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Essays on Monetary Policy under Openness

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Lille, March, 2011.

DECLARATION

I declare that the thesis does not include work-forming part of a thesis presented successfully for another degree. I declare that the thesis represents my own work except where referenced to others.

Abstract of Chapter 1

This part attempts to review different studies regarding the estimation of transmission lags in the monetary policy action - the time taken during the action and the impact of a monetary policy change. Even though we failed to find any such study for Pakistan, it has been established that monetary policy in Pakistan has an impact on real economy, which raises the question of the transmission lags in this economy. For answering this question, we build on the existing literature. These studies cover different channels and differences in the channels and their size between Pakistan and the other economies are highlighted. The explanation for the difference is due to differences in the size and structure of the economies in question and their state of cycle.

Abstract of Chapter 2

This chapter attempts to answer the questions regarding the possible impact of openness on inflation specifically under a convex Phillips curve. Our model predicts that in the current scenario of increased openness a non-linear reaction function will prevail. For policy purposes monetary policy necessitates to take into account some rather important factors into account as well, including domestic and foreign propensities to import and the exchange rate sensitivity to inflation. In addition, the agglomeration of the international markets would result into an even more important role of exchange rate dynamics as a response to the rising international trade.

Abstract of Chapter 3

This paper describes and analyses various methodologies for estimating potential output and consequently the output gap. The objective of this part of the thesis is to compute output gap data series for the sample of 158 economies, which would be further used in the panel analysis of chapter 4. Therefore, we estimate potential output and subsequently the output gap for the whole sample, using both the statistical and the structural methods. Though the results show some degree of association, the measures of output gap reveal inherent differences. Secondly we analyze the data estimated for Pakistan's economy using Taylor rule equation. Based on the annual data of GDP (1951-2007) for Pakistan the output gap reflects that Pakistan economy has been observing cyclical episodes of excess supply followed by excess demand in the period of analysis, and that the monetary policy in Pakistan is not Taylor based rather it shows a more accommodative stance.

Abstract of Chapter 4

This chapter provides estimates of the impact of globalization on inflation, yet considering a linear Phillips curve equation. This chapter assesses most of the possible channels of openness transmission mechanism. Secondly, we attempt to investigate the nature of globalization-inflation relationship; and to verify if globalization impacts the dynamics of inflation in the developed and the developing countries by the same token. How different is the impact on different regions and continents? The results confirm a global negative impact of trade openness on inflation. Interestingly, all the sub-samples show the same impact but, interestingly, with different magnitudes. Particularly, we find slight differences in the results for African countries.

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GENERAL INTRODUCTION

Economists over the last few decades have been focusing on the question of whether and how monetary policy affects the level of activity in the economy. Although, there is a widespread consensus on the short to medium-run effects of monetary policy shocks on the real activity and long-run effects on the price level; the relative importance of the channels of monetary transmission mechanism (MTM) is still open to debate. Monetary transmission mechanism, in simple terms, describes how a policy-induced change in the nominal money stock or the short-term nominal interest rate impacts the economy, through different channels, ultimately affecting the real variables such as aggregate demand, output, employment and inflation.

Monetary policy affects the real activity through various channels. In this regard literature takes into account the credit and money view. Where the former emphasizes the importance of financial market imperfections and recognizes the special role played by financial intermediaries in transmitting monetary impulses to output and inflation. While the latter refers to the traditional understanding of monetary transmission to real activity based on the standard IS-LM model, in which money supply and interest rate movements directly affect the level of consumption and investment expenditure through the traditional cost of capital, substitution, income, and asset price channels. Recent findings of the monetary literature and the important developments in the economic and financial structure of the economies on the whole invoke new insights and important questions that have recently attracted the attention of academics and policy-makers regarding the future course of monetary policy. However, apart from the importance of the transmission channels of monetary policy, the knowledge of time taken from action to affect of a policy is vital from the point of view of macroeconomists in particular. In this regard, various studies have already been conducted with varying conclusions based on the structure of economies in question.

It is true that the new era of increased openness – now onwards referred to as globalization – has also started affecting the real economies across the board. This thesis aims to make a

contribution to this discussion by developing a simple chain of studies, where starting with the analysis of monetary transmission the corresponding channels and the lags it develops a theoretical model to explain the developments and challenges to the monetary policy in the current scenario of global village.

Therefore, the first chapter emphasizes on some of these prominent studies, besides we look for what has been done in this context for the economy of Pakistan as a case study, as no such study had yet been conducted for this country, to estimate the time lag in the action and effect of monetary policy.

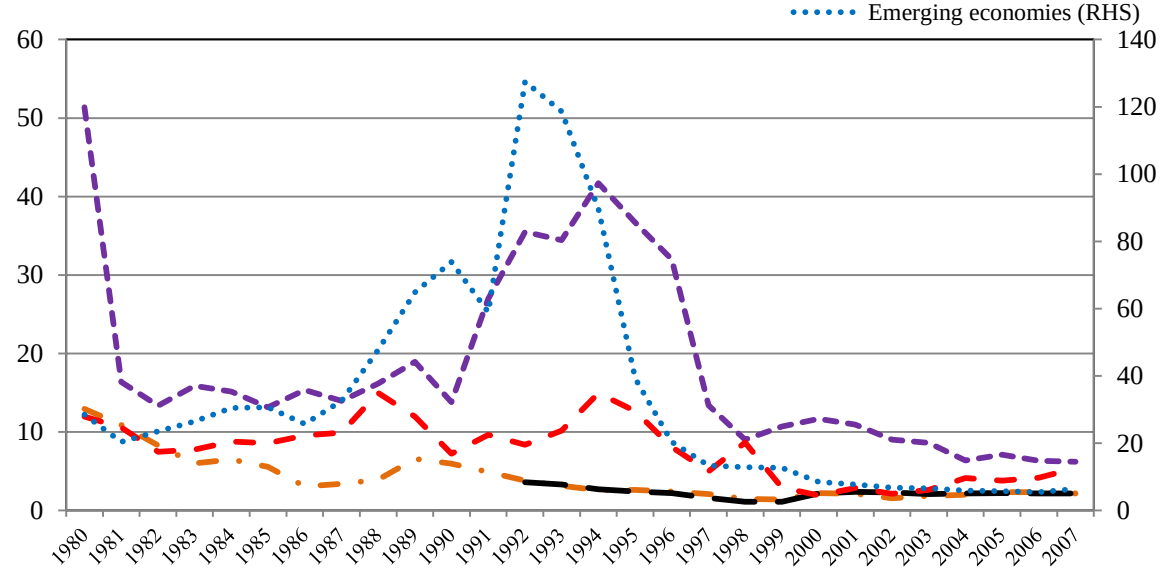
Economists have developed various theoretical models in this regard. Based mostly on the Phillips curve, usually the literature provides ample evidence on the inflation-unemployment relationship. Although a consensus has developed that the present monetary policy is facing new challenges as well, apart from the usual shock to the real economy. One of the most recent challenges is the impact of increased openness on the real economy and consequently the inflation.

In fact, monetary policy underwent substantial changes over the last few decades. The experiences of deep recessions and high volatilities of certain economic indicators lead the economists to search for nominal anchor of monetary policy and develop policies targeting monetary aggregates, output growth and or inflation. However, apart from the success or failure stories of these policies, Romer (1993) – in particular – came with the observation that it was not only the domestic factors that influence inflation in an economy, but the external factors were also playing a role in the fluctuations of domestic macroeconomic indicators (see Figure A). In this way the effect of increased openness has gained considerable importance in the design of the contemporary monetary policies.

Economists have identified different channels through which globalization affects inflation. The most prominent of those include firstly, the import price channel; where the cheap imports from the low cost countries cause a possible decline in inflation in the high cost countries. While the same holds for labour market as well, the second channel refers to the enhanced competition channel, where due to the strong demand on the back of increased openness would lead to increase the competition above board. This increased competition may lower the producer margins and consequently the general price level. In this debate we contribute by adding the export price channels, which is not yet discussed in literature. We

believe that pooling the global produce in a single market while leading to the harmonization of prices on one hand, would increase the prices for the low cost countries, where due to cheap labour the cost of production is low, the integration of markets would force these economies to raise their domestic prices to meet the international market.

Figure A. Annual Inflation Rate in Percent



Besides this contribution, the second chapter develops a theoretical model. By taking into account various variables including import intensities and the exchange rate effect, the model shows the relationship of inflation and unemployment on the back of growing globalization strategy, and this is the major contribution of this section of this study. As described earlier, there is a voluminous literature on the effect of increased openness on inflation and a consensus has almost been found on the existence of a negative relation between inflation and openness, we fail to find any evidence on two important questions in this regard: (i) economist usually have avoided to take into consideration or to debate upon the slope of the Phillips curve while estimating the inflation-openness relationship. (ii) Secondly, while going for an empirical estimation, it is observed that only the developed economies remain the apple of economists' eye, and usually they end up with a conclusion that increased openness lowers inflation in these economies. Being high cost economies, importing the cheap goods from low cost countries due to the removal of trade barriers, this conclusion is logical, yet indicating dire need of an enquiry into what happens to the inflation figure in those low cost exporting

countries. Is trade still a zero sum game for them, or it is offering a win-win situation to the economies on the whole?

To answer the first question we develop a theoretical model, based on Phillips curve approximation. The distinctive features of our model with the existing literature is that we take into account a convex Phillips curve, where a small increase in inflation would result in greater decline in unemployment at its high levels as compared to what an increase would be required to lower unemployment when it is already at its lows. Besides this we include the impact of openness in this model, to observe the impact of openness on inflation under a non-linear Phillips curve.

However, in responding the second question, due to the complex nature of variables and data constraints, it is technically inconvenient to estimate the non-linear Phillips curve (the theoretical model), therefore we examine this relationship by using a linear Phillips curve. One example of the complexity of these variables is the output gap. There is no secondary source of getting data on this important variable. In various studies, different measures of output gap have been used, but none goes without doubts. It is for this reason that we estimated the potential output and subsequently the output gap for a sample of 158 economies using various measures. Besides, as a case study we estimate the output gap for Pakistan by using various statistical and econometric methods to verify the results. In this way we attempt to find out if the resulted series using these different methodologies show varying outcomes while used in economic relationships. This makes the rationale for chapter 3.

However, in Chapter 4, using the output gap series already developed, we estimate a dynamic Phillips curve equation. This estimation remains unique of its kind, and the most comprehensive in nature in this context. We take a large sample of 158 countries including 23 developed economies and the rest. We estimate several models differing each on the basis of the structure and geographical location of economic clusters. Also some of the variables, including the social, political, economic and the overall globalization indices that we use to estimate this relationship are the ones never being used in this regard. We, while confirming the results of the existing literature regarding the globalization-inflation relationship in the developed countries bring new information on this subject.

CHAPTER NO. 01

Monetary Transmission Mechanism: A Deductive Analysis

1. Introduction

One of the most important objectives of any central bank is to manage the money supply in a way to effect and to keep the aggregate demand, and in turn the general price level, within some desirable limits. For this purpose, monetary policy is an effective tool to achieve the targeted level of output, unemployment and prices. Central banks manage aggregate demand in the economy through monetary policy to achieve their objectives. In most of the developed countries the goal of monetary policy is *low inflation;* based on the observation[1] that low inflation enhances growth of output and employment in long run i.e., there is a negative relation between inflation and output growth in long run. In most of the developing countries, policymakers take care of price stability but also of other objectives, including, higher output growth, domestic financial stability and normal operation of foreign payments. These major macroeconomics goals are hardly compatible; rather most of these are mutually conflicting. The current situation is thus reminiscent of what Friedman (1968) wrote: "there is a wide agreement about goals of monetary policy but less agreement that these goals are compatible and least agreement about the instruments of policy in achieving several goals".

Central banks implement policy changes by resetting their policy instrument – usually a short-term interest rate or a monetary or credit aggregate. These instruments affect the economy through various mechanisms of transmission to ultimate policy goals. The effects of changes in policy instrument are not transmitted to final goals directly and immediately, but through different channels and with delays. For the conduct of a good monetary policy, a sound knowledge of transmission mechanism of monetary policy and the lags involved in its effects is therefore important. Policymakers, while conducting monetary policy must know how much time their actions will take to reach the final goals of policy, and which of the channels would be more dominant in the transmission process. The identification of transmission channel determines the most effective set of instruments of policy, the timing of policy changes, and the constraints that the authority (Central Bank) may face in making its decisions. The choice of monetary transmission mechanisms and their effectiveness in the conduct of monetary policy, however, depends on specific features of economy in question such as the depth and structure of financial system and size and openness of the economy.

[1] Barro, Robert J., (1995); Fischer, Stanley, 1993, Ghosh, Atish, and Steven Phillips, 1998, Gillman, Max, and Michal Kejak, 2000a, 2000b, etc.

The question that, when the monetary policy/money-supply should be altered to obtain predetermined changes in the aggregate demand, and consequently in inflation, is fundamental and vital for the authorities when formulating policies. Changes in the policy instruments made by the policy makers are aimed at invoking an action to be channelized to different sectors of the economy to bring the desired effects. However, the action of a policy move takes time to effect. For instance, today's rate of inflation can't be affected by changing the monetary policy today, but the actions taken today will be translated into results after some time.

The precise measurement of this time length remains an important question for all those at the helm of economic affairs of any economy, and for the researchers as well. Studies, so far, have observed different lag lengths for different countries, depending on the size and the structure of the economies in question, whereas Cecchetti (2001) includes the differences of financial structure of the economies as well and attributes them to the different legal structures.

While the growing independence of the central banks across the globe has put the task of formulating monetary policy to them, it has also reduced the benefit of using the escape clause for the central banks in case of undesirable results. In case of Pakistan, the State Bank of Pakistan (SBP- the central bank) is entrusted with the responsibility of conducting the monetary and credit policy in a line with the Government’s targets for output growth and inflation. The financial structure underwent several changes before reaching current situation.

Pak-rupee was earlier linked to pound sterling till 70’s and then to US dollar; however; in the early 1980s, the monetary authority decided to adopt a floating exchange rate system. In the 1990s, financial sector reforms were initiated with the objective of transforming the financial structure from a controlled to a market based system. The State Bank of Pakistan (SBP) was given operational independence in 1994 (SBP 2001). With the abolition of credit deposit ratio (CDR) in 1995, the open market operation (OMO) and changes in interest rate have become the major instruments of monetary policy. Although it is a fact that monetary policy has witnessed improvement after the operational independence of SBP in 1994 (extended further

in 1997[2]), which was translated in one of the results, as the average inflation[3] since 1952 till 1997 remains above 7% pare annum, while the average inflation recorded in the decade after the after 1997 was declined to less than 6 percent on yearly basis. This while roughly suggests an improvement of the monetary transmission, also puts a further question on the credibility of the results: whether it was due to the structural change in the financial system or/and due to sound policies based on precise knowledge of the transmission mechanism and the corresponding lags involved, or due to good luck.

As stated earlier that the knowledge of the exact time lags of monetary transmission is inevitable from the point of view of any central bank. However, so far no such study has yet been conducted to estimate the time it take monetary policy changes to effect inflation in Pakistan; which provides a dire need and motivation for any such research in this area. Therefore this study is a survey of different researches regarding the monetary transmission mechanism, the transmission lags and the transmission channels; so as to draw some lessons for Pakistan economy.

This paper is organized in a way that, the next section describes the theoretical background of the monetary transmission mechanism in general; then the study defines and discusses the monetary transmission channels and the lags thereof, with reference to Pakistan economy. Section 2 briefly describes different relevant studies, whereas, the discussion is sequenced on the basis of different channels of transmission. There is some discussion on the econometric issues in the measurement of monetary transmission mechanism in section 3 and finally section 4 concludes.

2. Theoretical background

Questions, regarding the possibility of an impact of a change in money supply on the real economy, and about the time lag involved in the transmission of a money supply change to effect the real economy, came to fore through the classic Friedman-Culbertson debate in

[2] Operational independence was given in 1994; however in 1997 the autonomy was further strengthened by giving full and exclusive authority to SBP to regulate the banking sector and to conduct an independent monetary policy.

[3] Inflation in Pakistan is measured by taking the percentage change in the consumer prices index over different periods.

1960's. In the words of Friedman (1961)[4], "… there is no such thing as lag in the effect of the monetary action. When we refer to the lag, we mean something like the weighted average interval between the action and its effects". However, the responding criticism from Culbertson[5] discovered, the depth of the issue on one hand, while the existence of confusion in the subject, on the other.

The debate regarding the impact of monetary policy is, in-fact, not new and the history of economics provides ample evidence on this subject. Classical monetary theorists assume the neutrality of money on the basis of underlying assumptions that the economic agents do not suffer from money illusion rather they are motivated mainly by self interest[6]; and that pure competition exists in all markets (wage-price flexibility). On these grounds they hold that money serves mainly as a medium of exchange and does not play any role in the determination of output and employment levels. Thus monetary policy actions are neutral in their effect on real economic activity.

Keynes criticised the classical views of wage-price flexibility, on the basis that the existence of unions, minimum wage law, and long term legal contracts result in wage rigidity. Secondly he objected that the classical demand for money function ignored money's role as a financial asset. In the Keynesian model the aggregate supply has a positive slope and aggregate demand is influenced by government expenditures, investment, autonomous consumption, real net taxes and nominal money supply. He describes that increase in nominal money supply reduces nominal interest rate via the liquidity effect, and this fall in the interest rate stimulates investment spending. This causes equilibrium real income to increase; however subject to the conditions that if money demand is interest inelastic and investment is interest elastic. He also supported that both the monetary policy and fiscal policy affect the real economic variables. Hence money is non-neutral in a short run.

