity is almost inexistent. Furthermore, once we introduce firms and deal characteristics in column (4), both variables keep the same opposite signs and lose any significativity.

Looking at control variables, we can observe that an all cash transaction has a positive significant (10%) impact once on Synergy_CAR and Rivals_CAR. If an acquirer does not feel self-assured about the target's real value, it would be more cautious to pay with equity so as to share potential negative returns and thus minimizing the problem of adverse selection [Sudarsanam & Mahate (2003)]. On the flip side, a cash payment gives the acquirers' shareholders an opportunity to reap future gains from the merge. Following Jensen (1986), acquiring a target through a cash offer mitigates likely agency problems by releasing excess free cash flows. Based on these thoughts, it does not sound strange that rivals record positive impact from cash offers since the target perceived as a valued firm may convey a positive information about this very industry's health and potential synergisms. Moreover, we can note that acquirers R&D intensity has a negative and significant (5%) impact on Rivals_CAR meaning that technological acquirers with high R&D have a potential to harm competitors through a merger or an acquisition of another technological target firm. Not to mention that acquirers' R&D became negatively related to market's reaction at 5%, merging firms' profitability appears to play an inverse role since acquirers_ROA has a negative sign (-0.06) at 10% level while targets_ROA has a positive sign (0.08) highly significant at 1% level.

Finally, we observed that the impact of technological proximity on Synergy_CAR is correlated to the one on Rivals_CAR, but the nonsignificant coefficients in columns (3) and (4) do not allow us to validate these results. Therefore, we must wonder whether the market is sensitive to mergers' impact on rivals or not and whether the market may react differently depending on each industry characteristics.

Table 2 : Technological proximity on Merging firms and Rivals Market's reaction - Linear regression

	(1) Tech Prox	(2) Acquirers CAR	(3) Tech Prox	(4) Rivals CAR
Tech_Prox_S	0.04***	0.06*	0.00	0.01
	(2.80)	(1.88)	(0.15)	(0.18)
Tech_Prox_C	-0.03***	-0.02**	-0.02**	-0.01
	(-2.94)	(-2.20)	(-2.36)	(-1.57)
NP_Acq		-0.00***		-0.00*
		(-3.12)		(-1.87)
NP_Targ		-0.00		-0.00
		(-0.32)		(-1.15)
Status_Dummy		-0.01		-0.00
		(-0.78)		(-0.31)
TendOff_Dummy		0.01		0.01
		(0.87)		(0.89)
Attitude_Dummy		-0.03		0.00
		(-1.50)		(0.15)
PoisPill_Dummy		0.00		-0.03
		(0.05)		(-1.12)
AllCash_Dummy		0.01*		0.02*
		(1.65)		(1.69)
NboB_Dummy		0.01		0.01
		(0.75)		(0.43)
acq_mv		-0.00		0.00**
		(-0.30)		(2.21)
acq_runup		-0.01		-0.00
		(-0.50)		(-0.13)
acq_roa		-0.07		-0.03
		(-1.08)		(-0.43)
acq_mtb		-0.00		-0.00
		(-0.11)		(-0.20)
acq_lev		0.10*		-0.01
		(1.96)		(-0.25)
acq_Cash		-0.00		-0.01
		(-0.01)		(-0.54)
acq_rd		-0.09		-0.16**
		(-1.26)		(-2.54)
acq_fcf		-0.00		-0.00
		(-0.02)		(-0.04)
targ_mv		-0.00		-0.00*
		(-0.31)		(-1.93)
targ_RUN_UP		-0.00		0.01*
		(-0.27)		(1.87)
Targ_roa		0.00		0.00
		(0.55)		(0.40)
targ_mtb		-0.00		-0.00
		(-0.95)		(-0.76)
targ_lev		-0.05		-0.05
		(-1.49)		(-1.40)
targ_Cash		0.01		0.00
		(0.84)		(0.21)
targ_rd		0.02		0.01
		(0.68)		(0.19)
targ_fcf		-0.04		-0.02
		(-1.39)		(-0.77)
Relatedness_SIC_2		0.00		-0.01
		(0.13)		(-0.81)
Number of Cases	428.00	428.00	428.00	428.00
R^2-Squared	0.04	0.13	0.02	0.18

* p<0.1, ** p<0.05, *** p<0.01

4.2. Fixed Effects regressions: Technological Proximity's influence on market's response

4.2.1. Fixed effects regressions – Acquirers' 2-digit SIC

Since we are coping with several technological industries, the market could react differently depending on the target's line of business purchased by acquirers. From there, we introduced, in Table 5 Bis, fixed effects controlling for target's 2 SIC digit code and year effects over the 428 technological deals. Columns (1) to (3) show regressions over Synergy_CAR as a dependent variable; while columns (4) and (5) show regressions where the dependent variable is Rivals_CAR. Starting from the impact of technological proximity on merging firms' abnormal returns, we can see that Synergy_CAR is positively and significantly associated to technological proximity within subcategories/industry segments (α_1 = 0.07; 5%) once we control for all firm & deal characteristics in column (2). However, this impact remains positive when year effects are introduced but became non-significant. Moreover, Tech_Prox_C has an opposite impact since the coefficient α_2 is negatively significant at 5% level in column (2), and keeps the same sign and significance level in column (3) once we added year fixed effects. This suggests that technological proximity beyond firms' frontiers leading to a conglomerate process is perceived by the market as being detrimental to merging firms. Regarding columns (4) and (5), our empirical results show a similar impact on acquirers' rivals since technological proximity within the same industry between two merging firms has a positive influence on Rivals_CAR. That said, we must pinpoint the absence of significativity for Tech_Prox_S once at columns (4) and (5). Nonetheless, we can see that Tech_Prox_C has a negative impact on Rivals_CAR but weakly significant when we controlled for firm & deal characteristics and nonsignificant once we added year effects. These results indicate that the impact of technological proximity on acquirers' competitors goes hand in hand with the one on merging firms. Statistically, we can note that the closeness of two innovative firms, using patent counts in different industry segments inside one specific industry (Tech_Prox_S), has a positive impact on predicted abnormal returns albeit it is higly significant at 5% for merging firms and definitely nonsignificant for rivals. In addition to that, the closeness of two innovative firms, using patent counts across several industries (Tech_Prox_C), has a negative impact on predicted abnormal returns

albeit it is higly significant at 5% for merging firms but slighly significant at 10% for rival firms in column (4). On one hand, our empirical evidences suggest an « in-play » effect created in the competitors' abnormal returns in response to a merger involving technological proximity between targets and acquirers. The increased volume of M&As within a specific industry may reveal a high synergistic industry but also a high demand for resources owned by other companies, leading to a positive re-evaluation of these rival firms. Actually, the « in-play » occurs when the merger event increases the probability that competitors may become targets. Predicted by the productive efficiency hypothesis, the « in-play » effect motivates the positive information effect and follows naturally from the fact that competitors use similar production technologies and possess some of the same productive resources. Therefore, a takeover may signal increased resource scarcity, causing a positive re-evaluation of every firm holding this kind of resources. Moreover, acquiring another firm could easily be considered as a call for help, and a disability to keep up to date with the industrial speed. This may suggest that competition is strong and that rival firms are too competitive. Basically, our results are consistent with most of studies defending such a positive industry information effect.