Monetarists, while describing that fiscal policy has little effect on the economy, claim that monetary policy has marked effects during the short run. They hold that investment is interest

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[4] Friedman , M. (1961), " The lag in effect of monetary policy" *Journal of Political Economy*, Vol 69,p.447-466.
[5] J. M. Culbertson (1960), " Friedman on the Lag in Effect of Monetary Policy" *The Journal of Political Economy*, Vol. 68, No. 6, pp. 617-621

[6] The self interest for the consumers to be the maximization of utility and for the producers it is the maximization of profits.

elastic and the demand for real money balances is highly interest inelastic in the short run. Thus nominal money supply is the main determinant of equilibrium real income, in short run.

However; in the long run the real effects of monetary policy actions dissipate. According to them it is only the price level that ultimately is affected by any change in money stock. While the perfect information and workers expectation adjustment about price level in the long run usually nullifies policy effects, it is not necessarily the same in the short run. Hence money is non-neutral in the short run.

In contrast to the *classicals*, the new classical theorists incorporate *rational expectations*[7] in their models. They hold that unsystematic, unpredictable monetary policy actions can influence the level of real output and employment in the short run. In the long run, however, they affirmed the monetarists' view of neutrality of money.

New Keynesians accept new classical assumptions about rational expectations; however, they also criticised the existence of wage-price flexibility like Keynesians. They supported that monetary policy affects the economic activity at least in the short run, as they assume that pure competition does not exist. Therefore, wages and prices are inflexible and are not always market-determined because rational contracts make the nominal wage, at least partially rigid during the contract period. Therefore, money is not neutral in short-run.

From this theoretical perspective, a consensus has been witnessed on two points between both the Keynesians and the monetarists that (1) monetary policy do effect the real economy, at least in the short run and (2) for monetary policy to be effective, the nominal interest elasticity of demand for real money balances should be low and interest elasticity of investment should be high. However, both schools of thought remained silent on the time taken by the monetary policy to affect the real economy, leaving it to be empirically estimated.

Conclusively, monetary policy actions have only short-term effects on growth and employment, but long-term or permanent effects on inflation, at least in the short-run. Implementation of monetary policy, through any or a combination of its instruments triggers a chain of reactions, or impacts, in various sectors of the economy. Immediate impacts become

[7] Individuals have a basic understanding of how the economy works and they fully use all available past and current information.

visible in the financial markets, especially in money market. Later reactions work through banks, non-bank financial institutions, firms and households and end with an effect on the price level, after having transient effects on growth and employment, with a lag depending on the efficiency of the monetary transmission mechanism.

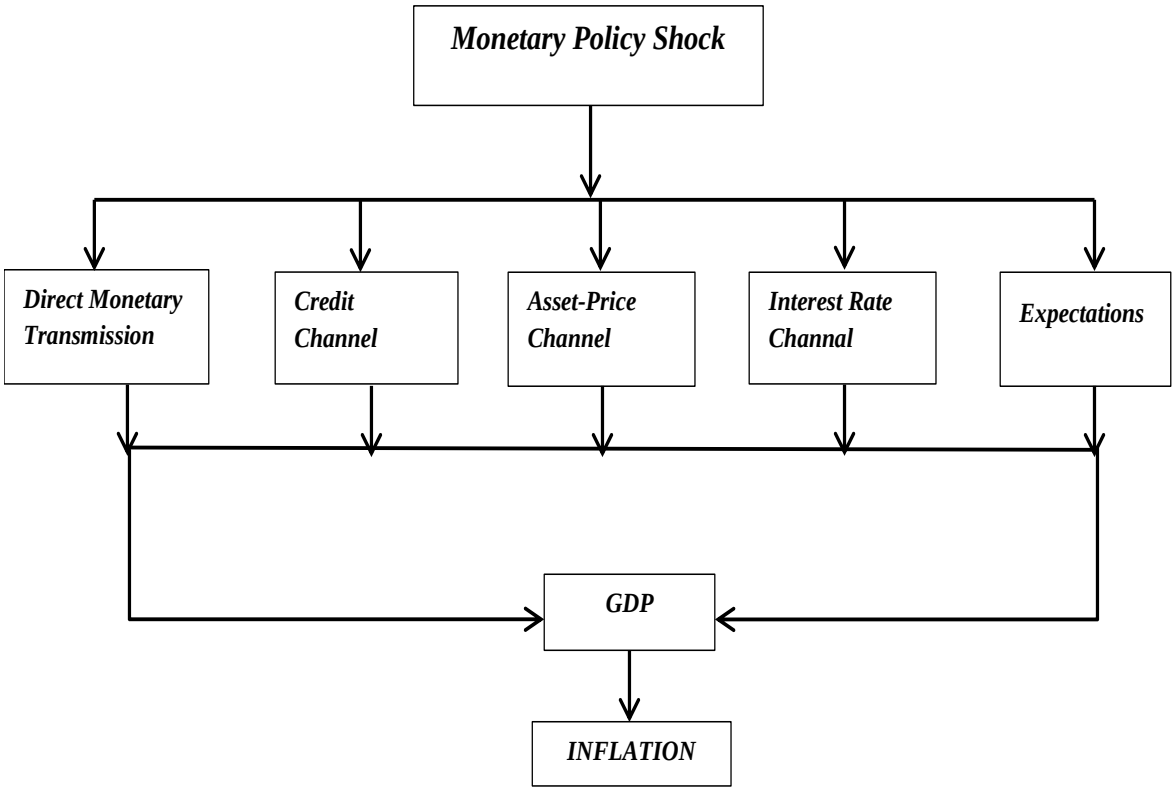
3. Monetary Transmission Mechanism (MTM)

3.1. In General

There is a relative consensus on the fact that monetary policy changes do impact the real economy, in the short run. A change in the monetary policy results in a consequent change in output and in turn in inflation as well. However, this impact of the initial change takes considerable time to reach the final goal. There could be various reasons behind this delay, for instance the depth of financial sector, the openness of the economy, the effectiveness of the monetary transmission mechanism, and importantly the dominant channel taking the change to the ultimate effect.

Monetary transmission mechanism in simple, describes how a policy-induced change in the nominal money stock or the short-term nominal interest rate impacts the economy, through different channels, ultimately affecting the real variables such as aggregate demand, output, employment and inflation (see Figure 1). In literature of monetary economics there are various channels named to carry the monetary impulses to affect the real economic variables; however the most important and the most discussed ones include: *money channel, exchange rate channel, asset price channel, and the credit channel.*

Figure 1. Monetary Transmission Mechanism in General*



*Source : Adopted basically from De Bondt (2000). Interactions simplified

Money or the interest rate channel is usually efficient in an economy, where the financial sector is deep and strong. The chain of reactions is stimulated after an initial change in the interest rates, which later on impact the major components of GDP, i.e., investment and consumption expenditures. A strong interest rate channel, with significant interest rates effects on consumer spending and investment is empirically found to be present in industrial countries.

A change in monetary policy also has a vital impact on exchange rate and, thereby, on net exports and aggregate demand. Increase in money supply, normally lowers the interest rates and depreciates the domestic currency. The lower value of domestic currency makes foreign goods more expensive, thus promoting domestic production. This results in an increase in net exports and aggregate output leading to an increase in inflation.

Another important channel is that of the *asset* price channel, where the changes in monetary policy are transmitted through two mechanisms: (a) the Tobin's *q* theory of investment and (b) the wealth effects on consumption. Tobin's *q* theory describes a mechanism through which monetary policy affects the economy via its effect on the valuation of equities. Whereas, the wealth effect is based on Modigliani's famous life cycle hypothesis. This suggests that it is the lifetime resources of consumers – human capital, real capital and financial wealth – that determine consumption spending. While a major component of financial wealth is common stocks, the fall in the stock prices decrease the value of financial wealth, thus decreasing the lifetime resources of consumers, and consequently resulting in a fall in their consumption.

By the same token, a change in interest rates affects the credit availability in the markets, which is finally transmitted to the aggregate demand and inflation. This is referred to as the credit channel which also incorporates two channels: (a) the bank lending channel and balance sheet channel. It is observed that central bank through its open market sales, drain reserves and, hence, limit their lending ability and vice versa. A fall in loans from banks reduces the credit availability in the market, thereby reducing investment expenditure and aggregate demand. However, on the other hand a change in the monetary policy has direct and indirect impact on the balance sheet of a borrower. A rise in interest rate increases the outstanding short-term debt liabilities of a firm and thereby affects the net cash flows of that firm. In addition, it can also cause a decline in the value of collateral, as an increase in interest rates may lead to shrink the asset prices.

However, the changes initiated through these channels are not transmitted overnight, but with certain delays – with lags. These lags could be either inside and/or the Outside lags. Whereas the inside lags represent the time elapsing between the recognition that a monetary change is required and actual implementation of this change. These are assumed to be relatively shorter. However, outside lags reflect the span of time in which policy actions affect the economy. These are usually longer and variable, depending on various reasons including the efficiency of the transmission channel.

One source of outside lags is delay in pass- through of changes in overnight cash rate to other interest rates. While the response of short-term money market interest rate is rapid and complete, pass-through to other interest rates such as the deposits and lending rates of

financial intermediaries appears to be slower (Lowe, 1995). Since intermediaries' interest rates are important determinants of cash flow, asset prices, and incentive to postpone expenditure, slow pass-through contributes to the transmission lag from the real cash rate to economic activity.

Gradual response of investment to changes in monetary policy also results in a lag. Again another source of lag is the slow impact of monetary policy on exchange rate. As a consequence, the exchange rate effects on tradable sector of the economy are also gradual and prolonged. Finally, the developments in one sector of the economy are gradually transmitted to other sectors of economy, as agents who were initially unaffected by monetary policy changes respond to altered behaviour of their suppliers and customers.

Central banks are generally entrusted with the responsibility for the conduct of monetary policy; however the effectiveness of such a policy depends on various factors whereas the independence of the central bank and the professional expertise are also important factors to be taken into account. Knowledge of the exact lags, in the effect of monetary policy actions on the economy, is therefore necessary from the point of view of any central bank; as Walsh (2005) says "monetary policy acts on both inflation and real economic activity with long lags", he further adds: "[for inflation] to be controllable, though, the forecast horizon must be set to be consistent with the estimated lags in the effect of monetary policy on actual inflation. The central bank is unlikely to be able to influence inflation over the next month, but it can affect the inflation rate two years out. Where in between the two horizons the optimal horizon lies depends on the lags in the monetary transmission mechanism".

3.2. In Pakistan

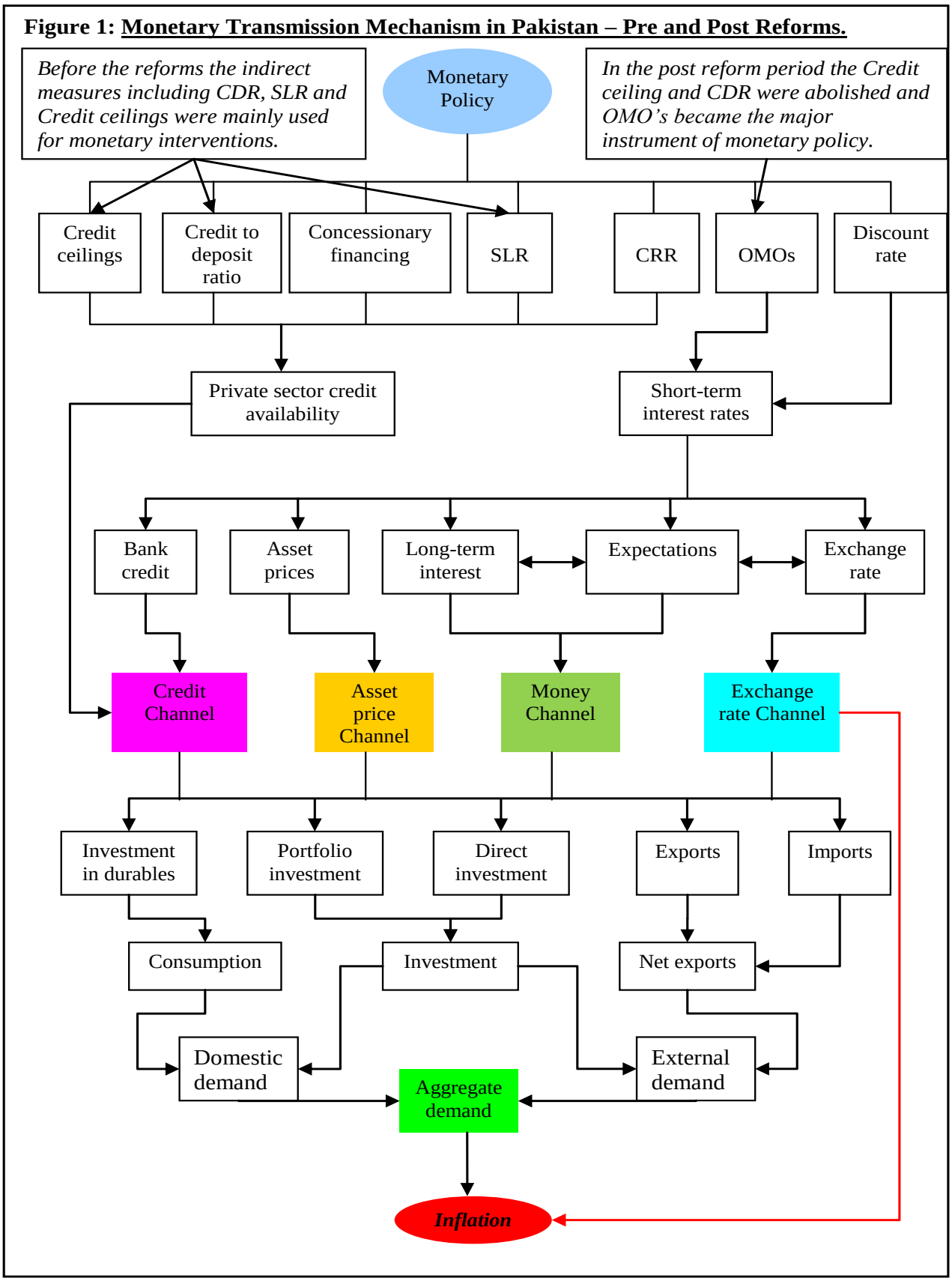
State Bank of Pakistan is responsible to secure monetary stability and fuller utilization of country's productive resources. Since the inception of Pakistan in 1947 till 1971, SBP used both indirect quantitative and qualitative measures of monetary policy to regulate credit. During this period the monetary policy was largely based on indirect controls, like Statutory Liquidity Requirement (SLR) determined the allocation of credit between the government and private sector supported by the system of bank-by-bank credit. Due to the weak securities market the Open Market Operations were rare, while the frequent use of margin requirements for credit on imports raised the money supply and monetary assets. However the role of SBP in the external account was limited and the currency was linked to pound sterling. However,

in the decade of 70's the government nationalized and merged the commercial banks. The reliance was shifted from indirect policy measures to credit planning and a National Credit Consultative Council (NCCC) was established. Thus, in the post reform period, the monetary transmission mechanism was primarily working through credit channel but without being supported by interest rates, which were controlled. Similarly, the exchange rate channel was also working, but not via interest rates. Impact on net exports was coming through the direct changes made in the exchange rate. Money channel and asset price channel were almost non-existent.

The decade of 80's brought significant changes in the monetary sector of Pakistan. The financial sector reforms were initiated and the SBP got the authority to conduct OMO's, the system of credit ceilings was abandoned and onwards the bank credit was regulated by changes in the bank rate, the liquidity ratio, the credit to deposit ratio (CDR) and more importantly through OMO's. Going forward the CDR system was also abolished, thus OMO's became the major instrument of the market based monetary policy. The abolition of credit controls, removal of caps on the banks' lending rates and the shift to floating exchange rate regime, consequently, led the earlier mode of transmission through credit channel undergo a transformation to reflect increasing efficacy of interest rates in influencing volume of bank lending. Thus the interest rate channel became effective.

However, like most of the developed countries the impulses of the interest rate changes are not yet properly translated in the stock price changes in Pakistan as well. Currently the capital markets are mainly accessible to big companies and to a small portion of the population, therefore the monetary policy changes are not reflected directly in the stock prices.

Figure 1: Monetary Transmission Mechanism in Pakistan – Pre and Post Reforms.



Nevertheless, the switch over from the managed exchange rate regime to a free float in 2000, led to another chain of transmission, and the relationship between short-term interest rates and the exchange rate showed its existence. Although the inflation pass-through effects and the net export effects were already present, the exchange rate channel became more effective, and is working now through interest rates.

Due to liberalization and globalization, the economy is now more vulnerable to external shocks than before. Changed macroeconomic environment, therefore, raised new set of questions, for instance: is there any change in the effects of monetary policy on real economic variables over time? The general price level dynamics in Pakistan economy has shown that it was not only driven by the monetary but also the fiscal pressures; it was due to the supply side but because of demand side factors as well. However the central bank claims that at least to the extent of core inflation the monetary policy remained effective[8]. Whereas, in the past, it was the excessive recourse of government for funding from the central bank - due to fiscal profligacy and unlimited recourse to the low and fixed interest rate financing - has proved inflationary in the long run[9]. Although the interest rates were kept low to accommodate output growth via promoting private sector credit growth, yet instead it lead to a further fiscal indiscipline as the government kept on borrowing on cheaper rates[10]. Huge fiscal deficit together with external factors has put immense pressure on the economy.

Rising energy and commodity prices in the international market have not only raised the current account deficit of Pakistan but it also inflated the domestic prices through high import prices. Record high fuel prices have been a reason of rising inflation in many countries around the globe in the recent times. Although, the government of Pakistan attempted to partially insulate the domestic economy from the recent shock by subsidizing the price of fuels domestically, it has resulted in a large current account deficit, thus putting pressure on exchange rate and a falling Pak-rupee has further aggravated the price dynamics.

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[8] State of Pakistan's Economy – Quaterly & Annual reports. State Bank of Pakistan. www.sbp.org.pk

[9] Although the interest rates were also kept low to improve the private sector credit growth, it did not work as the economy was facing host of structural problems and thus the private sector investment remained subdued. However, to address this issue a Monetary and Fiscal Coordination Board was established, in 1997, to ensure that the fiscal policy is well coordinated with the monetary policy. By the same token a parliament act was passed (the Fiscal Responsibility and Debt Limitation Act 2005) to address the issue of ever rising public debt by the government.

[10] The continual ups and downs in the political scene also contributed towards the fiscal indiscipline.

In this backdrop, the inflationary expectations continued to work and the hoarding and export of necessary food products for arbitrage gains, besides other factors, resulted into huge crisis in the domestic economy and the prices of some of the food items touched some unprecedented peaks. Later on when the government started to pass on the impact of the rising fuel prices to the domestic economy, it further fuelled the domestic inflation and the economy now has been facing the second round effects of inflation in the shape of further rise in the general prices after the rise in the oil prices[11].

In this scenario, it can be roughly established that inflation in Pakistan is not only from a single square, but it is a result of pressures from various channels. In this way the economy of Pakistan can be a good example of having a monetary transmission mechanism, where most of the channels are passing the initial impact of shocks to the ultimate. Here the interest rate, asset prices, exchange rate and credit channel has a visible impact on the inflation; while the weakening supply and in the face of a strong demand is also contributing to the rise in prices. Lastly, the inflation pass-through due to high import prices in the presence of a depreciating rupee has established the role of exchange rate channel in the economy, yet via interest rates it needs to be further analysed. The dominancy of any of the channels and the exact time lag of an action and effect in the context of monetary policy in Pakistan are yet to be estimated.

4. Evidence from Literature

4.1. MTM in Retrospect

Prior to1960, quantitative estimates of lags in the effect of monetary policy were rare. While there was disagreement on the effectiveness of monetary policy; some seemed to accept the proposition that there was sufficient impact in reasonable short run for monetary policy to be used as a device for economic stabilization. Although this view did not go unquestioned, the main challenge to conventional thinking came from Milton Friedman (1960). He argued that monetary actions affect economic conditions only after a lag that is both long and variable and concluded that attempts to pursue a counter cyclical monetary policy might aggravate, rather than ameliorate, economic fluctuations. According to him, on average of 18 cycles, peaks in the rate of change in stock of money tend to precede peaks in general business by about16

[11] The government is of the view that the full impact of international oil prices is yet to be shifted to the masses in full.

months and troughs in the rate of change in stock of money precede troughs in general business by about 12 months. For individual cycle, the recorded lead has varied between 6 and 29 months at crests and between 4 and 22 at trough.

This view initially met some strong criticism; for instance, Culbertson (1960) argued that "if we assume that government stabilization policies act with so long and variable a lag, how do we set about explaining the surprising moderateness of the economic fluctuations that we have suffered in the past decade?" He further criticized, "the broad record of experience . . . support[s] the view that anti-cyclical monetary, debt-management, and fiscal adjustments can be counted on to have their predominant direct effects within three to six months, soon enough that if they are undertaken moderately early in a cyclical phase they will not be destabilizing." However, Friedman (1961) discussed the issue comprehensively by defining the 'lag' in a way, "when we refer to the *lag*, we mean something like the weighted average interval between the action and its effects; and when we refer to an "average" lag, we mean the average of such weighted averages for several episodes." Thus he retained his stance of what he concluded in his earlier study and defied the relevance of Culbertson's assertion by calling it a 'casual empiricism'.

Batini and Nelson (2002) revisited the earlier work of Friedman (1972), to investigate lags (if any) in the transmission of monetary policy actions to inflation. Their study includes the UK and US data of money growth rates, inflation and interest rates for the period 1953-2001. The results reaffirm Friedman's evidence that it takes over a year before monetary policy actions have their peak effects on inflation; and his rationalization that the 'lags arise partly from the existence of long-term contracts and of legal obstacles to changes in prices and wages, partly from the persistence of inflationary expectations and partly from other sources.'

The issue has been discussed and analysed since then, and the importance of the channels through which the monetary shocks propagate to the real economy was also taken into serious account. In literature, researchers have estimated the time lag in the action and effect of monetary policy, while emphasizing on various channels of this transmission. However, the exact length of the transmission lags and the dominant channel(s) of transmission are yet to be determined. Although, as stated earlier, there is no study on the estimation of lags, yet some

researchers have tested the conditions necessary for a monetary policy impact on real variables.

4.2. Literature Regarding Pakistan

Mangla (1979) studied the money demand function in Pakistan for the period 1958-1971, using ordinary least square (OLS). The variables that he used include interest rate, real income and permanent income. Whereas for interest rate he used inter-bank call money rate and long-term returns on government bond as proxies, and deflated GNP to be a proxy for real income, weighted sum of nominal GNP for permanent income and M1 (money supply) has been proxied for money demand. He observed that the interest elasticity of money demand was significant and less than one, thus conclusively one condition for the effectiveness of monetary policy (low interest elasticity of real money demand) holds.

Khan (1982) estimated the money demand function for six developing countries including Pakistan, for the period 1959-78. Like Mangla (1979) he also used inter-bank call money rate and average interest rate on time deposits as proxies of nominal interest rate. GNP at constant prices was used as a proxy for real income. He also incorporated permanent income and expected inflation rate in his model, and found that the time deposits interest elasticity of real money demand (M_1 and M_2) was negative, less than one and statistically significant for Pakistan, thus affirming Mangla (1979).

Khilji and Leon (1989) specified real output as a function of unanticipated M_1 growth, anticipated M_1 growth and real government purchases. While using annual data for the period 1963-1986, they tested the neutrality of money hypotheses for Pakistan. They specified monetary growth as a function of one year lagged domestic credit growth, one year lagged growth in foreign exchange reserves and one year lagged monetary growth term. The fit of the equation was taken as the anticipated component of money supply while the residual part shows unanticipated money supply growth. They found that government purchases and anticipated money supply growth had significant and positive effects on output, whereas the unanticipated growth in money supply had either insignificant or negative effect on real output and employment. Hence, the money neutrality hypotheses were rejected for Pakistan.

Khan and Ahmed (1990) examined the demand for money function for Pakistan for the period 1959-60 to 1986-87. They proxied deflated GNP for real income. For interest rates they used

both average rate on time deposit and call bank rate to estimate money demand function. They found that call money rate elasticity of real money balance (M1) and average time deposits rate elasticity of real money balance (M2) was negative, less than one and significant for the period 1959-60 to 1970-70 and 1959-60 to 1980-81, respectively. They also confirmed the results of Khan (1982) and Mangla (1979).

Khan and Siddiqui (1990) examined the direction of causality among money, price and economic activity for Pakistan for the period 1972: I to 1981: IV. They found that causality runs from economic activity to money (M1 and M2). Moreover, they also found unidirectional causality running from M1 (money supply) to prices and a bi-directional feedback relationship between M2 (monetary assets) and prices. The study concluded that both money supply and prices were endogenous variables and therefore money supply was not a key variable in the determination of the level of output.

Upadhyaya (1991) evaluated the effectiveness of monetary and fiscal policies for the period 1957–87, using reduced form single equation model (by modifying the original St. Louis equation by adding foreign trade variables) for four Asian developing countries: India, Pakistan, Nepal and Sri Lanka. Assuming that the effect of each of the explanatory variable on the dependent variable was completed within two years, he specified two-year lags for each variable. For Pakistan the impact of change in money stock (M1) was found significant in the first year, yet insignificant at all lags. However, the overall cumulative impact was significant. He found unidirectional causality from the monetary variable to nominal GNP. The results confirmed the exogeneity of the monetary variable (M1) with respect to nominal GNP. He supported that monetary policy was more effective than fiscal policy in Pakistan.

Hussian (1994) estimated the money demand function for Pakistan using the co-integration technique. He specified money demand as a function of real income and nominal interest rate. Though the coefficient of the rate of interest has a positive sign during 1959 to 1991 for both real money balances (M1, M2 adjusted for inflation), the interest elasticity is negative and less than one for the period 1972 to 1991. Thus, one condition for the effectiveness of monetary policy holds for 1972-91.

Abbas and Hussain (2006) tested the relationship of money, income and prices in Pakistan. They used the annual data over 1959 – 2003. In their co-integration analysis they found a

long run relationship among money, income and prices. In addition, through granger causality test they found that in the short run prices effect money while in the long run the causality is in the other way round and the money affects prices.

Some of the above described empirical studies suffer from a few methodological and technical deficiencies: most of the studies did not examine the time series properties of the variables (stationarity of variables). Thus, OLS regression analysis may lead to non normal coefficient distribution, spurious regression problem and also inconsistent and inefficient OLS estimates of parameters. Moreover, these studies used nominal GNP rather than real GNP as a dependent variable, which in an equation with the inflation as an independent variable can lead to the problem of multicollinearity. However, apart from the proposed weaknesses, these studies confirm the relationship of money and inflation in Pakistan, and in majority of the studies the one condition of effectiveness of monetary policy is confirmed. Going a step forward, there is ample literature on the estimation of the lags in the transmission of monetary policy actions, and also with reference to the channels that play a dominant role in transmitting the effects of action to the objective. The next section describes some of the studies in this regard, sequenced on the basis of transmission channels of monetary policy.

4.3. Literature in General

(a) Interest Rate or Money Channel

Irving Fisher[12] and Knut Wicksell[13] held that in short run the transmission process was dominated by the movements of interest rate, while in the long run they emphasized on the role of changes in the real cash balances. According to them a rise in the currency in circulation may not at once raise the prices but will also reduce the velocity, which eventually apparently increases the wealth of the individuals, and everyone will try to reduce the cash balances by purchasing more goods and services (and vice versa), this will lead to a rise in the price level.

[12] Fisher, Irving. "The Purchasing Power of Money: Its Determination and Relation to Credit Interest and Crises." Rev. Ed. New York: reprints of Economics Classics 1963.
[13] Wicksell, Knut. *Lectures on Political Economy;* Vol. 2. Edited by Lionel Robins. London. Routledge and Kegan Paul Ltd 1950

Keynes[14] endorsed the wealth effect of Irving Fisher and Knut Wicksell. Whereas, later on Tobin, Friedman and Brunner-Meltzer also emphasized on the role of the relative prices channel. The relationship of money-interest rate-investment channel was surfaced. They promoted the view that it was the rate of return or yield on real or financial assets plays the key role in the transmission process and that the impact of a change in monetary policy is visible in the financial sector before it affects the real sector.

Tanner (1969) widened the scope of this issue and statistically investigated the lags in the effect of monetary policy, where the initial shock was a change in money supply. He based his study on answering the question that when should the money supply be changed to effect the aggregate demand in a predetermined way! The study was built on Tucker's analysis[15] of 1966, and he used an augmented two-stage least squares to estimate a dynamic IS-LM model.

According to Tanner the geometric distributed lag function developed by L. M. Koyck had a shortcoming that the coefficients of the lagged values were required to diminish steadily, so instead of using the simple geometric lag distribution, he used a generalized form of the negative binomial lag distribution developed by Solow[16].

To develop a distributed lag function, in the first step he developed three equations: (a) the partial adjustment model, on the basis that "there are costs in making asset transactions, attempted adjustments to newly established optimum quantities will be gradual. The adjustment period will vary directly with the costs of adjustment and inversely with the costs associated with disequilibrium positions. During such periods of adjustment, constrained optimal quantities will be demanded." The partial adjustment model specified that the current constrained optimal quantity demanded was related to the current unconstrained optimal

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[14] Keynes, J. M. *The General Theory of Employment Interest and Money;* New York: Harcourt, Brace and Company, 1936 – pp. 92, 93.

[15] Before this analysis (Tucker ," Dynamic Income Adjustment to Money Supply Changes", *American Economic Review*; June 1966, 56, 433-49) the empirical studies had evidenced that investment responds to changes in the level of interest rates, but with a distributed lag that may be too long for the monetary authorities to use monetary policy effectively for cyclical stabilization; however, Donald Tucker (1966) opposed this assertion, and pointed out that long distributed lags in the investment demand can exist without causing comparable lags in the response of aggregate demand to changes in the money supply. Lags in the money demand function act to counter the investment lags. His arguments implies that despite long lags in the bulk of the investment response, sharp changes in the money supply may effect sharp changes in the rate of interest and, as long as the coefficient of the short-run response of investment to the interest rate is not zero, sharp short-run movements in the aggregate demand.

[16] R. M. Solow; "On a Family of Lag Distributions". Econometrica, Apr. 1960, *28*; 393-406.

quantity by a coefficient of adjustment. (b) He assumed that the current unconstrained optimal quantity was in turn dependent upon an expected return; (c) In the third model he related the expected return to the observable variables by specifying the expectation generating equation.

In the second stage the study develops a macro-economic model which allows for dynamic adjustments in both the commodity and monetary sectors. For this purpose the IS-LM model was assumed suitable to capture the essential features of the Tucker's offsetting lag hypothesis. Consequently two dynamic structural equations were employed: (1) private expenditure (the sum of consumption plus investment demands) function and (2) money demand function. Variables like government spending, taxes, and foreign trade balance were treated as exogenous, while labour market adjustments and capital utilization changes were ignored.

The model was focused solely on the question of the timing relationship between changes in the money supply and the changes in aggregate demand. Thus the model used a dynamic form of the static IS-LM framework to determine the timing relationship between changes in the money supply and changes in aggregate demand. The earlier developed distributed lag relationship was also incorporated. The variables used in the model were. Aggregate private commodity expenditures, national income, interest rate, money demand, money supply, government expenditure, government taxes and the one used for net exports over imports. The study used the quarterly data of United States for the period 1947-1967.

The author concluded that "[although long lags in the investment function were found] the study finds that the bulk of the effects on aggregate demand of monetary policy can occur within three to six months of the change in the money supply." "… the findings of this paper cast serious doubt on the conclusion that anti-cyclical monetary policy must be abandoned, entrusting the objective of short-run stability to the other instruments of economic policy such as fiscal policy or direct controls of one kind or another. In fact, the evidence suggests that the impact of a change in the money supply is of about the same magnitude as the long-run effect. To the extent that this conclusion is true, monetary policy is ideal for and consistent with short-run stabilization requirements."

Despite the fact that this study improved the way the earlier studies used to analyze the subject: here two-stage least square method was used taking into account two sectors of the economy, thereby, avoiding the single equation bias that the earlier studies suffered from. Although, the author admits that there were several limitations to the methodology[17] of the study due to which this model was too simple to be used for the policy purposes, it did indicate that monetary policy appeared to work quickly enough for cyclical stabilization requirements and there should be little hesitation in applying monetary policy to this end.

Smith (1972) verified the results of Tanner (1969). In his study he tested the hypothesis by altering the specification of the model developed by Tanner. Smith attempted to find out the impacts of monetary policy while including the accelerator relationship in the investment demand equation. His study was based on the assumption that if there was an accelerator relationship in the investment demand equation and that if the monetary policy affected the goods and services market directly and not just through the money market, than substantial movements in the interest rate would not be necessary.

While using quarterly data for the period 1953-65, he estimated three structural equations in his model, each utilizing a geometric lag distribution and two identities. While quarterly data for the sample period 1953-65 was used. He estimated equations (2) and (3) by three-stage least squares whereas equation (1) was estimated by two-stage least squares. The variables used in his model were gross national product, private consumption expenditures, government expenditures plus net foreign investment, yield on all corporate bonds, demand deposits plus currency outside banks, gross private domestic investment, liquid assets, i.e., M plus time deposits in commercial banks and time. The results verified Tanner's conclusion that monetary policy could be effective in the short run.

Contemporary economists also emphasized the importance of interest rate channel, which reveals the traditional mechanism and the one often regarded as main channel of monetary transmission mechanism. A policy induced change leads to a change in long-term interest rate, which in turn affects business investment, investment in residential housing and consumer expenditure in durable goods, which leads to shift in aggregate demand and

[17] The study did not explain the exact channels through which monetary policy actions were transmitted, as to how was the money supply changed.

eventually a change in output and prices occur. This transmission mechanism depends on several links. The relationship between nominal interest and real interest rate is explained by theories based on price and wage rigidities. The link between short-term and long-term interest follows from the expectation hypothesis of term-structure of interest rate and relationship between aggregate demand and prices is explained by Philips curve.

Gruen et al. (1997) studying the lags in the monetary transmission in Australian economy, describe six sources of lags in the transmission of monetary policy actions to the real economy: interest rate channel, exchange rate channel, asset price channel, credit channel, expectations channel, and the cash-flow effects on the liquidity constrained borrowers. According to them, these channels and their mutual interaction played significant role in the lags of monetary policy. The major emphasis of the study remained on the interest rate channel.

The authors used the general-to-specific modelling strategy and begun with single equation models for Australian output. The variables used in the model were: quarterly growth of Australian non-farm output, growth of Australian farm output, short-term real interest rate, and the lagged log levels of Australian non-farm output and US output[18]. The models were estimated by ordinary least square, using quarterly data over the period 1980:Q3 to 1996:Q1.