On the other hand, a conglomerate takeover may put forward an underperformance of a specific industry since acquirers merge with targets from another industry. This could lead to a negative wealth effect on that specific industry and other stakeholders belonging to. However, another argument is that a conglomerate takeover may strenghten the acquiring firms' technological diversification and skills richness resulting in a negative impact on rivals, the latter perceived as less competitive. This possible technological competitive advantage could definitely harm rival firms' performance and entail to negative abnormal returns for competitors.

Eventually, our results are inconsitent with the collusion predicted by the market power theory but consistent with the positive information effect predicted by the productive efficiency theory.

Table 3: Fixed effects : Technological proximity on Rivals Market's reaction - Controlled - Acquirer_2_SIC

	(1) Tech Prox	(2) Acquirers CAR	(3) Year effects	(4) Rivals CAR	(5) Year effects
Tech_Prox_S	0.02	0.07**	0.05	0.04	0.02
	(1.57)	(2.16)	(1.63)	(1.22)	(0.53)
Tech_Prox_C	-0.02**	-0.02**	-0.02**	-0.02*	-0.01
	(-2.34)	(-2.49)	(-2.16)	(-1.78)	(-1.47)
NP_Acq		-0.00***	-0.00***	-0.00*	-0.00***
		(-2.89)	(-3.83)	(-1.92)	(-2.96)
NP_Targ		-0.00	-0.00	-0.00*	-0.00
		(-0.71)	(-0.37)	(-1.86)	(-1.21)
Status_Dummy		-0.03	-0.03	-0.00	0.00
		(-1.02)	(-1.14)	(-0.08)	(0.02)
TendOff_Dummy		0.01	0.02	0.00	0.01
		(0.86)	(1.57)	(0.24)	(0.92)
Attitude_Dummy		-0.03	-0.03	0.00	0.00
		(-1.15)	(-1.12)	(0.14)	(0.08)
PoisPill_Dummy		-0.02	-0.00	-0.02	-0.01
		(-0.49)	(-0.11)	(-0.66)	(-0.14)
AllCash_Dummy		0.01	0.00	0.02	0.01
		(1.07)	(0.16)	(1.63)	(1.00)
NboB_Dummy		0.01	0.02	0.01	0.01
		(0.77)	(1.24)	(0.64)	(1.04)
acq_mv		0.00	0.00**	0.00***	0.00***
		(0.89)	(2.00)	(2.99)	(3.47)
acq_runup		-0.01	-0.01	-0.01	-0.01
		(-1.56)	(-1.39)	(-1.10)	(-1.13)
acq_roa		-0.10	-0.12	-0.00	-0.05
		(-1.26)	(-1.28)	(-0.02)	(-0.66)
acq_mtb		0.00	-0.00	0.00	0.00
		(0.18)	(-0.35)	(0.59)	(0.11)
acq_lev		0.13**	0.13**	0.05	0.06
		(2.14)	(2.09)	(0.75)	(0.82)
acq_Cash		-0.01	-0.02	-0.00	-0.01
		(-0.76)	(-1.42)	(-0.27)	(-0.88)
acq_rd		-0.07	-0.09	-0.12**	-0.14**
		(-1.18)	(-1.36)	(-2.21)	(-2.40)
acq_fcf		0.02	0.02	-0.02	0.00
		(0.23)	(0.15)	(-0.21)	(0.02)
targ_mv		-0.00	-0.00	-0.00	-0.00
		(-0.34)	(-0.45)	(-1.37)	(-1.09)
targ_RUN_UP		0.00	0.00	0.00	0.01**
		(0.24)	(1.08)	(0.93)	(2.50)
Targ_roa		0.01	0.02*	0.00	0.02
		(1.01)	(1.75)	(0.35)	(1.01)
targ_mtb		-0.00	-0.00	-0.00	-0.00
		(-0.90)	(-0.89)	(-0.95)	(-0.86)
targ_lev		-0.07*	-0.07**	-0.02	-0.02
		(-1.91)	(-2.06)	(-0.44)	(-0.59)
targ_Cash		0.01	0.01	0.01	0.01
		(1.32)	(1.33)	(1.22)	(1.20)
targ_rd		0.02	0.01	0.03	0.01
		(0.74)	(0.24)	(1.22)	(0.37)
targ_fcf		-0.03	-0.02	-0.03	-0.01
		(-1.44)	(-0.98)	(-1.01)	(-0.50)
Relatedness_SIC_2		0.00	0.00	-0.00	-0.01
		(0.55)	(0.36)	(-0.42)	(-0.65)
Number of Cases	428.00	428.00	428.00	428.00	428.00
R^2-within	0.03	0.11	0.17	0.11	0.18
R^2-between	0.06	0.03	0.02	0.04	0.04

* p<0.1, ** p<0.05, *** p<0.01

4.2.2. Fixed effects regressions – Acquirers' 4-digit SIC

With a view to add more accuracy about the acquirer's line of business and since we are using the international patent clasification for our technological proximity measure, we generated new empirical results controlling for acquirer's 4 SIC digit code. Table 6 Bis shows a fixed effects model over our sample of 428 technological deals. For the sack of comparability, columns (1) to (3) still show regressions over Synergy_CAR as a dependent variable; while columns (4) and (5) show regressions where the dependent variable is Rivals_CAR. Starting from the impact of technological proximity on merging firms' abnormal returns, we can see that Tech_Prox_S is positive and highly significant at 1% level both in the univariate column (1) and firm & deal controls in column (2). This very coefficient α_1 remains positive but lost in significativity (10%) once we introduced year effects in column (3). On the other hand, Tech_Prox_C is still negative and significant at 5 % except in column (3). These empirical results indicate that the more we go deep in SIC code clasification better is the impact of technological proximity within different industry segments belonging to one specific industry. Looking at Rivals_CAR as a dependent variable in columns (4) and (5), our results show significant coefficient for our variables of interest in column (4). The closeness of two innovative firms sharing patents belonging to the same industry has a positive and significant impact on rivals' abnormal returns at 10% (Tech_Prox_S: $\beta_1 = 0.04$). Nevertheless, the closeness of two innovative firms sharing patents belonging to the different industries has a negative and significant impact on rivals' abnormal returns at 10% (Tech_Prox_C: $\beta_2 = -0.02$).

That said, we must note that targets and acquirers' number of patents are significant but at an unstable way and with a nil coefficient when it comes to Rivals_CAR in columns (4) and (5). Also, attitude and payment method characteristics seem to play some significant role respectively in column (2) and column (4) at 5% level. The choice of the method depends on whether the acquirer discerns valuation risk or not and may be partially guided by agency cost consideration. Basically, stock offers are widely perceived as a negative information signal while cash offers are believed to convey positive information. Intuitively, an equity offer is tantamount to a risk-distribution since the stock-offered value is closely linked to the ex-post performance of the joint entity. As for firms' characteristics,

target_lev is negatively significant at 5% in columns (2) and (3), and at 10% level in columns (4) and (5). It seems that the market does not perceive target_leverage in the same way as premiums. In addition, acq_RD has a highly significant and negative coefficient (– 0.14) in columns (4) and (5), meaning that acquirers' R&D intensity could harm rivals abnormal returns in a context of a technological merger proposal announcement.