They developed two models: one for headline CPI inflation and the other for the underlying CPI inflation. However, strong correlation was found in the real interest rate and its lags, thus leading to the problems of multicollinearity, so the length of lags of monetary policy was hard to estimate accurately. The authors used alternative ways as well to estimate the lag length, yet they remained uncertain about the results.

The approach of controlling for the forward-looking nature of policy response using instrumental variables was used. Thus inflation, output gap and the current account deficit to GDP ratio were used as instruments; however the results remained unchanged as that of the OLS procedure.

[18] As per authors the explanation of the underlying business cycle provides ample support in isolating the impact of monetary policy on output; and in this regard the authors referred to the empirical evidence of past 15 years, stating that US output, although being clearly exogenous to the Australian economy, has strongly influenced it.

The study concluded that although there was strong econometric evidence that the level of short-term real interest rate had a sizeable impact on output in the Australian economy, and as per OLS estimation one percentage point rise in the short-term real interest rate lowers the output growth by one-fifth to one-quarter percent in the first year, one third percent in the second year and one-sixth percent in the third year, although the estimates were subject to considerable uncertainty.

Their second conclusion was that "the strength of monitory policy's impact on output is underestimated by ordinary least squares estimation, while the length of the monetary policy lags is overestimated. Under plausible assumptions, the underestimation is concentrated in the first year, while the estimated impact on output growth in the second and third years is largely unaffected."

Influenced by Friedman (1960); Tanner (1969); Smith (1972); Nachane and Lakshmi (1998) investigated the Indian data for if any changes occurred in monetary transmission lags due to liberalization. According to them; "in the wake of the structural reforms launched by the Indian Government in 1991, fundamental changes have been witnessed in the financial system. The process of financial change exerts significant influences on the empirical definition of money, the money supply process and its transmission and on the demand for money. This not only raises issues about the instability of the relationship between monetary aggregates and the aspects of the macro-economy but also brings into question the potency of monetary policy. If financial change is indeed invoking fundamental alterations along these lines, then they would be manifested in at least certain quantifiable dimensions. This paper identifies two such dimensions viz; monetary policy lag and the causal associations of money with important macroeconomic magnitudes (specifically output and prices). If these causal associations are weaker in the post-1991 period, as compared to the preceding period, or if the lags emerge to be longer in the more recent period, then the financial change can be considered to have brought about the effect expected from theory."

To estimate the "causal lag" and the "causal coherency" they used the methodology defined by Granger (1969). They used the monthly data series of M1, M3 (money supply), WPI (wholesale price index) and IIP (index of industrial production). While they assumed that the

lags could be of less than a year, they had the data on Indian GDP only on annual or semi-annual basis, therefore monthly IIP was used as a proxy for the GDP. The duration of their analysis included both the pre and post liberalization period, i.e. from April 1977 to March 1997.

In the second phase, HEGY[19] framework was used to check for unit roots and seasonal unit root, for the data was monthly so there was a possibility of seasonal roots as well. The study, thereafter testing for the causal coherencies and causal lags concluded that the lags of monetary policy were shorter, than those earlier estimated by Friedman; and M1 was found more proactive and potent measure, as compared to M3, having a pronounced impact on output (both pre and post liberalization).

Sims (1998) studied the US data for any statistical evidence that money caused income or if it was otherwise. He found that causality was unidirectional from money to income, rejecting the hypothesis that causality was unidirectional from income to money. However the methodology he used to study that was somewhat different from the earlier ones.

The data (quarterly) used in the study covered the period 1947-69, and the variables used were GNP – Gross National Product, MB – Monetary Base (currency plus reserves adjusted for changes in reserve requirements), and M1 – currency plus demand deposits. The author used the Granger (1969) method, and the Distributed Lag methodology to estimate the direction of causality within the model. The study concluded that "no evidence appears to contradict the common assumption that money can be treated as exogenous in a regression of GNP on current and past money."

Alvarez et al (2001) stated the behaviour of interest rates and inflation in their study. They started with the assumption: that the instrument of monetary policy ought to be the short run interest rate that policy should be focused on the control of inflation and that inflation can be reduced by increasing short-term interest rates.

[19] Hylleberg et al (1990), framework suitably extended to the monthly context by Beaulieu & Miron (1993).

In their study they examined the properties of Taylor rules[20] using a neoclassical framework that was also consistent with the quantity theory of money and the body of evidence that confirms this theory. An essential assumption in their inquiry was that markets were incomplete or segmented, in a way that is consistent with the existence of a liquidity effect: a downward sloping demand for nominal bonds.

They used a segmented-markets model, adopted from the Alvarez et al (2001), and considered a series of examples under different assumptions on the behaviour of velocity shocks and on the specification of a policy rule. In the model that they used to generate the examples, production was a given constant, velocity was an exogenous random shock, and the equation of exchange determined the equilibrium price level, given the money supply. The study concluded that a policy of increasing short-term interest rates to reduce inflation can be rationalized with essentially quantity-theoretic models of monetary equilibrium.

In their study Arestis and Sawyer (2002) analyzed the channels of monetary transmission and the impact of monetary policy actions on the final objective, i.e. inflation. According to the authors, this study incorporated the 'new' monetary policy approach, where the money stock or the money supply was less effective and therefore the interest rate was used as the policy instrument, to affect the real economy.

The variables used by the authors included the output gap, nominal rate of interest, rate of inflation, inflation rate target and equilibrium real rate of interest (the rate of interest consistent with zero output gap). They established three equations, where one was the aggregate demand equation with the output gap determined by past and expected future output gap and the real rate of interest, second was a Phillips curve with inflation based on current output gap and past and future inflation and third was a monetary policy operating rule (of the Taylor's rule form) with the nominal interest rate based on expected inflation, output gap, deviation of inflation from target and the 'equilibrium' real rate of interest. In some way by the third they equation replaced the LM-curve which was previously used in the discussion of monetary and fiscal policy.

[20] Rules that specify the interest rate set by the central bank as an increasing function of the inflation rate or perhaps of a forecast of the inflation rate – Taylor, John B. (1993) "*Discretion versus Policy Rules in Practice",* Carnegie-Rochester Conference Series on Public Policy 39, 195-214.

The stock of money had no role in the model. The model incorporated a symmetric approach to inflation targeting. Inflation above the target would dictate higher interest rates to contain inflation, whereas inflation below the target would require lower interest rates to stimulate the economy and increase inflation.

They concluded that; "… monetary policy can be seen as aggregate demand policy in that the interest rate set by the Central Bank is seen to influence aggregate demand which in turn is thought to influence the rate of inflation. Monetary policy has become the only policy instrument for the control of inflation, but it can at best only address demand inflation."[21]

In the same way, Bovion and Giannoni (2002) studied the U.S data. They attempted to determine if the reduction in output and inflation variability had been associated with a change in the transmission of monetary policy. According to them the comparison of the period 1980:1 – 2001:2 with the preceding two decades showed that the standard deviation of quarterly output growth and the standard deviation of inflation had fallen sizably.

As a first step they estimated a small vector auto-regression (VAR) model using U.S. data from 1960 to 2001 and tested for its stability. They found instability in both the systematic part of the estimated VAR and in the variance of shocks. Then through counterfactual experiments they attempted to assess if the reduced variability of the economy was principally due to less important shocks or due to the changes in the propagation mechanism of these shocks. They found that the changes in the propagation of the shocks in the past two decades accounted for roughly 40 percent of the decrease in the variance of detrended output and for 60 percent of the reduction in the variance of inflation.

In their VAR analysis they used four variables: detrended output, the inflation rate, commodity price inflation and the federal funds rate. The variable of de-trended output was similar to the 'output gap'[22]. The inflation rate was the annualized rate of change in the GDP

[21] Arestis, & Sawyer (2002), 'Can Monetary Policy Affect the Real Economy?', *European Review of Economics and Finance*, vol. 3, no. 3, pp. 30

[22] The percent deviation of real GDP from a stochastic trend – the difference of the real GDP and that of the potential GDP, is referred to as the output gap.

deflator between two consecutive quarters. The commodity price measure was the quarterly average of the monthly spot market commodity price index.

The authors performed stability test on VAR, and for each equation of the reduced-form VAR, they tested jointly for the stability of all the coefficients on the lags of a given variable using the Wald version of the Quandt (1960) likelihood-ratio[23]. They used a heteroskedasticity-robust version of the test[24]. The results suggested strong evidence of changes in the VAR. Thus the study considered three sub-samples: the first corresponding to 1963:1 – 1979:3, the second to 1980:1 – 1997:4, and the third to 1984:1 – 1997:4. Using the break dates 1979:3 and 1984:1, they tested for stability of the variance-covariance matrix, and found that not only the propagation of the shocks had changed over the past decades, but also that the variance of the innovation had changed significantly.

Once the evidence of changes in the economy was established, the authors performed counterfactual experiments on the variance of output and inflation, to investigate whether the reduced volatility in output and inflation was mainly attributable to a change in the variance-covariance matrix of the disturbances or to a change in the propagation of the perturbations. The authors, for this purpose, used the estimates of the reduced-form VAR over different sub-samples. They found that both the changes in the propagation mechanism and the variance covariance matrix of innovation were important in explaining the reduced variability of output and inflation.

They concluded that; "… the change in the propagation mechanism has lowered the variability of macroeconomic variables to a large extent. This change has been associated further with a diminished effect of monetary policy shocks on output and inflation. This observation, however, does not imply that monetary policy has lost some of its potency in the past two decades, because the change in the transmission of monetary policy shocks could result from a change in the systematic behaviour of the Federal Reserve." Further they concluded that the reduced effect of monetary policy shocks was mainly due to a more

[23] The Andrews (1993) sup-Wald test.
[24] According to the authors; "this test, unlike the well-known Chow test, does not assume knowledge of the date at which the break in the parameters occurs. This test is also known to have power against other alternatives, such as one where the coefficients are following a random walk (see Stock and Watson [1998])."

effective systematic behaviour of monetary policy, and that there was little evidence that U.S. monetary policy had lost its potency in the past two decades.

Yuong Ha (2000) examined the implications of uncertainty about the length of monetary policy transmission lag in a stochastic environment for monetary policy. He used the three versions of the New Zealand's FPS (Forecasting and Policy System) model to examine transmission lag uncertainty and to conduct stochastic simulations. He states, "In the FPS model, a monetary policy tightening through a rise in interest rates makes it more expensive to borrow and consume today relative to the future. This causes a reduction in investment and consumption, that is, a fall in aggregate demand. This fall in aggregate demand below the economy's productive capacity eventually reduces inflation. The lags in this transmission channel are due to the time it takes for aggregate demand to respond to changes in interest rates, and the time it takes for inflation to respond to the output gap."

While concluding, the author stated that if the central bank does not know the length of monetary transmission lag, less aggressive and more forward looking inflation-forecast-based rules are robust. He further estimated that a strategy of over-estimating the transmission lag was superior to underestimating the lag.

(b) Asset Price and Exchange Rate Channel

Romer and Romer (1989) used a narrative approach to study the effects of monetary policy on the U.S economy. While arguing in favour of the narrative approach, they stated that its scope was fair wider than other approaches, as it allowed a huge set of information which cannot be employed using the conventional statistical tests; while usually it is the additional information that leads to answer the question of identifying the direction of causality between monetary factors and real economic developments.

The authors observed that monetary policy actions placed significant effects on the real economy. A move to anti-inflationary monetary policy led to an ultimate reduction in the U.S industrial production and the persistence of the real effects of these demand disturbances was observed for about two and half years. In other words, by 33 months after a shock, output has essentially returned to its earlier path. However, unlike the earlier studies made by Gruen et al. (1997), Sims (1972), Alvarez et al. (2001) etc, he, besides, the interest rate or money channel, also took into account the asset price, and the credit channels of monetary

transmission. However, still he ignored the impact and the role of the exchange rate channel in the transmission process. This was later incorporated by others including Taylor (1995), De Arcangelis and Di Giorgio (1999), Mishken (1995) etc.

Monetary policy can also have important effects on the prices of equity, bonds and real estate. A change in monetary policy leads to a change in equity prices, which affects investment through Tobin's q and hence a change in aggregate demand. This change in equity prices also entails a change in wealth, which leads to change in consumption and eventually aggregate demand is affected; thus eventually it is reflected in the general price level.

The relative asset price channel also includes exchange rate channel. This channel works through both aggregate demand and supply effects. On the demand side, a policy change leads to a change in domestic real interest rate, which through foreign interest parity condition brings about a change in real exchange rates, which in turn affects net exports and aggregate demand. On the supply side, the policy-induced change in real exchange rate changes the domestic prices of imported good, changing inflation directly. Moreover, changes in imported input prices shift the aggregate supply, which leads to change in output and inflation.

De Arcangelis and Di Giorgio (1999) investigated the real and nominal effects of monetary policy in Italy, by using structural VAR (Vector Autoregression) analysis. They started with presenting some general and preliminary descriptive evidence on short run empirical relationships between money, interest rates and output in Italy. However, as this simple statistical association could not answer the causality question, therefore they considered VAR models by using monthly data on output, pieces, a money aggregate (M0, M1, M2) and interest rate. The authors preferred the methodology of structural VAR, because according to them, this approach had the advantage of imposing a minimal set of theoretical restrictions on the model to be tested, thereby allowing for a close-to-pure statistical investigation of the time series properties of the variables included in the analysis.

The authors estimated different VAR models with different specifications using the variables of consumer prices, index of real economic activity (industrial production), M2, interest rate. They estimated first a 3 variable VAR model and then a 4 variable one; also they estimated it after replacing M2 with the monetary base (or the total bank reserves). However, as these

exercises were based on simple statistical models having no theoretical and institutional foundations, the measure of monetary policy shock was left for the researcher to decide. Therefore, to answer what an effective monetary policy should be, the authors preferred to link the model with the applied aspect, and they used the methodology developed by Strongin (1995) and Bernanke and Mihov (1998) extended to an open-economy framework and applied to Italy by De Arcangelis and Di Giorgio (1998). They believe it the best framework to identify monetary policy shocks and study the effects of such shocks on the economy.

They applied this framework to the Italian economy while focusing their analysis on the market for bank reserves, where monetary policy was actually implemented. Their VAR model included the monthly data for the period between June 1989 and May 1998, using the consumer price index, industrial production index and real exchange rate as non-policy variables; while total bank reserves, fixed-term advances and the overnight interest rate as policy variables. The price index, the industrial production index and the real exchange rate had been log-transformed. Total reserves and fixed-term advances had been normalized by dividing them by the 18-month (past) moving average of total reserves in order to use the level relationship among total reserves, fixed-term advances and non-borrowed reserves. Since the Italian banking system experienced some relevant changes in the reserve requirement ratios in the sample period, they used the adjusted series for total bank reserves offered by the Bank of Italy. The overnight rate was in levels.

Their results confirmed De Arcangelis and Di Giorgio (1998). In particular, the regime based on controlling the overnight rate was accepted, while the over-identifying test rejected the hypothesis that the Bank of Italy in the 90s was targeting the non-borrowed reserves aggregate. Although the role of the exchange rate varied from being an intermediate target to only working as a transmission channel, there was no evidence that this induced a change in the monetary policy operating procedures.

Taylor (1995) discussed the monetary transmission mechanism in his study, with a specific emphasis on the *financial market prices* framework. The study explained that although the quantities (money supply, bank credit, government bonds supply, etc.) were important to be incorporated while modeling the transmission mechanism, due to some measurement

problems and the data availability most of the economists have used the prices of foreign exchange and credit instead of their quantities[25].

The study has thus kept its main focus on the exchange rate channel of monetary transmission mechanism. It states that "… the change in short-term interest rate has an effect on both the exchange rate and the long-term interest rate. Of course, one should remember that the short-term interest rate is only one many factors affecting the exchange rate and the long-term interest rate, and the effects of the short-term interest rate on both are uncertain and variable over time. In any case, given the rigidities in the economy, these changes in *nominal* exchange rates and interest rates in turn affect *real* exchange rates and *real* interest rates. The changes in real rates then have a short-run effect on real net export, real consumption and real investment and thereby on real GDP. After the short run, however, wages and goods prices begin to adjust, and as they do, real GDP returns to normal. In the long run the real interest rate and real exchange rate return to their fundamental levels. Thus, the linkage is from short-term interest rates, to exchange rates and long-term interest rates and finally to real GDP and inflation."

The author thereby emphasized on the importance of exchange rate in the monetary transmission by referring to the *interest rate parity relationship*[26]. He estimated an empirical model of transmission mechanism in the United States, Canada, Germany, France, Japan, Italy and the United Kingdom, and concluded that changes in the exchange rates were a key part of monetary transmission mechanism.

In the same way Mishkin (2001)[27] studied the role of asset prices in monetary policy. He surveyed the transmission mechanisms of monetary policy, while focusing on how monetary policy affects the economy through asset prices. The major emphasis of the study was on the

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[25] The author states that; "much has been made of the unreliability of any one measure of the money supply because of recent changes in technology and regulation. In fact, the demand for money function – at least for the M1 and the M2 definitions – seems to have shifted substantially in recent years. The measures of credit flows, sometimes proposed as an alternative to the money supply, have been at least unreliable. Even those researchers who have found an important role for credit have not found a stable structural relationship between an aggregate measure of credit and GDP or inflation. It is for these reasons, in my view, that many empirical researchers interested in estimating structural models have opted for this financial market prices approach rather than one of the quantity approaches."

[26] It states that the interest rate differential between any two countries is equal to the expected rate of change in the exchange rate between those two countries. - Mundell (1962).

[27] NBER working paper 8617.

role of stock market prices, real estate prices and the exchange rates. The author observed that other asset prices had also a significant role in the transmission mechanism; however he stated that targeting of asset prices by central banks is likely to lead to worse economic outcomes as the control of these asset prices are beyond the scope and capabilities of central banks.

5. Some Methodological Issues

Central banks (monetary authorities) use huge sets of information to envisage the future course of monetary policy and the real economy. While there have been found some limitations regarding the models used and to be used, Boyd and Smith (2000) studied the econometric issues in measuring the monetary transmission mechanism. They presented estimates of a simple model involving four standard equations for 57 developing countries using annual data for the period 1966-1996. The equations they estimated were: the trade balance equation, a purchasing power parity condition, and IS curve and a Philips curve. The variables included the real GDP, domestic price level, the foreign price, nominal exchange rate, real exchange rate, real money supply, nominal interest rate, a measure of fiscal policy and balance of trade.

They found 'very large dispersions' of the estimates of the standard equations, which they explained, being possibly due to the fact that (a) countries were really different; (b) the data was poor; (c) it might be the result of simultaneity bias; (d) might be due to spurious regression and (e) most probably due to the fact that "country specific idiosyncratic shocks and measurement errors associated with the unobservables such as expected inflation and the natural rate of output act like omitted variables correlated with the regressors." Therefore they suggested that, to get reliable estimates of the transmission mechanism for a particular country, it is necessary to have reasonable measure for the unobservables, and reasonable proxies for the variety of idiosyncratic, country specific, factors.

These issues were also captured by the most recent researches held by Bernanke et al. (2003), and Shibamoto (2005), which used FAVAR (factor augmented autoregressive) models to estimate the effects of monetary policy on the real economy. Bernanke et al. (2003) stated that rationale behind the usage of VAR models is that they usually give empirically plausible assessments of the dynamic responses of key macroeconomic variables to monetary policy

changes. Moreover, they stated that it is also useful because identification of the effects of monetary policy shocks requires only plausible identification of those shocks and does not require identification of the remainder of the macroeconomic model.

However, VAR methodology has been criticized on the grounds that multiple different identifications of the monetary policy shocks will lead to different inferences about the expected changes in the real economy. Secondly they oppose VAR on the basis that usually a low dimensional VAR cannot use those huge sets of information that is available to the central banks and the monetary authorities, only to protect the degree of freedom. Which can further result into the problem of 'price puzzle[28]' and also while only a limited number of variables are used in the model, impulse response of various important variables could not be observed, which would be rather more important to measure the effect of a policy change on the real economy. Although, this problem could be coped by using Bayesian VAR model, which can possibly avoid the problem of degree of freedom, yet it is the computational complexities of these models due to which mostly they were not preferred over the FAVAR models.

Therefore, they attempted to combine the standard VAR analysis with the factor analysis. According to them, "If a small number of estimated factors effectively summarize[s] large amounts of information about the economy, then a natural solution to the degrees-of-freedom problem in VAR analyses is to augment standard VARs with estimated factors." As in this way large number of time series can be summarized in shape of a few estimated indexes or factors. They used both one step and two step estimation methods based on FAVAR model, and supported the FAVAR approach, and they found reliable results of the analysis of responses of real economy to the monetary policy innovations.

6. Conclusion

In this study, an attempt has been made to survey some of the studies by different economists made on the subject of lags in the monetary transmission. It has been established that from the stand point of central banks the determination of lags has high importance. As the

[28] "the conventional finding in the VAR literature that a contractionary monetary policy shock is followed by a slight increase in the price level, rather than a decrease as standard economic theory would predict" Bernanke et al (2003).

monetary interventions or shocks take time in propagation or to be responded by the real economy, and a pre-determination of this time duration is vital from the policy perspective. However, difference of observation is found among researchers, which reveals that these monetary lags are relative to the different circumstances of different economies. It depends on the financial and economic structure of the countries in question and also on the channels of transmission that are dominant in the effect of the monetary policy actions.

Although various transmission channels have also been discussed, yet broadly speaking it moves around the money and asset price channel, as the earlier can merged the impact of interest rate and credit, while exchange rate being an asset price can be merged with the later. The transmission mechanism while working through the interest rate channel, states that a change in interest rates will place an impact on the spendings of the people, on their investment decisions, and on their demand for money. Thus all these factors together or even separately impact the asset prices and the aggregate demand, which will ultimately alter the general price level in a way reciprocating the initial change in interest rates. However these studies did not specify one exact channel of propagation and the exact or precise quantitative lags as well.

Studies based on Pakistan establishes that monetary policy remained effective and that it has an impact on the real economy, however, the magnitude of such an impact and the time taken in the transmission of an action to be translated into effect remains a question yet to be answered. Historical evidence roughly reflects that different channels of propagation were involved in MTM yet the dominant channel is not yet identified. However, there are studies in general about these issues with ample guidance and lessons for Pakistan while conducting such a study

Different studies have estimated the lags and found results: from Friedman (1960), Batini and Nelson's (2002) correlation based studies describing the presence of long and variable lags, to the more empirical studies based on VAR (vector autoregressive) and complex macroeconomic models by Bernanke and Blinder (1992), Sims (1992) and others. VAR models, in particular low-dimensional, are criticized severely to deal with the monetary policy. Primarily on the ground that these models can't use the huge set of available information and to conserve the degrees of freedom they have to use limited number of

variables. However, VAR analysis can be useful to study the dynamic effects of economic variables. Usually the assessment of these models is plausible that is why these are widely used to assess the empirical fit of the structural models[29].

Keeping in view the advantages of VAR analysis the recent research has now been augmenting the standard VAR with a small number of estimated factors that summarize huge sets of information and thereby the problem of degree of freedom can be avoided. This approach is named usually as FAVAR (factor augmented VAR) approach.

The different results of the lag analysis reveal the fact that the usage of different econometric techniques also can have significant influence on the results. The correlation analysis of Friedman although gave results yet their reliability was questioned. Similarly, some researchers used VAR analysis to describe the lags, whereas Nachane and Lakshmi (1998) also attempted to link the difference in lags to the financial liberalization in India, and found different results. Therefore, it seems pertinent that it is not just the application of different techniques and the usage of different models that result in different estimates but it is the behaviour of economy on that particular point that makes the difference. Secondly, the point in time of the cycle of the economy also matters seriously to be known, whether the economy in question is at recession or in the stage of recovery.

The analysis made by Gruen et al. was distinct on the grounds that, besides headline inflation, they also took into account the underlying inflation, while studying the transmission mechanism. It is suggested that it is necessary from the point of view of a central bank that the lags should be determined in the impact of monetary changes on core inflation in particular and on headline in general. As in case of Pakistan as in the recent past, the overall inflation has been mainly pushed by the food group or due to the international oil prices thus leaving very small room for the monetary policy to impact; however if it was to be done only on the basis of the results of lags with the headline, it could be deceiving.

[29] See, Boivin and Giannoni (2003); Christiano, Eichenbaum, and Evans (2001).

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CHAPTER NO. 02

Openness and Inflation under Convex Phillips Curve

1. Introduction

Recently, the debate regarding the design and the ultimate objectives of monetary policy has engaged the attention of researchers and academia. In its usual course the monetary policy of a central bank is aimed at stable inflation, sustained economic growth and to the possible extent a check on the level of unemployment and exchange rate. This is the reason that the loss function of a central bank generally includes inflation and output, however, the weights assigned to each of these two variables reflect the priority and inclination of the central bank's objectives. For instance, by the eve of 21st century a wave of inflation targeting was observed and many central banks adopted the *inflation targeting* strategy, with the single explicit policy object of stable inflation[1]. However, over the last few years a divergence from the inflation targeting policies by the banks is witnessed among the researchers, which introduced a policy aimed at explicitly stabilizing both inflation and the output gap variations leading to improved overall stabilization, named Speed Limit Policy (Walsh, 2003).

In this way a loss function is appropriate for stabilizing the real economy, which involves both the stabilization of inflation and output gap (Svensson, 1999). Such a loss function would restrict the policy makers from adopting an expansionary motive, which, in the Barro and Gordon (1983) framework, gives them otherwise a short-term incentive to lower unemployment below the natural rate, yet rising output above potential unsystematically would be inflationary (Blinder, 2000) and (Gerlach, 2003).

It could be conceived that it is not even the output gap but its volatility is important to be kept in limits, as under pure discretion the output gap and inflation may fluctuate in a way where one may be triggering the other regardless the causality. It is the optimal pre-commitment policy that would have enough to impart inertia in output gap and inflation. Such a monetary policy would have the elements of Speed Limit Policy, where Walsh (2003) supports, on the basis of previous findings, the superiority of nominal income growth targeting over inflation targeting. Nominal income growth to a greater extent follows the pattern of real output growth. Since output gap is the difference of real output growth from the potential, which in most cases follows a deterministic time trend. Hence targeting nominal income growth would be effectively leading to suppress the output gap fluctuations.

In the current scenario where output gap in a majority of economies is experiencing changes which invokes attention towards the conventional Phillips curve relationship. The concept of

[1] See table A1 in appendix.

inflation-unemployment trade off could be expanded, as now there are factors other than the domestic output or unemployment, which may be effecting domestic inflation considerably. The most important figuring out is increased openness, both in trade and finance. Recent literature has established the role of openness in the current dynamics of inflation[2]. This describes the fact that monetary policy besides taking into consideration the classical domestic factors has to be vigilant to the impacts of increased openness as well. However, the determination of the slope of Phillips curve and the impact of globalization under such a situation is pertinent from the point of view of both central bankers and academics, as per Temple (2002) open economy macroeconomic models advocate that the slope of such a trade-off should be related to the extent of openness. This is an interesting part of this debate, and provides a motivation for our investigation.

Inflation process has recorded significant developments over the recent past. Inflation dynamics have not remained the same after the recent current wave of increased global trade over the last two decades. The changed environment of reduced trade barriers to the international trade has put new challenges to the contemporary monetary policy of the central banks, placing doubts on the credibility of the monetary policy and may lead to extrapolate the downward inflation bias.

Removal of trade barriers among economies of different sizes and structures unveils various issues. The observation that greater openness places an impact on domestic inflation and on the dynamics of domestic inflation process, leads to the issue of relevancy of the central banks' monetary policy to check inflation. Although it is established among the economists that the long run inflation is a monetary phenomenon and is controlled by the central bank, the short run fluctuations in inflation are attributed to various factors, including the non-monetary factors as well.

There is rich literature on the determination of these factors and as described that globalization has been found one of those, a negative impact of greater openness on inflation has been established[3]. This observation has been retrieved from various empirical studies based on the augmented Phillips curve, as it is customary to bank on Phillips analysis to investigate the relationship between inflation and unemployment or output gap. However, from the point of view of central banks it is still to be disclosed that what would be the

[2] For details see Romer (1993), Ball (2006), and Daniels *et al.* (2005) among others.
[3] For details see Badinger (2009); Ball (2006); Temple (2002) and Romer (1993).

reaction of increased openness to inflation in the presence of convex Phillips curve and in either scenario what lessons it holds the for monetary policy.

These questions widen the scope of this study, as the objective is not just to replicate the impact of increased openness on inflation, but to go a step further to investigate the response of inflation to openness under the condition of a non-linear Phillips curve[4]. This is one of the contributions of this chapter, as this aspect of globalization-inflation relationship has not yet been studied. Furthermore, it is also an endeavor to find out if there are any guidelines for the contemporary monetary policy.

Customarily, an unemployment and inflation relationship falls under the umbrella of Phillips curve; however, the slope of such a curve is under mounting criticism. Contrary to Kuttner and Robinson (2008), flattened Philips curve, we document here the conduct of inflation towards globalization in the presence of a convex Phillips curve. The determination of the slope of the Phillips curve is a dire requirement for the framers of monetary policy, as in the event of it being convex, reveals the fact that excess average inflation arises because in a stochastic convex economy, average unemployment exceeds its natural rate (Laxton *et al.*, 1999).

Slope of the Phillips curve, if convex, reveals that a decline in unemployment at its higher levels would cause a smaller rise in inflation than it does at its low levels. This makes the specification of central banks loss function more important. It is common with the central banks to follow an opportunistic monetary policy based on asymmetric loss function, under a linear Phillips curve (Gordon, 1997). This implies that generally central banks in their reaction are more aggressive towards inflation to bring it down to the target, but passive towards the unemployment level. Whereas the recent research advocates the convexity of Phillips curve (Tambakis, 2009) and an established impact of openness on inflation, it thus provides ample space to analyze one in relation to other. That is, we believe that inflation-openness nexus under a convex Phillips curve would bring more information on this subject.

Therefore, the purpose of this study is to explore the impacts of increased openness on inflation, provide that the slope of Phillips curve is convex. We identify the behavior of inflation with regard to openness under various circumstances depending on the cycle of the

[4] By nonlinearity we mean convex and not a concave Phillips curve here.

economy. We show that under a convex Phillips curve increased openness places a negative impact on inflation through variations in the domestic and foreign propensities to import.

This chapter is organized in a way that section 2 describes a brief background of the issue; section 3 includes a review of part of the existing literature on the issue; section 4 explains the convexity of Phillips curve. Section 5 describes the theoretical model and explains different aspects of the relationships thereof, while section 6 concludes.

2. Globalization-Inflation Relationship in Retrospect

Although the inverse relationship between inflation and unemployment was unveiled initially by Irving Fisher in 1920, the relationship between money wages and unemployment was formerly first established by William Phillips (1958). However, the conjecture of Phillips that the lower unemployment would lead to higher inflation and vice versa has been questioned in the recent era. It has been found that currently inflation has become less responsive to the fluctuations in output and unemployment (Kuttner & Robinson, 2008). This observation indicates a flattening Phillips curve.

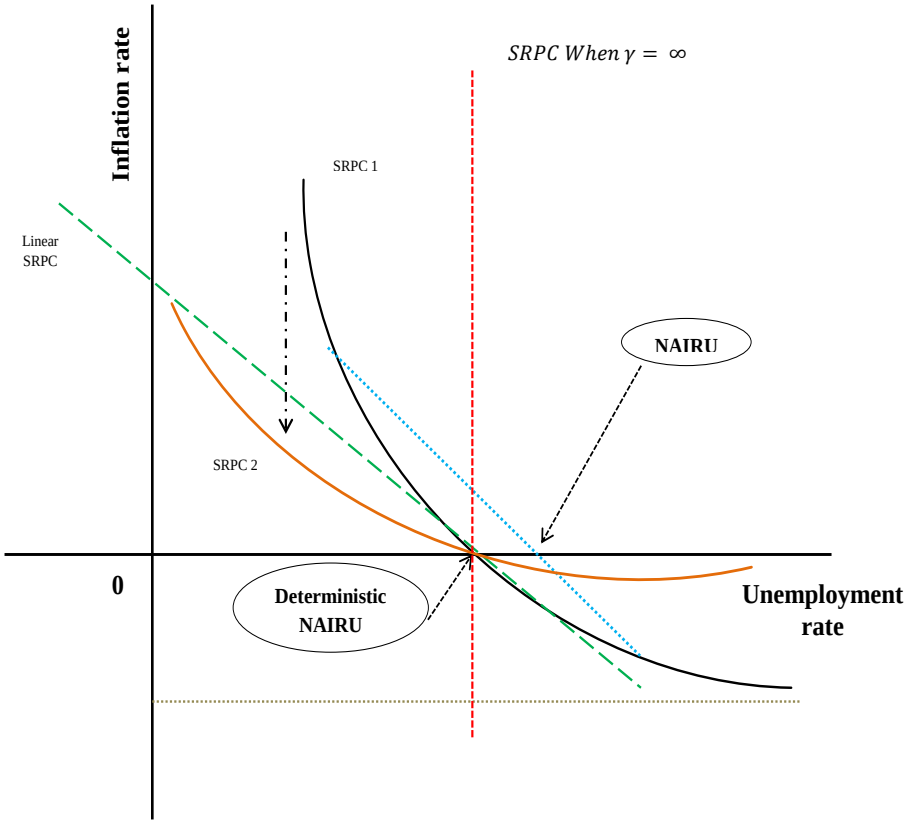
Another argument for this flattening Phillips curve could be that the sticky prices and wage rigidity could result in the short term trade off between output and inflation. In the other case, if the nominal prices and wages were flexible, it would be a classical dichotomy where the monetary policy would be highly effective in controlling inflation but would have nothing to do with output volatility. However, the slope of this trade off where on one hand could be linked to the institutional aspect of wage-setting mechanism (Beaudry & Doyle, 2000) could be supposedly related to the average rate of inflation (Ball, Mankiw & Romer, 1988) provide the evidence that the short run trade-off was flatter in low inflation countries rather than in high inflation ones. Phillips curves may be flatter when the inflation rate is low, as in times of low inflation the prices would be less responsive to the output fluctuations; however, it might not always be true (Bakshi, Khan & Rudolf, 2004).

One observation that we get from the so far studies on this subject is that mostly the debate and the research are still restricted to the classical mechanism, and to the idea of relatively closed economies. In the current age of growing international trade it would be leading to partial conclusions if ignored the impact of globalization on the slope of Phillips curve and in turn on the dynamics of inflation. One limitation of Kuttner and Robinson (2008) is that while pointing out the two stages of reduced-form output-inflation nexus they take into account the

cost-push cause of inflation and ignored the demand pull cause, where a significant feature of this source is the increase in the price level in the rest of the world. In the preview of enhanced competition, integration of labour and capital markets and the convergence of single global market, the impacts of a variation in the economic activity or inflation in one corner would sound louder in the other as compared to the past.