4.2.3. Discussing our empirical results

Basically, our empirical results validate Hypothesis H1.a since the higher Subcategories technological proximity (Tech_Prox_S) between the acquirer and the target, the more positive will be market's reaction to merging firms. This is in line with Hart (1995) arguing that a merger between companies having complementary technologies is value-enhancing, while a merger including companies having independent technologies is value-reducing. A moderate degree of overlap in the acquirer and target knowledge bases are likely to create synergies and a positive impact on the acquiring firm's subsequent innovation output. Our results also validate Hypothesis H2.a since the higher Categories technological proximity between the acquirer and the target, the more negative will be market's response to merging firms. Granted, two different technologies inside the same industry might easily impel two firms to merge, still, two different technologies each of which belongs to different industries might dampen the two firms to merge. Assimilation, managerial, and communication costs are some good reasons that might make the market reacts negatively to such acquisition and illustrate the latter argument. Our results are therefore consistent with previous researchers analyzing the value of diversification when many corporations started to diversify and finding no striking evidence about the value of diversified companies [Servaes (1996), Ravenscraft & Scherer (1987), Lang & Stulz (1994)].

Notwithstanding, our empirical evidences do not validate hypotheses H1.b and H2.b predicting an opposite impact on rival firms. Actually, Table 3 and Table 4 show a correlation between merging firms and acquirers' rivals regarding the impact of technological proximity on predicted abnormal returns – albeit coefficients in Rival_CAR regressions are weakly significant or even nonsignificant under year effects. First, the higher subcategories technological proximity between the merging

Table 4: Fixed effects : Technological proximity on Rivals Market's reaction - Controlled - Acquirer_4_SIC

	(1) Tech Prox	(2) Acquirers CAR	(3) Year effects	(4) Rivals CAR	(5) Year effects
Tech_Prox_S	0.04***	0.07***	0.06*	0.04*	0.02
	(4.75)	(2.83)	(1.95)	(1.70)	(0.79)
Tech_Prox_C	-0.02**	-0.02**	-0.02*	-0.02*	-0.01
	(-2.52)	(-2.28)	(-2.03)	(-1.73)	(-1.59)
NP_Acq		-0.00***	-0.00***	-0.00	-0.00
		(-2.99)	(-3.43)	(-1.33)	(-1.58)
NP_Targ		-0.00	0.00	-0.00*	-0.00
		(-0.05)	(0.26)	(-1.85)	(-1.47)
Status_Dummy		-0.02	-0.02	-0.01	-0.01
		(-1.08)	(-1.42)	(-0.85)	(-1.01)
TendOff_Dummy		0.01	0.02	0.00	0.01
		(0.68)	(1.30)	(0.30)	(1.06)
Attitude_Dummy		-0.03*	-0.02	-0.00	0.00
		(-1.93)	(-1.29)	(-0.10)	(0.21)
PoisPill_Dummy		-0.00	0.00	-0.04	-0.03
		(-0.08)	(0.05)	(-1.59)	(-1.28)
AllCash_Dummy		0.01	0.01	0.02*	0.01
		(1.52)	(0.69)	(1.86)	(1.18)
NboB_Dummy		0.01	0.02	0.01	0.01
		(0.87)	(1.47)	(0.42)	(0.85)
acq_mv		0.00	0.00	0.00***	0.00***
		(0.01)	(0.81)	(3.63)	(4.80)
acq_runup		-0.01*	-0.01*	-0.01	-0.00
		(-1.95)	(-1.86)	(-1.34)	(-0.91)
acq_roa		-0.10*	-0.10	0.02	-0.00
		(-1.83)	(-1.22)	(0.32)	(-0.01)
acq_mtb		0.00	-0.00	0.00	0.00
		(0.23)	(-0.01)	(0.27)	(0.09)
acq_lev		0.05	0.05	-0.03	-0.04
		(1.23)	(1.21)	(-0.69)	(-0.70)
acq_Cash		-0.00	-0.01	0.00	-0.01
		(-0.21)	(-1.20)	(0.14)	(-1.02)
acq_rd		-0.09	-0.09	-0.14**	-0.14**
		(-1.36)	(-1.28)	(-2.65)	(-2.36)
acq_fcf		0.02	-0.00	-0.04	-0.05
		(0.24)	(-0.04)	(-0.61)	(-0.57)
targ_mv		-0.00	-0.00	-0.00**	-0.00*
		(-0.78)	(-0.72)	(-2.25)	(-1.87)
targ_RUN_UP		-0.00	-0.00	0.00	0.00*
		(-0.83)	(-0.15)	(0.41)	(1.99)
Targ_roa		0.00	0.01	0.00	0.01
		(0.48)	(1.22)	(0.10)	(0.76)
targ_mtb		-0.00	-0.00	-0.00	-0.00
		(-1.42)	(-1.19)	(-1.21)	(-0.95)
targ_lev		-0.08**	-0.07**	-0.07*	-0.07*
		(-2.09)	(-2.55)	(-1.78)	(-2.04)
targ_Cash		0.01	0.01	0.01	0.01
		(1.43)	(1.61)	(1.05)	(1.34)
targ_rd		0.03	0.02	0.03	0.02
		(1.02)	(0.68)	(1.39)	(0.87)
targ_fcf		-0.04**	-0.03	-0.03	-0.02
		(-2.12)	(-1.27)	(-1.62)	(-0.95)
Relatedness_SIC_2		0.01	0.01	-0.00	-0.01
		(0.89)	(0.81)	(-0.50)	(-0.66)
Number of Cases	428.00	428.00	428.00	428.00	428.00
R^2-within	0.04	0.12	0.17	0.12	0.18
R^2-between	0.35	0.05	0.10	0.00	0.21

* p<0.1, ** p<0.05, *** p<0.01

firms, the more positive will be market's reaction to rival firms. The announcement of a merger may convey a positive information about the resources' value of the industry and those controlled by rival firms. Arguably, two technological merging firms with complementary assets will gain more efficient production, resulting in higher infra-marginal rents to these very firms. Nonetheless, the increased volume of M&As within an industry may reveal a high synergistic industry but also a high demand for resources owned by other companies, leading to a positive re-evaluation of these rival firms. Basically, the increased demand may result in expectations of future merger activity, giving birth to a positive « in-play » effect on rival firms from the announcement of a merger, for all that matters.

Second, the technological proximity across several categories/industries between the merging firms results in a negative market's reaction to rival firms. The innovation literature showed that technological overlaps between merging firms play a tremendous role in post-acquisition innovation [Hart (1995), Breschi et al (2003), Leten et al (2007), Hoberg & Phillips (2010), Bena & Li (2014). The Competitive Advantage hypotheisis is broken into two versions: Efficient through competitor, and Rational Overpayment. The latter suggests that acquirers would rationally overpay for the target so as to shy away from a negative payoff externality which they would suffer from if another rival takes over the target firm. « Rational Overpayment » version predicts negative abnormal returns for rivals when acquirers experience negative abnormal returns. Thus, independent technologies within a merger would negatively impact the acquirer even if rivals rely on target's technologies. In addition, Productive efficiency theory predicts that rival firms may suffer from more competition in the industry due to a new more-efficient combined firm [Eckbo (1983)]. Actually, a scale-increasing efficient merger have a tendency to negatively impact the industry's equilibrium product price, which harms competitors and by itself causes a negative industry wealth effect. Moreover, a conglomerate or an acquisition of a firm belonging to another industry may strenghten the new firm through an increase of its skills' diversification and knowledge bases' richness. This possible technological competitive advantage could definitely harm rival firms' performance and result in negative abnormal returns for competitors.

We still want to emphasize the perfectibility of our technological proximity variable since we have conducted several econometric attempts to eliminate

inconsistencies. However, the complexity of the variable coupled with our heavy database arouses reluctance on the accuracy and representativeness of our variable. One of the limits of this paper remains the variable complexity and its econometric conception.