The rationale behind this flattening of the Phillips curve is sometimes given in relation to globalization, based on the assumption that increased goods and labour movement across border without tariff barriers would de-sensitize inflation from domestic demand pressures (Lakova, 2007).

Figure 1. Phillips Curve



The second reason behind the reduced dependence of inflation on the output gap changes could be the effect of globalization (Borio and Filardo, 2007). It means that in the recent wave of reduced trade barriers and increased international trade could desensitize the domestic inflation from the impacts of over or under-heating of the domestic economy to a greater extent. As currently there is a greater role of international factors impacting the domestic

inflation, this fact has serious consequences for the monetary policy: (i) as the policy makers would not need anymore to indulge into a Speed Limit Policy, what so ever be the rise in output; and (ii) that the low level of unemployment as a consequence would be less inflationary.

However, as Mishkin (2007b), observes that the debate so far on the issue of a less responsive inflation to the economic activity was based on mere correlations and not on the true structural relationships. And in the support yet another opinion that the short-run inflation – unemployment trade off may be driven by a convex Phillips curve (Tambakis, 1998). This may not be taken as a divergence from the earlier argument of the external factors' impact that leaves inflation less sensitive to the variations in the domestic output gap; rather it is the structure, size and strength of economies that figure out this difference. The stronger an economy, the higher is the inflation sensitivity to the domestic factors. It is said that over the last few years short run Phillips curve remained nonlinear (Clark, Laxton & Rose, 1996), that is a rise in inflation results in a greater decline in unemployment at high unemployment levels than it does when unemployment is already at low levels (see figure 1). This implies that in a stochastic economy observing a convex Phillips curve if requires to keep average inflation stable, it would need minute rise in unemployment during the period of low inflation and vice versa. As under a convex Phillips curve the NAIRU (non accelerating inflation rate of unemployment) retains a deterministic rather than a random setting (Tambakis, 1998). This observation brings the debate regarding the slope of the Phillips curve to an interesting juncture, and provides strong impetus to this study.

Secondly, we observe that the existing literature regarding the inflation-unemployment trade off remain limited either to analyze the shape of Phillips curve (Tambakis, 2008; Kuttner & Robinson, 2008) or to study the impact of globalization on the Phillips curve or inflation in the perspective of a linear or flatter Phillips curve (Beaudry & Doyle, 2000; Davis, 2009). However, still a lacuna remains to study the impact of openness in the presence of a convex Phillips curve, and the analysis of this curb is the subject matter of this paper.

3. Literature Review

Inflation behavior is a perennial topic for the policy framers in general and for the central bankers in particular. Inflation dynamics have registered a change over the last two decades particularly with the advent of increasing trade and financial openness. And since then the

researchers are eager to find out the exact mechanism and the magnitude of the openness pass-through of inflation. In this regard the path breaking work of Romer (1993) opens up the fact that openness causes a decline in inflation. This claim has been supported later on by the others (Lane, 1997). Later on, Terra (1998), made a new assessment of the inflation-openness nexus on the same lines as that of Romer (1993), and confirmed the negative relationship. In addition, this observation was further supported by Razin and Loungiani (2005); Chen *et al.* (2004); to some extent by Ball (2006) and Temple (2002); yet there is some evidence in contrary as well. For instance Ihrig *et al.* (2007) finds no evidence in support of the negative impact of greater openness on inflation. This makes it interesting to explore the important studies in this regard so as to find out the basis of this different observation.

Nevertheless, while the determination of globalization –inflation relation is important in its first place, it is also of vital importance from the point of view of policy makers to establish how it will impact the Phillips curve. The shape of the Phillips curve has serious implications for central banks, since it is the slope of the Phillips curve that guides towards the required changes in the central bank loss function and determines consequently the design of monetary policy. In this regard, recent literature casts doubts on the slope of Phillips curve. Where some support the flattening Phillips curve, as described in the earlier sections of this paper; Dupasquier and Ricketts (1998), study the non-linearity of the Phillips curve, by taking into account five different models[5] and find a strong evidence of non-linearity for the US economy. Clark, Laxton and Rose (1996), Schaling (1999), Laxton, Rose and Tambakis (1998), Tambakis (1998), Bean (2000) also explored the convexity of Phillips curve. It implies that the stronger an economy the weaker would be the sacrifice ratio as the slope of Phillips curve though convex steepens in the strong economies. Filardo (1998) does not advocate a single slope of the Phillips curve, but holds evidence for its varying shapes subject to the economic cycle. He finds that when the output gap in an economy is positive, the Phillips curve is convex. This evidence supports the puzzling nature of this subject. Therefore to have a comprehensive overview below we summarize some of the important studies on this subject (see table 1).

[5] These models include the capacity constraint model, the costly adjustment model, the misperception model, the downward nominal wage rigidity model and the monopolistically competitive model.

Table 1. Literature Review

S.No	*Author & Title*	*Data & Methodology*	*Key Results*	*Brief Findings*
1	Romer (1993), 'Openness and Inflation: Theory and Evidence'	Data on 114 countries, since 1973. Regressing log of average inflation on openness. The control variables used: real per capita income as a proxy to general measure of development; dummy variables for OECD membership and different regions and dummy variables for CPI as GDP deflator to measure inflation.	The results show a negative and significant relation between inflation and openness. The link between openness and inflation is weaker in relatively politically stable countries with more independent central banks. The study does not find any link between openness and inflation among the highly developed countries. Average inflation rates of inflation are lower in smaller open economies.	Although the results provide no evidence, however, that the possible endogeneity of the import share is the source of a negative association between openness and inflation, country land area and population are chosen as instrumental variables to control for the issue endogeneity of openness. Romer (1993) observes a steeper Phillips curve in open economies. The theoretical rationale that he provides is that the more an economy is open it leads to unanticipated monetary expansions resulting in real depreciation, which may translate into higher inflation through higher import prices. In this case the output is not inflationary leaving smaller cushion to the policymaker to inflate. In this way he shows that an absence of pre-commitment in monetary policy can lead to inefficiently high inflation. However, in addition to the monetary policy pre-commitment he also considers the government budget financings and seignorage, for this negative association between openness and inflation.
2	Terra, C.T. (1998), 'Openness and Inflation: A New Assessment.'	Data on 114 countries over a period of 1973 – 1990.	As the study a replication, so it finds the same results as that of Romer (1993: negative impact of increased openness on inflation.	This study followed Romer (1993), however, it divides the sample into four groups according to indebtedness level. Also the timeframe was separated into two periods: the pre-debt crisis period from 1970 to 1981, and the debt crisis period from 1982 to 1990. Terra adds to the results found in Romer (1993) that the negative impact of openness on inflation may largely be driven by the data of heavily indebted economies.

Table 1. Continued...

S.No	*Author & Title*	*Data & Methodology*	*Key Results*	*Brief Findings*
3	Romer (1998), 'A New Assessment of Openness and Inflation: Reply.'	A reply to Terra (1998).	He concludes that the channel that Terra proposed accounts for only a modest part of the overall relation. The study does not satisfy its claim.	Romer critically responds Terra on the basis of two main arguments: (1) Terra (1998), reports the negative relation between openness and inflation which is large and significant for the highly indebted countries in the pre-crisis period, yet weaker during the crisis period. This negative relation is also found in the less indebted countries. Therefore the study does not satisfy its claim. (2) The uthor criticizes Terra's mechanism on conceptual and empirical basis. In fact, there is no evidence that the highly indebted countries could run larger can run a trade deficit. Whereas Terra's mechanism operates in contrary, as according to her mechanism, indebted countries need to run trade surpluses to repay their debts.
4	Temple (2002), 'Openness, Inflation and the Phillips Curve: A Puzzle.'	With a smaller sample than the OECD, Temple uses the data of imports share to GDP as openness variable, a structural dummy for post 1972 periods, inflation and sacrifice ratios.	This study records a slight impact of openness on inflation yet with high degree of uncertainty.	The study mentions doubts on the strong influence of openness on the Phillips curve. Temple also describes that output-inflation trade-off may vary depending on the forces driving the change in output and employment; whereas one possibility could be that openness impacts the output-inflation trade-off mostly during expansions, rather than during a disinflation.
5	Razin and Loungani (2005), 'Globalization and Disinflation: The Efficiency Channel.'	Annual data on 19 OECD countries over the period 1960-1987. Variables include: the annual inflation rate, output, current account restriction, capital account restriction, and sacrifice ratio.	The study concludes that globalization lowers inflation. It observes that the central banks of a globally integrated economy are more inclined towards inflation surveillance than that of the output management due to the integration of capital and goods markets.	They introduced the marginal rate of substitution between the output gap and inflation in this paper. The purpose of using this rate was to explain how globalization forces induce monetary authorities to place greater emphasis on reducing the inflation rate than on narrowing the output gap. They find that when trade and financial openness increase, policymakers that are driven by efficiency considerations become more aggressive on inflation and less responsive to the output gap.

Table 1. Continued...

S.No	*Author & Title*	*Data & Methodology*	*Key Results*	*Brief Findings*
6	Lane (1997), 'Inflation in Open Economies.'	Cross country data of 114 countries from 1973 to 1988 is used in linear regressions. The study uses average inflation rate as a dependent variable and regresses it on the share of imports in GDP, total GDP, and a set of control variables including political instability and per capita income. Natural openness, as constructed in Lee (1993), was used as the measure of trade.	The results depict a negative correlation for the whole sample as well as the OECD sample. As the data was divided in two grouped of wealthy economies and the OECD. The study extended Romer (1993) and find that in a more open economy the gains to surprise monetary expansion and, thus, the incentives to inflate, are lower. Moreover, the openness effect is strengthened after controlling for country size.	Lane explains that as a more open country suffers more from the negative terms of trade, it gains less from surprise inflation. He also claimed, however, that the negative relation between inflation and trade openness holds not only for large countries, but also for economies too small to affect international relative prices.
7	Ihrig, Kamin, Lindner and Marquez (2007), 'Some Simple Tests of the Globalization and Inflation Hypothesis.'	Data on 11 industrialized countries to estimate a standard Phillips curve, using net exports, GDP, and inflation data.	The study does not establish any evidence to support globalization effects on inflation.	They argued, however, that globalization may affect inflation through another channel, that of net exports. It concludes that globalization affects net exports and, hence, it may help stabilize real GDP, output gaps and inflation, or might allow domestic demand to fluctuate without destabilizing GDP.
8	Chen, Imbs and Scott (2004), 'Competition, Globalization and the Decline of Inflation.'	Two data-sets were investigated, both focusing on EU manufacturing data. One dataset included eight countries and twenty-one industries from 1988 to 2000, which did not contain markups. The other dataset included seven countries and ten industries from 1989 to 1999 and markups were included in the data.	This analysis suggests that, in the short run, openness and prices have a negative relationship while in the long run, openness mainly works through productivity. Estimations of this data show that the effects of openness are transmitted via both productivity and markups, where productivity was found to play a dominant role in affecting prices.	This paper includes monetary and fiscal policy effects, and besides that greater openness was also considered as a factor that reduces inflation. It defines two channels through which globalization effects inflation: markups and productivity. The study concludes that if the monetary policy remains unchanged, with the fall in markups and the rise in productivity being induced by increased import shares results in reducing aggregate inflation.
9	Daniels and VanHoose (2006), 'Openness, the Sacrifice Ratio and Inflation: Is there a Puzzle?'	Coubb-Douglas approximation applied, using the parameters of income, inflation, exchange rate, domestic and foreign propensities to import.	The study concludes that greater openness increases the sacrifice ratio.	The study confirms the earlier observations regarding the inverse relationship between openness and inflation

Table 1. Continued...

S.No	*Author & Title*	*Data & Methodology*	*Key Results*	*Brief Findings*
10	Tambakis (2008), 'Optimal Monetary Policy with a Convex Phillips Curve.'	The data from 7 developed countries over the period 1986-2006. The variables include inflation, natural rate of unemployment, annual rate of unemployment, minimum rate of unemployment and various parameters.	The analysis shows that convexity of short run Phillips curve is a source of positive inflation bias when the policy makers target the natural rate of unemployment.	The paper suggests that optimal monetary policy induces positive co-movements between average inflation, average unemployment and inflation variability and positively skewed unemployment distributions.
11	Lo and Granato (2008), 'What Explains Recent ...: Evidence from Developed Countries.'	The data of the developed countries over 1957-2004, regressing cross country inflation shock die-out-rate over economic openness.	The study finds out a negative impact of openness on the inflation.	The authors link the inverse impact of openness on inflation to the aggressiveness of monetary responses during the period of 1990s.
12	Badinger (2009), 'Globalization, the Output-Inflation Trade-off and Inflation.'	Over a period of 1985-2004, this study uses the data of 91 countries for instrumental variable regression. Inflation (GDP Deflator), GDP (nominal & real), financial openness, political instability	The study finds an inverse relation between openness and inflation. In this way it confirms earlier findings in this regard. It reports that one percent increase in economic openness would lead to 0.2 to 0.4 percent decline in inflation.	However, the study does not establish any robust relation between openness and inflation for subsample of 25 OECD countries. The rationale behind this result, the study reveals, is that the global disinflation over the recent past decades was mainly due to the improved inflation performance of developing rather than the highly developed countries.
13	Ball (2006), 'Has Globalization Changed Inflation?'	The data on 14 industrial countries over the period 1985-2005. Variables include: inflation and output gaps.	The study finds that the foreign output variations place no significant impact on the domestic inflation. It concludes that it was hard to support if globalization had changed the structure of long-run Phillips curve.	Although the analysis rejects the impact of openness on inflation, it acknowledges that globalization has changed the magnitude of coefficient of domestic output gap in relation to inflation. However, it states that financial openness may have an impact on inflation, yet an indirect one.
14	Bowdler (2009), 'Openness, Exchange Rate Regimes and the Phillips Curve.'	Data on 41 countries for different periods, i.e., 1948-86; 1973-86; 1981-1998. Panel regressions.	The study finds evidence that increased openness has a positive impact on the slope of Phillips curve.	The paper emphasizes on Phillips curve relationship with trade openness in relation to the exchange rate regime. It measures the Phillips curve slope using data from only the 1980s and 1990s. Evidence from both output-inflation trade-offs and sacrifice ratios indicates that openness has a positive effect on the slope of Phillips curve; however, this relationship is evident during the post-1980 period. The study supports this result in a way that since 1980s the macroeconomic management was less inclined towards fiscal policy and direct inflation controls, which are likely to undermine a relationship between openness and the Phillips curve slope.

Apart from the review compiled above, there is still enough to be included which is relevant to the subject. This while reveals the importance of this matter; it also describes the controversy in this issue. While Romer (1993), Razin and Loungani (2005), Lane (1997), Chen *et al.*, (2004), Lo and Granato (2008), Badinger (2009), and others find a negative impact of openness on inflation, Ball (2006), Temple (2002) remains uncertain over it, while some find no evidence at all in this regard. Where most of the studies establish the existence of a negative relationship between openness and inflation, slope of the Phillips curve remains still a question to be answered.

In this regard, we observe that while it remains customary to estimate a Phillips curve relationship to analyse inflation-openness relationship, there is less evidence that the slope of Phillips curve has also been taken into consideration, while analyzing this nexus. However, Romer (2003) indicates a steeper Phillips curve while revealing a negative inflation-openness relationship, few for the same support a flatter curve (Davis 2009; Lakova 2007). Nevertheless, Tambakis (2008) establishes the existence of a convex Phillips curve and advocates the dominancy of symmetric loss function over alternative loss function, which is to some extent in line with the Walsh's Speed-limit Policy.

4. Convexity of Phillips Curve

The relationship between unemployment and inflation opened a new chapter in the field of macroeconomics; however in its micro-foundations it describes a simple and visible trade-off. In a scenario of downward rigidity of wages, high rate of unemployment offers an incentive to the firms to lower the wages; which they would not be able to do otherwise over a period of low unemployment. Rather during a period of low unemployment would result in disproportionately high rises in the wages (Shapiro & Stiglitz 1984). A simple linear Phillips curve presents this relationship as following equation:

$$\pi_t = \pi_t^e + \gamma(u_{gap}) + \varepsilon_t \qquad (1)$$

Here π_t is the actual inflation, π_t^e represents the inflation expectations, the term γ symbolizes the constant slope of the Phillips curve, and (u_{gap}) is the unemployment gap, which is the difference between natural and actual rate of unemployment. The term ε_t is the

random disturbance term with a zero mean and constant variance, including other factors that could effect inflation at different moments[6] but not explained by the explanatory variables.

However, as per the scope of this paper, we adopt the slope of a nonlinear or more specifically convex Phillips curve as per Tambakis (2008), similar to that of the Debelle and Laxton (1996) and Laxton, Rose and Tambakis (1997):

$$\pi_t = \pi_t^e + \gamma \frac{u^N - u_t}{u_t - \varphi} - \varepsilon_t \qquad \text{Where } \gamma < 0 \tag{2}$$

Here $\pi_t \; and \; \pi_t^e$ and ε are the same as defined as in equation 1; however, u^N is the natural rate of unemployment; u_t is the actual rate of unemployment, and the term φ is the minimum unemployment, and its value is higher than 0 but lower than the natural rate of unemployment, and γ represents the horizontal asymptote defining the maximum unanticipated deflation if excess supply becomes unbounded.

The convexity of the Phillips curve denies the impartiality of inflation from the exogenous shocks. It implies that any stochastic shock to the economy consequently fluctuating inflation would lead to a variation in unemployment from its natural rate (see Figure 1). As per Tambakis (2008) differentiating equation (2), explains the original Phillips curve's claim that if the unemployment rate goes below its natural rate, the cost push inflation would grow more than it would grow if the unemployment rate falls at high levels. Such as:

$$\frac{\partial u_t}{\partial \pi_t} = -\frac{(u_t - \varphi)^2}{\gamma(u^N - \varphi)} < 0 \tag{3}$$

This traces back the issue to the original Phillips curve conditions; however, as per scope of this study one important observation is that in the literature this habitude of Phillips curve has not been discussed in the context of recent economic up and downs due to the globalization strategy.

5. Non Linear Phillips Curve Facing Globalization

The role of globalization as a check on inflation has recently attracted attention (Ball, 2006; Rogoff, 2006). Inflation process has been under a continuous change and it is true that inflation in both the developed and the emerging economies has witnessed a sharp

[6] These factors may include the external shock (oil price hikes), and the exogenous wage variations.

deceleration since the 1980s, and that it remains subdued, despite temporary spikes in the prices of liquid fuels and / or raw materials. The parallelism between the recent globalization wave and the reduction in inflation has led to a perception that the determinants of the slowdown in inflation were not only the domestic ones but could also be part of the fruits of globalization.

Taking into account the liberalization and deregulation of markets (Loungani & Razin, 2005), the international competition leading to higher productivity growth, an increased labour supply and the resulting check on wage pressures (Borio & Filardo, 2006), sound fiscal policies (IMF, 2006) and the improved governance of monetary authorities (Crowe and Meade, 2007), one can depict several factors that may have led to the fall of inflation across countries. Such trends thus reinforce the links between openness and inflation that were notably exhibited by Romer (1993) and Lane (1997).

Although the literature is rich on the relationship between globalization and inflation, it is silent when the question comes to the existence of the same relationship in the presence of a non-linear (convex) Phillips curve. In this regard, we take the Cobb-Douglas approximation as used by Daniels and Van Hoose (2006):

$$y = \mu(p^* + s - p) + (1 - \beta)y + \beta^* y^*$$

Here the fraction β is the domestic and β^* is the foreign propensity to import; p is the log of aggregate domestic and p^* is the foreign price level. While y is the log of aggregate domestic while y^* is the foreign output. And μ is the real exchange rate elasticity of the desired spending.

As the above equation is based on the variables at log level, therefore to get a growth rate we take the first difference of the variables:

$$y - y_{-1} = \mu(p^* - p^*_{-1} + s - s_{-1} - p + p_{-1}) + (1 - \beta)(y - y_{-1}) + \beta^*(y^* - y^*_{-1})$$

We get:

$$\dot{y} = \mu(\dot{p}^* + \dot{s} - \dot{p}) + (1 - \beta)\dot{y} + \beta^* \dot{y}^*$$

$$\dot{y}[1 - 1 + \beta] = \mu(\dot{p}^* + \dot{s} - \dot{p}) + \beta^* \dot{y}^*$$

As $\dot{p} = \pi_t$ so it could be written as:

$$\dot{y}[\beta] = \mu(\pi_t^* + \dot{s}_t - \pi_t) + \beta^* \dot{y}^* \quad (4)$$

Equation 4 shows a reduced Cobb-Douglas form model; however, to take into account the impact of unemployment we assume a short-term production function of the type given in Daniels and Van Hoose (2006), where labour is the only factor of production:

$$y = \alpha l$$

Here unemployment could be stated as the difference of population with the employed labour force:

$$u_t = 1 - l$$

Replacing l with the value in the preceding equation:

$$u_t = 1 - y_t/\alpha$$

Further, it could be simplified as:

$$y_t = \alpha(1 - u_t)$$

As this equation takes the levels of unemployment rate, so we change it to the growth rate in unemployment. Taking the lag of the preceding equation:

$$y_{t-1} = \alpha(1 - u_{t-1})$$

Now taking the first difference:

$$\dot{y}_t = -\alpha \dot{u}_t \quad (5)$$

Replacing $\dot{y}_t$ from equation 5 in equation 4:

$$-\alpha \dot{u}_t \beta = \mu(\pi_t^* + \dot{s}_t - \pi_t) + \dot{y}_t^* \beta^*$$

$$\dot{u}_t = -\frac{\mu}{\alpha\beta}(\pi_t^* + \dot{s}_t - \pi_t) - \dot{y}_t^* \frac{\beta^*}{\alpha\beta} \quad (6)$$

As equation 2 is also in its level form, so we convert it to first difference, taking its lag and subsequently the first difference gives the following equation:

$$\dot{\pi}_t = \dot{\pi}_t^e + \gamma\left[\frac{u^N - u_t}{u_t - \varphi} - \frac{u^N - u_{t-1}}{u_{t-1} - \varphi}\right] - \dot{\varepsilon}_t \quad (7)$$

Further simplification gives:

$$\dot{\pi}_t = \dot{\pi}_t^e + \gamma\left[\frac{\dot{u}_t(\varphi - u^N)}{(u_t - \varphi)(u_{t-1} - \varphi)}\right] - \dot{\varepsilon}_t \quad (8)$$

Replacing the value of $\dot{u}_t$ from equation 6 in equation 8:

$$\dot{\pi}_t = \dot{\pi}_t^e + \gamma\left[\frac{(\varphi - u^N)}{(u_t - \varphi)(u_{t-1} - \varphi)}\{-\frac{\mu}{\alpha\beta}(\pi_t^* + \dot{s}_t - \pi_t) - \dot{y}_t^*\frac{\beta^*}{\alpha\beta}\}\right] - \dot{\varepsilon}_t$$

We arrive at:

$$\dot{\pi}_t = \dot{\pi}_t^e + \gamma\frac{(\varphi - u^N)(\mu(\pi_t - \dot{s}_t - \pi_t^*) - \dot{y}_t^*\beta^*)}{(u_t - \varphi)(u_{t-1} - \varphi)\alpha\beta} - \dot{\varepsilon}_t \quad (9)$$

The model reveals various interesting features. Here the rate of change of inflation depends not only on the expectations, but as a classic Phillips curve it is also subservient to the variations in the variations in unemployment. Here we relax the condition for the value of φ, as per our baseline model, we consider its value higher than the natural rate of unemployment[7]. Therefore, *ceteris paribus,* if due to some reasons, which in most cases could be the short term capacity constraints as figured out by Tambakis (2008) as well, the natural rate of unemployment fall even below the economy's minimum, then any shock to inflation in a stochastic economy, would push the current unemployment rate higher than the natural rate, and this is the vital identification of the convexity of Phillips curve. Here the γ being a negative term, reflects the curvature of the Phillips curve as if it becomes infinite, the Phillips curve becomes vertical.

Moreover, the model positively takes into account the import propensities and the impact of variation in the foreign output $\dot{y}_t^*$. The impact of these variables and that of the exchange rate as well is explained in the section ahead. Nevertheless, it could still be claimed that the model is inline with the earlier findings starting from Romer (1993) that rising foreign output rate would help reducing inflation, with the propensities to import playing a key role in channeling this effect of globalization.

[7] We consider the scenario where the domestic general price level increases, it leads to an increase in the domestic inflation, which is understandable and reflects the reliability of the model. $\frac{\partial \pi_t}{\partial \pi_t} = \frac{\gamma\mu(\varphi - u^N)}{(u_t - \varphi)(u_{t-1} - \varphi)\alpha\beta} > 0$

5.1. Slope of the Phillips Curve

While coming to the slope of the Phillips curve as derived in this study, it implies that the sacrifice ratio is not constant and the inflation and unemployment trade-off improves continuously over time. Differentiating equation 9, the slope of Phillips curve is

$$\frac{\partial u_t}{\partial \dot{\pi}_t} = -\frac{[(u_t-\varphi)(u_{t-1}-\varphi)\alpha\beta]^2}{\gamma[(u_{t-1}-\varphi)\alpha\beta]\left[(\varphi-u^N)\{-\mu(\pi_t^*+\dot{s}_t-\pi_t)-\dot{y}_t^*\beta^*\}\right]} < 0 \qquad (10)$$

It reveals that an excess demand for labour would decline the unemployment rate below its minimum, which would result into a rise in the wage inflation; the causality may run in both or any direction. This is in line with the structural state-dependence as suggested by in Phillips (1958). However, at the same time, it indicates a distinction from the contemporary studies on this subject, as the earlier studies, although take into account the non-linearity of Phillips curve, ignore the impact of openness in this relation. Openness could impact inflation via an effect on unemployment in a globalized environment. Increased globalization leads to an improved employment rate thus reducing domestic inflation, provided that the economy has the export potential. However, this would depend on the value and variations of φ in the economy and its proportionality with the natural and current rate of unemployment.

5.2. Inflation – Openness Nexus under a Convex Phillips Curve

5.2.1. Openness and Inflation

Increased openness impacts the domestic output and consequently inflation through various channels (see Chapter 4). This rise in output growth places an impact on inflation which is explained in the following equation taking the first order derivative of the domestic inflation as a function of foreign output.

$$\frac{\partial \dot{\pi}_t}{\partial \dot{y}_t^*} = -\frac{\gamma\beta^*(\varphi-u^N)}{(u_t-\varphi)(u_{t-1}-\varphi)\alpha\beta} \quad < 0 \qquad (11)$$

Increased openness has a warming impact on economies with a potential to export; and consequently, this increased economic activity has the negative impact on unemployment rate; firms finding themselves in an increasingly competitive environment would be ready to hire the labour force to meet the global market requirements. This economic activity would bring labour force to the market keeping in view the effect of relaxed barriers in the goods and

labour markets globally. Here two effects could be noted; firstly, as per the existing literature (Shapiro & Stiglitz, 1984; Tambakis, 2008), influx in the labour market would empower the firms to decline the wages, resulting in cost pull decline in inflation. Here the model also confirms import price channel of globalization, where cheap imports from the low cost countries help lowering the inflation in the high cost importing countries provided that $\varphi > u^N$. Even, ignoring this effect as it may show up in a long run; the strong demand for labour in the competitive environment would raise the wages, at least the number of employed force, and by improving the purchasing power of many, it would result in demand pull inflation. However, later on once the things cool down to a stable situation, the firms would find them in a strong bargaining position, and this would lead to new scenarios.

Nevertheless, it is pertinent to note here that economies moving from a recession to an increased economic activity would be observing a decline in inflation as a result of increased openness; while the countries enjoying a rate of unemployment already lower than the minimum would find a rise in inflation (see Table 2). As discussed above that the economies having a potential to export on the back of increased openness would observe a boost domestically and this increased economic activity would have a positive impact on inflation domestically. Therefore, to observe the impact of increase in β on the inflation-output relationship we differentiate equation 10 with respect to β:

$$\frac{\partial^2 \ddot{\pi}_t}{\partial \ddot{y}_t^* \partial \beta} = \frac{\gamma \beta^* (\varphi - u^N)(u_t - \varphi)(u_{t-1} - \varphi)\alpha}{[(u_t - \varphi)(u_{t-1} - \varphi)\alpha\beta]^2} \quad > 0 \qquad (12)$$

The model explains here that increased openness increases the terms of inflation-output trade-off. Intuitively, we explain here the pattern of unemployment levels being impacted by the globalization; as the impact that it would place would be different depending on the structure of the economies in question. At a first instance it leads to an increased economic activity in the potentially exporting economies, thus decreasing unemployment and giving rise to inflation on the back of both the reduced unemployment as well as rising economic activity. However, it would also have a different impact on the high cost countries. As in this case it would give rise to the increased import intensity leading to a reduction in inflation due to the low cost imports. Here we explain this fact through the relationship between β^* and the domestic inflation in the debate ahead. However, this issue requires an in-depth exploration, as the low cost economies because of the cheap labour would not enjoy an ultimate dominancy due to increased openness, as the high cost economies would still retain the

advantage of producing the high-end products as an equilibrant on their balance of payments with respect to the countries with low-end production. Our observation is in conformity with the Daniels and VanHoose (2006), where they conclude that increased openness would decrease the average inflation.

5.2.2. Domestic Vs Foreign Price Level

Nonetheless, this does not explain impact of increasing inflation in the rest of the world on the domestic economy. Taking a first order derivative of equation 9 as a function of the inflation in the rest of the world reveals that globalization results in a divide in the economies based on their structures, sizes and comparative advantages. Leading back the argument to the import price channel, on the whole it leaves us with two kinds of economies: the low cost exporting economies, and the high cost importing economies. In this short run picture, the relationship between inflation in between these two kinds would be negative. As the gains in low cost economies due to increased economic activity would result into lowering of unemployment and an upward push to inflation, while on the contrary it would lower inflation in the high cost importing countries[8].

$$\frac{\partial \dot{\pi}_t}{\partial \pi_t^*} = -\frac{\gamma\mu(\varphi - u^N)}{(u_t - \varphi)(u_{t-1} - \varphi)\alpha\beta} \qquad < 0 \text{ where } \varphi > u^N \tag{13}$$

However, in case of economies moving out of a recession, the improved level of employment and increasing competition in the labour and goods markets both domestically and internationally, keeps the potential to change the scenario. For instance: If $\begin{Bmatrix} u^N \\ u_t \end{Bmatrix} < \varphi < u_{t-1}$ resulting into $(u_t - \varphi)(u_{t-1} - \varphi)\alpha\beta < 0 \; and \; \therefore \frac{\partial \dot{\pi}_t}{\partial \pi_t^*} > 0$

Nevertheless, this assumption does create certain ambiguities, as in this case it is not only the economies going out of recession but the contrary would also be facing the same situation. This is in fact due to the unexplained variables in the model, where the real exchange rate elasticity of desired spending could play an important role and it is the actual sign of this variable which will explain the exact outcomes of this equation.

5.2.3. Inflation and Exchange Rate

The last equation not totally, but to a greater extent also ignores the direct impact of exchange rate movements on the back of import price channel. As increased openness would raise the imports from the low cost countries, this rising exports would depreciate the currency value in

[8] For further details regarding the globalization channels and their working, see Chapter 4.

the exporting countries and this will result a rise in inflation in such economies. On one hand the currency depreciation results in a surge in the import prices, thus leading to a reduced import base, which puts a boosting impact on national income. On the other hand as it has already been established that increased globalization would lead to higher economic activity raising inflation.

$$\frac{\partial \dot{\pi}_t}{\partial \dot{s}_t} = -\frac{\gamma\mu(\varphi - u^N)}{(u_t - \varphi)(u_{t-1} - \varphi)\alpha\beta} \qquad < 0 \quad \text{where } \varphi > u^N \tag{14}$$

However, as discussed that this scenario is hard to persist in the shorter long run. Two major factors are on the back of the possible diffusion of this effect. Firstly, the decreased value of local currency creates and enlarges the interest rate differential from the international market, leading to a move the gains of current account out, through the capital account. In a flexible exchange rate regime this would overrule the earlier depreciation and resultantly a downward tracking current would move towards the general price level in the economy.

Although the growing economic activity, depreciating the currency due to increased exports, would also decline the level of unemployment exceptionally. This influx of working hands in the labour market would shift the bargaining power to the firms and would put pressure on inflation due to the cost push factors.

5.2.4. Inflation and Exchange Rate Elasticity

The effect of variations in the real exchange rate sensitivity on inflation in the backdrop of a convex Phillips curve is:

$$\frac{\partial \dot{\pi}_t}{\partial \mu} = \frac{\gamma(\pi_t - \dot{s}_t - \pi_t^*)(\varphi - u^N)}{(u_t - \varphi)(u_{t-1} - \varphi)\alpha\beta} \qquad > 0 \tag{15}$$

In equation (10) the parameter μ puts an important condition while explaining the relationship. The value of μ, being considered a positive parameter, indicates the sensitiveness of expenditures on sector outputs to the variations in the real exchange rate. Increased sensitivity of output spending as a response to the exchange rate fluctuations would lead to acceleration in domestic inflation in the presence of globalization strategy, provided that the current rate of unemployment is more than the natural as well as the minimum rate of unemployment. This reflects the desired after-effects of the increased openness resulting in the enhancement of economic activity and consequently a rise in the number of jobs by the firms. We confirm here Daniels and VanHoose (2006) that the increased sensitivity of desired domestic spending pertaining to rise in the real exchange rate would result into variations in

the terms-of-trade, which results in larger effects on output. This while provides an incentive to the monetary authority to increase the domestic money stock to depreciate the domestic currency, would raise inflation in *ceteris paribus.*

5.2.5. Inflation and the Propensities to Import

Another important feature of our model, which is the epicenter of this study, is that while the propensity of the foreigners to import will improve the domestic unemployment, which would decline as per Phillips curve. And as it is discussed above that in the relatively longer term the domestic inflation would decline as a response to the decline in the unemployment rate as a result of the firms' behavior to reduce the wages due to the convenient availability of workers in the labour market. Here we observe this impact as follows:

$$\frac{\partial \dot{\pi}_t}{\partial \beta^*} = -\frac{\gamma \dot{y}_t^* (\varphi - u^N)}{(u_t - \varphi)(u_{t-1} - \varphi)\alpha\beta} \qquad < 0 \tag{16}$$

This observation is in conformity with the literature so far on this issue (see Romer, 1993; Rogoff, 2006). Openness on its face value would place a negative impact on inflation in the high cost importing countries, while consequently, it would lead to a rampant competition in the economics above board on the basis of comparative advantage, and would lead to a slowdown in overall inflation. Here it is note worthy that for any variation in β^* the foreign output rate would place a negative multiplier effect, on the domestic inflation. The impact of increased openness on a traditional convex Phillips curve relationship of inflation-unemployment trade-off could be studies by differentiating equation 10 with respect to β^* to obtain

$$\frac{\partial^2 \dot{\pi}_t}{\partial u_t \partial \beta^*} = -\frac{\gamma(\varphi - u^N)\dot{y}_t^* . \alpha\beta(u_{t-1} - \varphi)}{[(u_t - \varphi)(u_{t-1} - \varphi)\alpha\beta]^2} \qquad < 0 \tag{17}$$

Here equation 17 shows that higher openness places a positive impact on the inflation-unemployment trade-off. Increased openness would lead to a push to the economic activity in the low cost economies and with this push while the purchasing power would rise particularly in the exporting countries, but the impact would be registered everywhere. This follows directly from equation 16, where $\frac{\partial \dot{\pi}_t}{\partial \beta^*} < 0$ is an important outcome of this chapter in the context of an open economy. This is also consistent with the empirical evidence as witnessed in chapter 4 and in the existing literature (Romer 1993), that increased openness tends to put a downward pressure on inflation. Table 1 describes that the economies in transition from recession to recovery would observe a deceleration in short run inflation on the back of

enhanced openness, while for the economies with a rate already lower than the natural rate of unemployment globalization would be inflationary.