Conclusion

Technological interdependence has become ubiquitous within the corporate world, and it is no accident that large firms expand their technological competencies over many technological fields. In this paper, focusing on patents, we studied the impact of technological proximity between merging firms on abnormal returns of that very firms and of acquirers' rivals. Technological proximity has been computed at two different levels, namely ***Categories/industries*** and ***Subcategories/industry segments***. The former refers more to vertical mergers (conglomerate) while the latter refers to horizontal mergers and technological proximity within one specific industry. We carried out a cross sectional study that analyses technological proximity between merging firms across 37 subcategories (horizontal mergers) and 6 different categories (vertical mergers) as reported by NBER classification of patents [Hall et al (2001)].

This paper helps to better understand M&As impact on competitors through the market's response to a merger announcement involving technological interaction between acquirers and targets. Furthermore, it helps to know whether there is a difference in the impact on rivals, depending on the nature of the merger and the industrial proximity among merging firms.

Studying 428 deals where both acquirer and target have at least one patent from 1990 to 2006, we found a correlation between merging firms and acquirers' rivals regarding the impact of technological proximity on predicted abnormal returns. The closeness of two innovative firms, using patent counts in different industry segments inside one specific industry (Tech_Prox_S), has a positive impact on predicted abnormal returns albeit it is higly significant at 5% or 1% for merging firms and at 10% level or even nonsignificant for rival firms. This suggests that the increased demand may result in expectations of future merger activity, giving birth to a positive « in-play » effect created in the competitors' abnormal returns in response to a merger involving technological proximity between targets and acquirers.

Moreover, the closeness of two innovative firms, using patent counts across several industries (Tech_Prox_C), has a negative impact on predicted abnormal returns albeit it is higly significant at 5% for merging firms but slighly significant at 10% for rival firms. This suggests that technological proximity beyond firms' frontiers leading

to a conglomerate process is perceived by the market as being detrimental to merging firms but also to rival firms. Basically, a conglomerate takeover may put forward an underperformance of a specific industry since acquirers merge with targets from another industry. This could lead to a negative wealth effect on that specific industry and other stakeholders belonging to.

All in all, the higher Subcategories technological proximity (Tech_Prox_S) between the acquirer and the target, the more positive will be market's reaction to merging firms, but also to acquirers' rivals. On the other hand, the higher Categories technological proximity between the acquirer and the target, the more negative will be market's response to merging firms, but also to acquirers' rivals.

In conclusion, our results are inconsitent with the collusion predicted by the market power theory but consistent with the property rights theory and the positive information effect predicted by the productive efficiency theory.

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Appendix 2 : Variables' measurement

Variables	***Measurement***
A - Firm's characteristics :	
Firm size	Ln of firm's market capitalization on day – 42
Market-to-book ratio	log [(total Assets – Common Equity + MV of common shares outstanding) / (Total Assets)]
R&D intensity	R&D / (Total Assets)
Return on Assets	Operating Income / (Total Assets)
Leverage	(Total Debts – Cash) / (Total Assets)
Run-up	Ln (p_{-1}/p_{-42}); where p is the stock price
Firm Sales	ln (Sales)
Relatedness_2_SIC	1 if both target and acquirer share the same 2-digit SIC code; and 0 otherwise [we did the same for 4_SIC]
B - Deal characteristics :	
Status	1 if Completed ; and 0 otherwise
Competitive	1 if multiple bidders; and 0 if single bidder
Payment Method	1 if all cash; and 0 if stock or mixed
Attitude	1 if Friendly; and 0 if hostile
Tender offer	1 if Tender offer; and 0 otherwise
Poison Pill	1 if Poison Pill; and 0 otherwise

CONCLUSION GENERALE

A l'heure où la connaissance double tous les 9 ans en quantité depuis les années 1980, et où le volume des fusions/acquisitions atteint le record de tous les temps à 4 590 milliards de dollars en 2007[126], le paysage économique semble avoir connu de réelles mutations et concentrations d'entreprises autour des savoir-faire technologiques. L'importance que jouent désormais les brevets, les marques, les enseignes et autres, dans la dynamique et la croissance de l'entreprise est un élément fréquemment mis en avant pour justifier les restructurations d'entreprises et l'expectative de gains synergétiques. Le capital immatériel peut demeurer un concept d'un usage général, néanmoins il tend aussi à se traduire en indicateurs de gestion non financiers et à être explicité dans la communication financière de l'entreprise. Les investisseurs trouvent en effet dans ces données sur l'intangible un intérêt qui fait défaut aux états financiers incomplets. En effet, ces éléments communément appelés « actifs immatériels » demeurent difficilement mesurables si l'on se reporte uniquement aux données comptables et financières. En substance, les rapports financiers divulguent des indicateurs financiers qui méritent d'être complétés par des indicateurs extracomptables ne représentant pas une mesure quantitative mais davantage une mesure qualitative [Amir & Lev (1996), Cazavan-Jeny & Jeanjean (2005), Béjar (2006), Callen et al (2010)].

L'objet de cette thèse de doctorat a été de contribuer à ces débats par le truchement d'une analyse statistique et économétrique portant sur un « actif immatériel » : le Brevet ! La valeur des brevets informe les parties prenantes sur les avantages des brevets, dans le sens où elle aide la comptabilité à « mesurer » la valeur des incorporels ainsi qu'à valoriser la productivité et la qualité de la R&D. Ainsi, il serait judicieux de coupler les montants inscrits dans les postes comptables aux indicateurs extracomptables et révélateurs de qualité. En effet, de nombreuses études américaines ont voulu montrer le rôle de la qualité des brevets en tant qu'informations complémentaires à celles des dépenses en R&D. Outre la mesure quantitative du nombre de brevets, les chercheurs ont créé des variables mesurant la

[126] Source : https://www.amkeo.fr/1087-2/

qualité des brevets à travers le lien scientifique, l'avantage technologique, la rapidité d'innovation, les citations de brevets, etc.

Cette thèse de doctorat s'inscrivant dans une perspective de gestion et de finance d'entreprise, nous avons focalisé sur la qualité des brevets au sens techno-économique de l'invention afin d'analyser l'aspect « réalité économique », plutôt que la dimension légale qui tient compte des offices et services d'acceptation des brevets comme Office des Brevets Européens (OEB) ou encore United States Patent and Trademark Office (USPTO).

Dans cette course aux brevets, l'accès au savoir et aux nouvelles technologies est devenu une priorité et une condition indispensable pour la pérennité de l'entreprise ; et la meilleure arme pour se garantir une exclusivité optimale et un avantage compétitif solide sur le long terme pour un nouveau produit innovant : c'est « l'acquisition même du brevet » ! En effet, l'innovation collaborative renforcée juridiquement par une fusion ou une acquisition, permet à chacune des entités d'avoir une vision plus large et plus complète du marché, de bénéficier d'une réduction du « time to market » et d'une réduction des risques en les partageant, mais surtout de pouvoir accéder pleinement au capital immatériel de l'autre et d'accélérer les processus d'innovation. Manifestement, un projet d'innovation issu de l'acquisition d'une société possédant un capital immatériel et appartenant (ou non) à l'environnement d'une entreprise constitue une réelle opportunité de se lancer dans une innovation à risques forts pour maintenir sa compétitivité, plaçant cette dernière en pôle position sur le marché.

Au vu de l'engouement et d'une riche littérature autour des activités de fusions/acquisitions, il est clairement constatable que ce phénomène relève d'une ampleur singulière à la fois pour les universitaires et le monde économique. D'ailleurs, il est d'autant plus intéressant que divers domaines académiques, de la théorie sur l'organisation industrielle à la finance de marché et d'entreprise, en passant par le contrôle des entreprises, ont avancé différentes explications pour justifier les fusions/acquisitions.

Cette thèse de doctorat a donc pour visée d'enrichir le lien qui pourrait exister entre les opérations de fusions/acquisitions et la qualité des brevets perçus comme un moyen de diversifier et/ou perfectionner les compétences technologiques en place. Hypothétiquement, un portefeuille de brevets diversifié pourrait être un gage de qualité technologique, ouvrant la voie à plusieurs connections possibles, reflétant

une entreprise qui vit avec son temps et annonçant l'émulation qui en découle. Fondamentalement, l'objet de ce doctorat se veut être une réflexion sur le choix de la société cible – ou Target –, et dans lequel nous considérons que l'acquéreur va davantage s'intéresser à des informations plus « concrètes » et visionnaires, rendant mieux compte de la richesse économique que le simple nombre figurant dans la case R&D. Ces informations seraient donc axées sur la qualité des brevets et la valeur ajoutée des opportunités qui découle du potentiel de diversification et de complémentarité technologiques. A partir d'un travail de traitement, de classification et de regroupement par entreprise d'une population de 3 279 509 brevets, notre expérimentation porte sur le marché américain qui demeure le terrain standard des tests de nouvelles idées et de nouvelles hypothèses en matière de comptabilité financière. Notre période d'étude s'écoule de 1990 à 2006. Pour l'essentiel, les données mobilisées ont été collectées à partir de différentes bases de données en fonction de l'information recherchée. Les données relatives aux brevets sont disponibles à partir de NBER[127] (National Bureau of Economic Research) qui réunit tous les brevets d'utilité délivrés par USPTO[128]. Les données afférentes aux fusions/acquisitions sont extraites de la base de données Thomson Financial's SDC[129]. Quant aux données financières et aux rendements anormaux, ils sont respectivement extraits de Compustat et CRSP, ces deux bases de données faisant partie de WRDS.

Le travail proposé s'inscrit dans une démarche positiviste et largement empreinte par l'approche hypothético-déductive. Nos trois questions de recherche ont été traitées dans le cadre de trois essais constituant le cœur de ce doctorat.

L'innovation survient à la suite d'une combinaison d'éléments techniques existants pour donner lieu à de nouvelles synthèses complémentaires (Schumpeter, 1934), et l'innovation incite de plus en plus d'entreprises de différents secteurs à coopérer ensemble en matière d'inventions technologiques. Hall et al. (2001) ont travaillé sur les brevets via la base de données NBER et ont proposé une classification de chaque brevet par catégories et sous-catégories, tout en respectant

[127] NBER est une base de données de 3 279 509 brevets entre 1976 et 2006, et contient pour chaque brevet, une année de demande, une année de délivrance, un numéro de brevet unique, un numéro de cessionnaire de brevet et une classe de technologie de brevet (selon le système IPC); parmi d'autres.

[128] US Patent and Trademark Office

[129] Nous commençons à partir de 1990 car les informations fournies par le SDC sont moins fiables avant 1990 et se terminent en 2006 car les données de brevets disponibles dans NBER se terminent en 2006.

la classification internationale des brevets (IPC). Les catégories se rapportent aux secteurs ou aux industries et vont de 1 à 6, il s'agit donc d'une vision de conglomérat. Les sous-catégories au nombre de 37 font référence à des secteurs d'activité ou à des segments d'industries et sont numérotés de 11 à 69[130], il s'agit plus d'un contexte de fusions horizontales ou verticales[131].

À cet égard, nous avons donc calculé deux niveaux pour nos variables d'intérêt, le premier faisant référence aux conglomérats et le deuxième faisant allusion aux fusions horizontales et/ou verticales. Ces deux niveaux sont étudiés à travers nos deux variables de qualité des brevets, à savoir : la diversification technologique et la proximité technologique.

⟶ Notre premier essai repose sur l'ubiquité de l'interdépendance technologique dans l'univers entrepreneurial et la cadence accélérée du progrès technique qui incitent vivement les entreprises à se concentrer sur leur cœur de métier, mais aussi et surtout, à s'émanciper au-delà des frontières pour gagner en polyvalence technologique. [Rosenberg (1976), Gambardella & Torrisi (1998)]. De ce fait, à partir d'un large échantillon de 4 708 entreprises actives dans les brevets (NBER database) et 36 817 observations entre 1990 –2006, nous avons voulu examiner si le volume de fusions/acquisitions des entreprises technologiques, ceux qui possèdent au moins un brevet, influence le degré de diversification de ces mêmes entreprises. Ainsi, nous étudions l'arrivée de nouveaux deals et l'évolution dans le temps du degré de diversification de l'acquéreur, à deux niveaux, durant l'année t, t+1 et t+2.

En conséquence, ***la question de recherche consiste essentiellement à se demander si le volume des fusions/acquisitions renforce la concentration autour du cœur de métier ou si, a contrario, il permet aux acquéreurs de transcender les frontières et d'améliorer leur degré de diversification (autres profils de compétences technologiques).***

Pour répondre à notre question, nous avons donc introduit en variable indépendante et d'intérêt le Volume de fusions/acquisitions (MA_Volume)[132] ; quant à

[130] Les sous-catégories sont numérotées en fonction de la catégorie à laquelle elles appartiennent ; ainsi la sous-catégorie 12 appartient à la catégorie 1 et la 23 appartient à la 2. Toutes les catégories n'ont pas le même nombre de sous-catégories, c'est pour cela d'ailleurs qu'il n'y en a pas 58.

[131] Les données de la base Compustat Industry Segment ne sont pas toujours fiables quant au nombre de segments d'une entreprise et de ses variations [Hyland & Dlitz (2002), Villalonga (2004)].

[132] mesuré par le ratio de la valeur total des transactions opérées par une firme i au cours d'une année t divisée par la valeur comptable des actifs de cette même firme à la fin de la même année [Sevilir & Tian (2011)].

la variable dépendante, nous avons donc utilisé le HHI calculé à partir de nos données de brevets, et pris en compte chaque niveau de diversification. A partir de régressions linéaires suivant le modèle d'Ohlson (1995) ainsi que de modèles à effets fixes contrôlant les secteurs d'activité (SIC 2-digit et 4-digit) et les années, nous avons trouvé les résultats suivants pouvant se résumer en trois points comme suit.

Tout d'abord, nous avons constaté qu'il existait un lien étroit entre l'activité de fusions/acquisitions et le degré de diversification au sein des segments industriels, car la variable MA_Volume à l'année t se traduit par un coefficient négatif et significatif sur la diversification au cours de cette même année, ce qui laisse à penser que les entreprises qui effectuent des fusions/acquisitions améliorent leur degré de diversification à ce premier niveau de sous-catégories. Sur le plan économique, l'ampleur de la variable MA_Volume suggère qu'une augmentation de 10% des activités de fusions et acquisitions équivaut à une modification de 0,002 du HHI des sous-catégories allant de 0 à 1.

Ensuite, nos résultats montrent que l'estimation du coefficient de MA_Volume reste négative et hautement significative même un an et deux ans après la première année de l'opération. Statistiquement, le coefficient MA_Volume reste négatif et significatif aux seuils de 5% et 1%, respectivement pour les années t + 1 et t + 2, après avoir contrôlé la technologie, les caractéristiques des entreprises, et les effets fixes du secteur d'activité et de l'année. Ce résultat suggère que les fusions/acquisitions conclues au cours de l'année t continuent de contribuer à augmenter le degré de diversification des entreprises au sein des segments industriels au cours des deux années suivantes.

Et enfin, quand il s'agit du degré diversification au niveau des catégories / industries, nous montrons que la variable MA_Volume a un coefficient positif l'année t et devient négatif au cours des deux années suivantes, mais qu'il est nettement insignifiant au cours des trois années t, t + 1 et t + 2. Ces résultats suggèrent donc que les entreprises ont recours au canal des fusions et acquisitions pour renforcer leurs compétences autour de leurs activités principales plutôt que pour transcender les frontières de l'entreprise.

⟶ Notre deuxième essai repose sur de précédents articles ayant montré que les caractéristiques d'un soumissionnaire, d'une cible ou d'une transaction qui impliquent un plus grand potentiel de synergies ou qui renforcent la concurrence éventuelle pour la cible, sont une des raisons phares des primes de fusion plus élevées [Flanagan & O'Shaughnessy (2003), Moeller et al (2004), Bargeron et al (2008), Ang & Wu (2011), Madura et al (2012), Alexandridis et al (2013), Davis and Madura (2017)]. La plupart des études se sont concentrées sur les fusions/acquisitions en général, omettant de spécifier et d'expliquer la grande variation entre les primes payées lorsque la technologie entre en jeu. Dans une volonté d'avancer d'autres arguments sur ce qui pourrait influencer les primes versées lorsque des brevets d'inventions sont impliqués, ***nous nous sommes demandé dans quelle mesure la diversification technologique de la société cible affectait les primes de fusion payées par les acquéreurs et la réaction du marché à la synergie.*** Concrètement, les résultats de ce deuxième papier sont triptyques.

Premièrement, en prenant l'ensemble de notre échantillon de 1493 transactions entre 1990 et 2006, nous avons observé que les primes de fusion étaient moins sensibles à la dimension technologique de la cible que la réaction du marché. À première vue, en introduisant toutes les variables de contrôle et en procédant à des régressions groupées, la dimension technologique (si la firme possède des brevets ou non) des acquéreurs semble l'emporter sur celle de la cible. Quant aux rendements anormaux, ils semblent être plus réceptifs et attentifs au portefeuille de brevets de la cible.

Toutefois, notre deuxième résultat concerne exclusivement un sous-échantillon de cibles technologiques lorsque seule la cible est technologique – peu importe que l'acquéreur possèdent des brevets ou non -. En exploitant un modèle à effets fixes contrôlant les secteurs d'activité à 2-SIC digit de la cible et l'année du deal, nous avons trouvé que la diversification dans les segments industriels était positivement significative à 10% (5.19) et que la diversification au sein des industries devenait négative à 5% (- 5,47). De surcroît, une fois que nous avons contrôlé les effets fixes du SIC à 4 chiffres pour gagner en précision, non seulement les deux coefficients conservent les mêmes signes opposés, mais ils deviennent amplement significatifs et rejetant l'hypothèse nulle à 1%. D'une part, cela indique indéniablement que les primes payées par les acquéreurs technologiques ou non-technologiques sont augmentées lorsque la cible est diversifiée au niveau des segments industriels ; en

revanche, elles sont sérieusement ajustées à la baisse lorsque la cible est diversifiée à travers diverses industries. En ce qui concerne la réaction du marché, elle apparaît positivement liée à la diversification au sein des secteurs d'activité, alors qu'aucun impact n'apparaît au niveau supérieur des catégories - lorsque nous avons contrôlé le code 2-SIC de la cible. De manière surprenante, aucune de notre diversification technologique n'est significative, ni les sous-catégories ni les catégories, une fois que nous avons contrôlé le code 4 SIC de la cible nous empêchant de rejeter l'hypothèse nulle pour la variable dépendante synergy_CARs.

Troisièmement, nous nous sommes concentrés sur un autre sous-échantillon lorsque la cible **et** l'acquéreur sont deux entreprises technologiques – possédant toutes deux des brevets –. Pour ce qui est des primes de fusion, avec les mêmes procédures de contrôles, nos résultats sont largement significatifs avec une p-value de 1% et pratiquement identiques, à cela près, que l'impact négatif de la diversification des catégories/industries est légèrement plus prononcé que l'impact positif de la diversification des sous-catégories/segments industriels. Quoi qu'il en soit, ces résultats suggèrent fortement que, dans un contexte de possession réciproque de technologies, les acquéreurs perçoivent toujours de manière positive les sociétés cibles diversifiées à l'échelle des sous-catégories, mais ils demeurent très clairement réticents à payer davantage pour celles qui se dispersent au sein de différentes catégories ou industries. Quant au sentiment du marché, la diversification au sein des segments de l'industrie a toujours un impact positif sur les rendements anormaux combinés (5%) lorsqu'on tient compte du code à 2 chiffres SIC ; en revanche, plus aucune réaction ne fait surface en contrôlant avec un SIC à 4 chiffres, qu'il s'agisse de la cible ou des acquéreurs et peu importe le niveau de diversification.

⟶ Notre troisième essai s'inscrit dans l'approfondissement de l'interaction technologique entre sociétés fusionnantes et de son impact par ricochet sur les rivaux de l'acquéreur. En effet, l'absence de synergies réduit considérablement la concurrence des entreprises qui fusionnent, les rendant moins agressives sur le marché. Cela pourrait conduire à des parts de marché de la nouvelle structure inférieures à la somme des parts de marché antérieures à la fusion [Vassolo (2004)]. Dans cette perspective, nous avons posé la question de la proximité technologique des entreprises qui fusionnent et de son impact sur la réaction du marché mesurée par les rendements anormaux cumulatifs. Au point où nous en sommes, les

innovations, les technologies et la course aux brevets suscitent un engouement prépondérant parmi les entreprises de tous les secteurs technologiques.

Dans le but de faire valoir d'autres arguments sur ce qui pourrait influencer la réaction du marché aux fusions/acquisitions technologiques, nous nous sommes demandé **dans quelle mesure la proximité technologique renforçait les entreprises qui fusionnent et nuisait aux concurrents des acquéreurs**. Concrètement, l'objet de cette étude est d'examiner les conséquences sur les rivaux lorsque les brevets des acquéreurs et des cibles sont industriellement « liés » (fusions horizontale ou verticale) ou « non liés » (conglomérats). Ainsi, nous avons analysé la proximité de deux entreprises innovantes possédant des brevets appartenant à différents champs technologiques et son impact sur le sentiment du marché, mesuré par les rendements anormaux prévus pour les entreprises qui fusionnent (Synergy_CAR) et les entreprises rivales (Rivals_CAR).

En étudiant 428 opérations de fusions/acquisitions dans lesquelles l'acquéreur et la cible ont, chacun, au moins un brevet déposé entre 1990 et 2006, nos résultats empiriques peuvent être présentées en trois points.

Premièrement, nos résultats indiquent une corrélation entre les entreprises qui fusionnent et les entreprises concurrentes en ce qui concerne l'impact de la proximité technologique sur les rendements anormaux prédits, cet impact sur les rivaux des acquéreurs allant de pair avec celui sur la fusion des entreprises. D'une part, la proximité technologique au sein de segments industriels se traduit par une réaction positive du marché pour les sociétés fusionnantes, mais également pour les concurrents. D'autre part, la proximité technologique entre différentes industries se traduit par une réaction négative du marché pour l'acquéreur et sa cible, mais également pour ses entreprises rivales.

Cela nous conduit à notre deuxième résultat. La proximité de deux entreprises innovantes, utilisant des comptes de brevets dans différents segments de l'industrie au sein d'une industrie spécifique (Tech_Prox_S), a un impact positif sur les rendements anormaux prédits ; bien qu'elle soit hautement significative à 5% ou 1% pour les entreprises qui fusionnent, et seulement au niveau de 10%, voire sans importance pour les entreprises concurrentes. Cela suggère qu'une hausse de la demande peut donner lieu à des prévisions d'activités de fusion futures, donnant lieu à un effet « in-play » positif créé par les rendements anormaux des concurrents en

réponse à une fusion impliquant une proximité technologique entre les cibles et les acquéreurs.

Troisièmement, la proximité de deux entreprises innovantes, utilisant le nombre de brevets dans plusieurs industries (Tech_Prox_C), a un impact négatif sur les rendements anormaux prévus ; même si elle est très significative à 5% pour les entreprises fusionnées, mais légèrement significative à 10% pour les entreprises concurrentes. Ceci suggère que la proximité technologique au-delà des frontières des entreprises aboutissant à un processus de conglomérat est perçue par le marché comme préjudiciable aux entreprises en fusion, mais également aux entreprises concurrentes. Fondamentalement, une prise de contrôle par un conglomérat peut mettre en avant une sous-performance d'un secteur spécifique dans la mesure où les acquéreurs fusionnent avec des cibles d'un autre secteur. Par conséquent, cela pourrait avoir un effet de richesse négatif sur ce secteur spécifique et les autres parties prenantes qui en font partie.

Nos trois questions de recherche traitées dans cette thèse de doctorat ont apporté de nouveaux éléments de réponse quant au lien éventuel entre la qualité des brevets et les fusions/acquisitions. En substance, il en ressort trois résultats majeurs au vu de la connexion de nos trois essais.

✓ Le premier résultat majeur se situe dans le lien étroit entre l'activité de fusions/acquisitions et la possession de brevets au sein de segments spécifique à une industrie. En effet, l'activité de fusions/acquisitions contribue de manière significative à l'amélioration du degré de diversification de l'acquéreur au sein des secteurs d'activité. En outre, les primes payées par les acquéreurs technologiques ou non-technologiques sont augmentées lorsque la cible est diversifiée au niveau des segments industriels. Et enfin, la proximité de deux entreprises innovantes, utilisant des comptes de brevets dans différents segments spécifiques à une industrie, a un impact positif sur les rendements anormaux prédits.

✓ Le deuxième résultat majeur concerne la différence criante dans nos résultats empiriques entre les primes de fusion et la réaction du marché. Nous avons montré que la diversification technologique joue un rôle prépondérant pour les primes payées aux sociétés cibles technologiques, mais ne semblent avoir aucun effet sur la réaction du marché aux potentielles synergies. Au fond la possession d'un éventail

diversifié de brevets constitue une information pertinente aux yeux des sociétés qui fusionnent, mais semble transparente aux yeux du marché.

Nos résultats mettent donc clairement en évidence une différence de perception à l'égard de la diversification technologique et du potentiel qualitatif que peuvent apporter les brevets, selon que nous analysons la réaction du marché ou la détermination des acquéreurs à payer le prix fort pour s'offrir une société diversifiée !

✓ Le troisième résultat majeur concerne la dimension et l'impact d'une fusion conglomérale dans nos trois essais. En effet, que ce soit le degré de diversification à travers différents secteurs, ou l'impact de ce niveau de diversification conglomérale sur les primes et les rendements anormaux, ou encore la proximité technologique entre différents secteurs, nos résultats ont toujours montré une relation statistique négative et/ou non significative avec les autres variables d'intérêt. Concrètement, ces résultats traduisent les réticences ainsi que l'ensemble des coûts et des risques afférents à l'entrée dans un nouveau secteur. Pour autant, il n'existe point de règles ou de lois exclusives pour rendre compte de la réalité économique et les intentions humaines. En effet, Patel & Pavitt (1997) ont souligné que les grandes entreprises chimiques et électriques sont plus actives dans les technologies relatives aux minéraux non métalliques que les entreprises de minéraux non métalliques elles-mêmes. Fondamentalement, l'essentiel serait ainsi de tirer profit d'une technologie différente qui pourrait avoir une valeur ajoutée importante pour leur cœur de métier, sans pour autant avoir accès à d'autres marchés ou à vouloir gagner des parts sur un autre marché spécifique. Certes, la convergence technologique est « le processus par lequel différentes industries parviennent à partager des bases technologiques similaires » [Rosenberg (1976)], mais la convergence technologique est également motivée par la montée en puissance de technologies génériques pouvant être utilisées dans plusieurs industries différentes. Dans cette perspective, nous pouvons également prendre pour exemple concret la plus importante opération de rachat dans l'histoire de Google[133]. Le 15 Août 2011, le géant de l'internet s'offre, pour 12.5 milliards de dollars, la société Motorola et ses 15 200 brevets sur la téléphonie mobile. S'emparer de 17 000 brevets d'un coup permet d'accélérer le développement dans la téléphonie mobile sans investir dans plusieurs années de R&D. Ainsi, Google peut aussi mieux envisager le marché chinois et y imposer son système Android.

[133] Source : lemonde.fr

Néanmoins, notre travail de recherche comporte deux limites non négligeables.

D'une part, le droit afférent aux brevets constitue une mesure juridique à double tranchant. Si les lois sur les brevets ont pour visée première de protéger les inventions et de lutter contre l'usurpation intellectuelle, nombreuses sont les entreprises qui abusent des droits de brevets pour ruiner leurs concurrents. En effet, Google et ses amis d'élite se sont attiré un nouveau système de brevets plus faible qui permet de contester des brevets hors des tribunaux, sans jury, sans aucune présomption de validité et avec un faible niveau de preuve[134]. Un fait qui a causé d'énormes dommages économiques aux inventeurs et aux petites entreprises qui dépendaient de leurs brevets pour se protéger des élites contrevenantes. Fondamentalement, la demande de dépôt ou l'acquisition de brevet ne révèle pas toujours une intention de développer un avantage concurrentiel technologique, mais bien de faire payer les rivaux dans les procès judiciaires jusqu'à les ruiner. D'ailleurs, malgré la vente de Motorola à Lenovo en 2014, Google a conservé le contrôle de la majorité des brevets pour défendre Android. Cela permet au géant américain de mettre un frein aux multiples procès intentés par les constructeurs à tous ceux qui concevait des mobiles Android. Par conséquent, une protection trop élevée ou trop faible des brevets et de la concurrence peut se traduire par des distorsions dans les échanges. Il est alors urgent de définir un équilibre entre politique de concurrence et droits de brevets afin d'éradiquer les abus tout en gardant une protection raisonnable et pragmatique.

D'autre part, étant donné la place prépondérante qu'occupe l'innovation de nos jours ainsi que l'intérêt grandissant du marché envers les nouvelles technologies, il est devenu essentiel pour les entreprises « d'apparaître » comme innovantes. Ainsi, bien des entreprises se concentrent sur les demandes de brevets et/ou l'acquisition de ces derniers dans l'optique d'émettre un signal d'inventivité au marché et aux autres parties prenantes. En substance, nous pouvons citer la stratégie du déposant « visible » qui consiste à signaler les compétences de l'entreprise, mais surtout à entraîner les entreprises rivales sur de fausses pistes afin d'alourdir leurs dépenses en R&D [Mbongui-Kialo (2012)].

[134] Source : World Intellectual Property Organization – Patent Law

En conclusion à notre travail de recherche, la diversification des investissements dans différents secteurs d'opportunité est plus susceptible de générer une valeur de croissance que les investissements dans un secteur sélectionné, à condition que les innovateurs veillent à garder une cohérence technologique. Cependant, il est essentiel de souligner qu'il existe toujours un hiatus entre l'étude statistique et la réalité économique en soi. La diversification conglomérale par le biais d'acquisitions de sociétés appartenant à d'autres secteurs, paraît constituer un avantage de taille pour la survie des entreprises dans le monde économique d'aujourd'hui et de demain. Effectivement, les entreprises doivent penser aux opportunités technologiques émergentes : un profil technologique qui était « marginal » hier pourrait bien devenir un « profil central[135] » aujourd'hui ou demain. Développer des connaissances dans des domaines variés ouvre la voie à une fertilisation croisée et crée des fonctionnalités permettant aux entités d'améliorer les processus de production.

Fondamentalement, il nous semble important de souligner que la richesse, et plus spécialement la richesse immatérielle, sont des sujets d'études de temps long pour lesquels nous ne pouvons faire des bilans au bout de 2 ou 3 ans … Il faut donner du temps au temps pour voir comment la richesse se développe, et principalement la richesse immatérielle qui découle d'une diversification et/ou proximité technologiques avec toutes les nouvelles adaptations qu'elles requièrent !
Les enjeux autour des actifs immatériels intangibles d'une part, et les enjeux autour des actifs immatériels incorporels, d'autre part, se concrétisent en réalité à la fin d'un parcours, à la fin d'un long chemin par une richesse matérielle de grande ampleur et prometteuse pour l'avenir.

[135] Marginal technological profile versus Core technological profile [Patel & Pavitt (1997)].

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Résumé de la thèse

Le XXIème siècle marque définitivement le passage à l'ère de l'économie de la connaissance ; en témoigne la croissance exponentielle du volume de brevets passé de 50 milliards de dollars en 1994 à 200 milliards en 2008. Dans cette course aux brevets, au vu de la vitesse d'innovation et des attentes grandissantes des consommateurs, l'accès au savoir et aux nouvelles technologies est devenu une priorité et une condition indispensable pour la pérennité de l'entreprise. Pour autant, la meilleure arme pour se garantir une exclusivité optimale, et un avantage compétitif solide sur le long terme pour un nouveau produit innovant : c'est « l'acquisition même du brevet » ! Outre la réduction des risques et les économies d'échelle, l'activité de Fusions/Acquisitions semble désormais être la voie royale pour accroître les investissements technologiques des entreprises et, surtout, à élargir leurs bases de connaissances en greffant de nouvelles compétences et savoir-faire, de nouveaux brevets et autres, appartenant au même secteur voire même extérieur.

A partir d'un travail de nettoyage, de classification et de regroupement par entreprise d'une population de 3 279 509 brevets sur la période 1990-2006, nous nous sommes intéressés au lien qui pourrait exister entre les opérations de fusions/acquisitions et la qualité des brevets perçus comme un moyen de diversifier et/ou perfectionner les compétences technologiques en place.

Fondamentalement, cette thèse de doctorat se veut être une réflexion sur le choix de la société cible, et dans lequel nous supposons que l'acquéreur va davantage s'intéresser à des informations plus « concrètes » et visionnaires, rendant mieux compte de la richesse économique que le simple montant figurant dans le poste comptable R&D.

Ainsi, en accord avec notre posture épistémologique hypothético-déductive et nos données quantitatives collectées à partir de NBER, SDC, Compustat et CRSP, cette thèse propose une étude axée sur la qualité des brevets au sens de la valeur ajoutée des opportunités qui découle du potentiel de diversification et de complémentarité technologiques dans un contexte de concentration d'entreprises. À cet égard, nous avons donc calculé deux niveaux pour nos variables d'intérêt ; le premier faisant référence aux conglomérats (industries) et le deuxième faisant allusion aux fusions horizontales et/ou verticales (segments d'industrie). Ces deux niveaux sont étudiés à travers nos deux variables statistiques de qualité des brevets, à savoir : la diversification technologique et la proximité technologique.

Enfin, cette thèse de doctorat indique un lien étroit entre l'activité de fusions/acquisitions et la possession de brevets au sein de segments spécifique à une industrie. En revanche, la diversification et la proximité technologique semble nouer une relation négative, et souvent non significative, avec une concentration conglomérale ; traduisant ainsi les réticences et l'ensemble des coûts/risques afférents à l'entrée dans un nouveau secteur.

Ce travail de recherche conclue sur une différence de perception à l'égard de la diversification technologique et du potentiel qualitatif que peuvent apporter les brevets, selon que nous analysons la réaction du marché ou la détermination des acquéreurs à payer le prix fort pour s'offrir une société technologique diversifiée.

Mots-clés : Fusions/Acquisitions, Qualité des Brevets, Diversification et Proximité technologiques, Réaction du Marché, Impact sur les concurrents.

Abstract

The twenty-first century definitely marks the transition to the era of knowledge economy; this is evidenced by the exponential growth in the number of patents, from $50 billion in 1994 to $200 billion in 2008. In this race for patents, given the pace of innovation and rising expectations of consumers, access to knowledge and new technologies has become a priority and a prerequisite for companies' sustainability. However, the best weapon to guarantee an optimal exclusivity and a strong competitive advantage over the long term for an innovative new product: it is "the very acquisition of the patent"! In addition to risk reduction and economies of scale, the Corporate Takeovers activity now seems to be the road to increase business technology investment and, most importantly, to broaden their knowledge base by adding new skills and know-how, new patents and others, belonging to the same sector or even outside.

Starting from a cleaning and a classification of a population of 3,279,509 patents over the period 1990-2006 and a clustering by company, we were interested in the link that could exist between the Corporate Takeovers activity and the quality of patents as a means to diversify and/or upgrade existing technological skills.

Basically, this doctoral dissertation is meant to be a reflection on the choice of the target company and in which we assume that the acquirer will be more interested in more "concrete" and visionary information, better reflecting economic wealth than the simple amount in the accounting R&D.

Thus, in keeping with our hypothetico-deductive epistemological stance and our quantitative data collected from NBER, SDC, Compustat and CRSP, this thesis proposes a study focused on the quality of patents and the added value of opportunities that derives from the potential technological diversification and complementarity in a context of corporate concentration. In this respect, we have therefore calculated two levels for our variables of interest, the former referring to conglomerates (industries) and the second referring to horizontal and/or vertical mergers (industry segments). These two levels are studied through our two statistical variables of patents quality, namely: technological diversification and technological proximity.

Finally, this doctoral thesis indicates a close link between M&As activity and patent ownership within industry-specific segments. On the other hand, diversification and technological proximity seem to establish a negative, and often insignificant, relationship with a conglomerate concentration; reflecting therefore the reluctance and all the costs/risks associated with entering a new sector.

This research work concludes on a difference in perception of technological diversification and the qualitative potential that patents can provide, depending on whether we analyze the market's reaction or the determination of acquirers to pay the high price to afford a diversified technological target.

Keywords: Corporate Takeovers, Patent Quality, Technological Diversification and Proximity, Market's Reaction, Impact on Rival Firms.

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