This is an implied observation that if the economies achieve a certain level of employment, it would raise the purchasing power of the society on the whole, and would raise the aggregate demand, resulting a surge in inflation. The increasing living standard of the workers would erode the earlier benefits of the low cost imports for the economies through out.

6. Conclusion

In this study we attempted to answer some of the question regarding the impact of globalization strategy on inflation in the presence of a non-linear Phillips curve. Besides confirming the earlier observations regarding the existence of a negative impact of openness on inflation, we establish that the import price channel, which is in fact the leading channel of globalization transmission mechanism9, is very much operative and visible.

In this regard, the Daniels and VanHoose (2006) observation of a greater openness having a negative impact on inflationary bias, while at the same time having a positive relationship with sacrifice ratio raises questions. And one important question that we answer here is that reduced trade barriers lead to a decline in inflation, even in the presence of a convex Phillips curve. This result has also a relevance to Tambakis (2008) contribution where the symmetric loss function with a convex Phillips curve may suppress inflation bias. However, our analysis implies that his findings could result mainly from the cross country differences in the extent of wage rigidity, i.e. the structure of the labour markets. Our model predicts that in the current scenario of increased openness, a non-linear symmetric loss function may still prevail but for the policy purposes, it necessitates to take into account some other important factors into account as well, including domestic and foreign propensities to import and the exchange rate sensitivity to inflation. In addition, the agglomeration of the international markets would result into an even more important role of exchange rate dynamics as a response to the rising international trade. Based on this consideration this factor would have a keen role in the future determination of inflation targets as well.

Furthermore, we show that in the presence of a convex Phillips curve any upward variation in the foreigners' propensity to import would place a downward pressure on inflation, provided

[9] For details see Chapter 4.

that the current and the lagged rate of unemployment is less than minimum unemployment rate; however, if the minimum rate of unemployment is below the natural rate ceteris paribus, it would turn the relationship to the inverse.

This result has important hints for the contemporary monetary policies. One inference could be drawn that as the external factors as openness is effecting domestic inflation, it makes monetary policy less relevant. However, we show that this is half truth: inflation-openness nexus makes monetary policy even more relevant than ever. However, it advocates a paradigm shift in the contemporary monetary policies of many central banks, claiming to target inflation.

Here it is necessary to add that though our model provides a general explanation to the impact of globalization under a convex Phillips curve, it doesn't explicitly differentiate the low cost economies from those of the high cost. Secondly, it doesn't provide information on the time lag between the action and impact of the increased globalization on economies whatsoever their size or structure. Our analysis being consistent with the inferences of the new open economy macroeconomics literature signals towards the probable drawbacks of the existing empirical work that does not take into account important structural differences across economies. Therefore, in chapter 4 we attempt to cope with this issue by taking into account not only a single pool of countries irrespective of their structure, but we estimate the same effect for different regional and economic groups.

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Table 2. Different Scenarios based on Relatively Varying Values of φ

$\varphi > 0$	$\varphi < u^N$	$\varphi > u^N$	$\varphi < u_{t-1}$ $\varphi > u_t$	$\varphi > u_{t-1}$ $\varphi < u_t$	$\varphi > \begin{Bmatrix} u_t \\ u_{t-1} \end{Bmatrix}$	$\varphi < \begin{Bmatrix} u_t \\ u_{t-1} \end{Bmatrix}$	$\varphi > u_t$ $\varphi < \begin{Bmatrix} u^N \\ u_{t-1} \end{Bmatrix}$	$\varphi > u_{t-1}$ $\varphi < \begin{Bmatrix} u^N \\ u_t \end{Bmatrix}$	$\varphi > \begin{Bmatrix} u_t \\ u_{t-1} \end{Bmatrix}$ $\varphi < u^N$	$\varphi < \begin{Bmatrix} u^N \\ u_{t-1} \\ u_t \end{Bmatrix}$
$\frac{\partial \dot{\pi}_t}{\partial \dot{y}_t^*}$	> 0	< 0	> 0	> 0	< 0	< 0	< 0	< 0	> 0	> 0
$\frac{\partial \dot{\pi}_t}{\partial \pi_t^*}$	> 0	< 0	> 0	> 0	< 0	< 0	< 0	< 0	> 0	> 0
$\frac{\partial \dot{\pi}_t}{\partial \dot{s}_t}$	> 0	< 0	> 0	> 0	< 0	< 0	< 0	< 0	> 0	> 0
$\frac{\partial \dot{\pi}_t}{\partial \mu}$	< 0	> 0	< 0	< 0	> 0	> 0	> 0	> 0	< 0	< 0
$\frac{\partial \dot{\pi}_t}{\partial \beta^*}$	> 0	< 0	> 0	> 0	< 0	< 0	< 0	< 0	> 0	> 0
$\frac{\partial^2 \dot{\pi}_t}{\partial \dot{y}_t^* \, \partial \beta}$	> 0	< 0	> 0	> 0	> 0	< 0	< 0	< 0	< 0	< 0
$\frac{\partial^2 \dot{\pi}_t}{\partial u_t \, \partial \beta^*}$	> 0	< 0	> 0	> 0	< 0	< 0	< 0	< 0	> 0	> 0

Appendix

Some Technical Notes

Different hypothesis based on the varying values of φ in equation 9

1. Considering $\varphi = 0$

$$\dot{\pi}_t = \dot{\pi}_t^e + \gamma \frac{(-u^N)\{-\mu(\pi_t^* + \dot{s}_t - \pi_t) - \dot{y}_t^* \beta^*\}}{u_t u_{t-1} \alpha\beta} - \dot{\varepsilon}_t$$

2. Considering $\varphi = u^N$

$$\dot{\pi}_t = \dot{\pi}_t^e - \dot{\varepsilon}_t$$

Figure A1. Phillips Curve with $\gamma = 0$

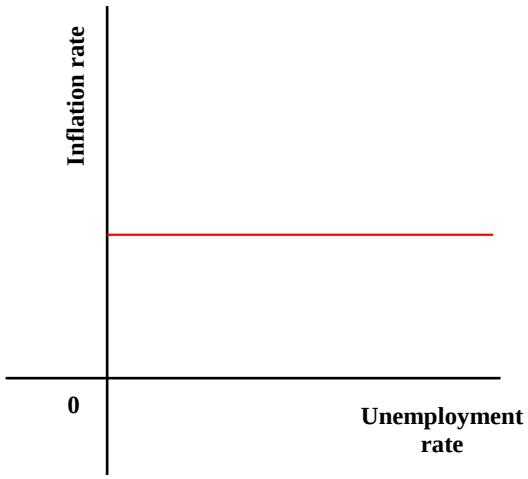
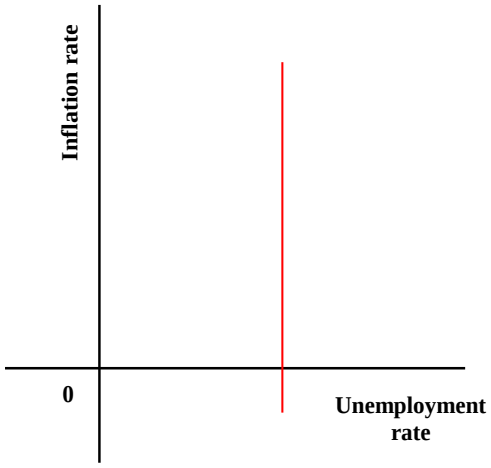


Figure A1 shows that if the value of γ becomes 0 then Phillips curve becomes a horizontal line. It reveals that any change in inflation would be the result of variations in inflation expectations only.

3. Considering $\varphi = u_{t-1} = u_t$

$$\dot{\pi}_t = \infty$$

Figure A2. Phillips Curve with $\gamma = \infty$



However, in case if γ becomes equal to infinity than the Phillips curve becomes vertical and it remains unknown, what could be the reaction of inflation due to any change in any of the variables in our model (see Figure A2).

Table A1. Inflation Targeting Economies and the Potential Candidates

S. no	Countries Targeting Inflation	Since	Potential Coutries to Adopt Inflation Targeting			
1	Australia	1993	1	Albania	25	Runisia
2	Brazil	1999	2	Angola	26	Serbia
3	Canada	1991	3	Armenia	27	Sri Lanka
4	Chile	1999	4	Azerbaijan	28	Sudan
5	Colombia	1999	5	Belarus	29	Turkey
6	Czech Republic	1998	6	Bolivia	30	Uganda
7	Hungary	2001	7	Botswana	31	Ukraine
8	Iceland	2001	8	Costa Rica	32	Uruguay
9	Indonesia	2005	9	China	33	Venezuela
10	Israel	1997	10	Dominican Republic	34	Vietnam
11	Korea	2001	11	Egypt	35	Zambia
12	Mexico	2001	12	Georgia		
13	New Zealand	1990	13	Guatemala		
14	Norway	2001	14	Guinea		
15	Peru	2002	15	Honduras		
16	Philipine	2002	16	Kenya		
17	Poland	1998	17	Kyrgiz Republic		
18	Romania	2005	18	Mauritius		
19	Slovak Republic	2005	19	Moldova		
20	South Africa	2000	20	Morocco		
21	Sweden	1993	21	Nigeria		
22	Switzerland	2000	22	Pakistan		
23	Thailand	2000	23	Papua New Guinea		
24	UK	1992	24	Paraguay		

Source: IMF 2006, "Inflation Targeting and IMF". Tables 1 and 2.

CHAPTER NO. 03

Output Gap Measures: An Application to Pakistan Economy

1. Introduction

Potential output, the associated output gap, the sacrifice ratio and the natural rate of unemployment are the concepts that gained importance over the past few years among researchers both in academia and central banks. The importance of these concepts surfaced because of the growing fame of the Inflation Targeting Policies, Speed Limit Policies[1], notably the policies in which the measures of potential output and output gap are useful to identify the scope for sustainable non-inflationary growth and to allow an assessment of the stance of macroeconomic policies. It is said that, *ceteris paribus*, if the actual output is greater than the potential, or the output gap is positive for long time, it will raise inflation to respond to the demand pressures in the economy, and vice versa. Thus, from the point of view of policy makers, the importance of the output gap estimation is fundamental.

Output gap, which is the difference between the actual and the potential output in any economy; it shows the divergence (if any) from the potential output. At any point of time it gives an assessment of the excess demand or the spare capacity in the economy. However estimating output gap requires information on potential output, which is normally unobserved, and even contradictory in its definition. Whether the potential output is the potentially attainable output or the maximum level of output that an economy already does attain without driving the inflation? – The level of economic activity which is consistent with no inflation pressures in the economy.

The expression 'potential output' has been defined in different ways. From an academic point of view it is the level of output that could be attained by employing all the available resources, i.e., full employment (Okun, 1962). However, the understanding of potential GDP has changed during the last decades, and at present the practitioners and also some of the academicians define potential output as per definition of De Masi, who defined potential GDP as "the maximum output an economy can sustain without generating a rise in inflation" (De Masi, 1997: 40).

The importance of prior knowledge of output gap is twofold. It has relevance to the fiscal policy and to the monetary policy as well. As an excess demand in the economy would be a signal of strengthening inflationary pressures, while if the economy is operating below its

[1] Gramlich, E.M., the governor FED, described the monetary policy with emphasis on output gap variability, and used the term Speed Limit policy for such a policy in his remarks at Wharton Public Policy Forum in April 22, 1999. According to him the speed limit policy would try to ensure that aggregate demand grows almost by the expected rate of increase of aggregate supply, and this increase may be more easily predicted.

capacity it indicates the presence of deflationary pressures that can lead to recession. For instance the indication of over or underutilization of resources would pose a question on the ongoing monetary and fiscal policies.

From the fiscal side, the government revenues and expenditures are also affected by the cyclical position of the economy (Donders & Kollau, 2002). The potential output and the output gap can give a measure of the government structural fiscal position while adjusting for the surpluses and deficits due to the cyclical up-downs, thus determining the cyclically adjusted budget, which would be equal to the budget in case the actual output was equal to the potential. In the view of the three prominent advantages as discussed above that output gap helps determining the course of monetary and fiscal policy and as the same time it has engaged the attention of researchers and policy makers to assess the scope of economic activity and to identify the outcome of the policy changes in the economy. Therefore, it necessitates the computation of this unobservable variable.

Unstable inflation and the fluctuating output in Pakistan economy makes it even more important that the inflation dynamics to be studied in the backdrop of output gap. While monitoring a developing country, one of the main objectives of the central bank of Pakistan is to support output growth in the economy without allowing general price level to rise substantially. While keeping in mind the complex causal relationship of output growth and inflation, the knowledge of potential output appears crucial from the point of view of any central bank. So far, there is no published official data series of output gap in use either by the central bank or the academia, so this gives ample motivation to serve the existence of the purpose behind this study.

This chapter estimates the potential output and subsequently the output gap. While the emphasis here been kept in particularly on Pakistan economy, we compute the output gap for the sample of 158 countries and for different economic and regional groups as described in chapter 4 by using different methodologies[2].

The paper is organized in such a way that the next section presents various methodologies that have been used so far by different researchers and the central banks for the estimation of potential output; section 3 comprises a review of literature on the subject; section 4 describes the results of the estimation for Pakistan. In section 5 an attempt has been made to use the

[2] Group-wise output gap data is presented in appendix table A1 to A4; however, the country-wise data could be provided by the author on request.

output gap estimates to compute the Taylor rule based interest rates, so as to have a comparative picture of the central bank's policy; and finally section 6 concludes.

2. Potential Output and Output Gaps: An overview of the Methods

In the literature there are several different ways to estimate the potential output (see table 1). However, still there is no consensus on which method to be preferred and why? Being an estimation of the unobserved part of the output, it is always done with doubts. It has been observed that it can lead to different results, even for the same data, depending on the methodology of estimation. While there is a rich literature regarding the estimation methodologies of potential output, the researchers have different opinions on the merits and demerits of different estimation techniques.

Table 1. Different Methods of Output Gap Estimation[3]

	Non-Structural Methods		Multivariate Methods		Structural Methods		Direct Measure
1	Peak-to-peak Method	1	Beveridge Nelson's Multivariate Decomposiion Method	1	Okun's Law	1	Capacity Utilization Method
2	Linear Detrending	2	Multivariate Filter by Hodrick Prescott	2	Production Function Approaches		
3	Robust Detrending			3	Long-run Restriction Models		
4	Phase Average Detrending						
5	Hodrick Prescott Filter Method						
6	Beveridge Nelson Decomposition Method						
7	Method of Estimating Unobservable Components						
8	Band-Pass Filter Method						

Potential output is often regarded as representing the trend of the actual output, thus the researchers have developed de-trending methodologies, estimating the trend and the cycles and besides other econometric tools, the filters have also been in exclusive use. The most widely used univariate technique is the Hodrick-Prescott (HP) filter. Like the other univariate

[3] Adopted from Chagny and Dopke (2001).

techniques, the HP filter uses only information included in the actual output series to derive the potential output measure. Other univariate techniques include the Beveridge-Nelson (1981) method, the Band-Pass (BK) filter proposed by Baxter and King (1995), the "Running Median Smoothing" (RMS) algorithm of Tukey (1997) and the so-called "wavelet filters" (Scacciavillani & Swagel, 1999).

These univariate techniques have been criticized for, amongst other things, their inability to properly distinguish between the underlying permanent and transitory components of the time series considered (Dupasquier, *et al*., 1997). Partly in response to this critique, a variety of multivariate methods have been proposed. These include the multivariate extensions of the Beveridge-Nelson method (MBN) (Evans & Reichlin, 1994), Watson's (1986) unobserved-components model, the multivariate (MV) model by Laxton and Tetlow (1992) and the extended multivariate filter (EMV) by Butler (1996).

Finally, a number of researchers in recent years have made use of structural vector autoregression models (SVAR's) to determine potential output and output gaps. These include Dupasquier *et al*. (1997) and Scacciavillani and Swagel (1999).

2.1. Peak-to-Peak De-trending Method

Peak-to-peak method, often referred to as trend line through peaks is a time series technique, involves filtering linear trends between the cyclical peaks in the output series. This approach does not assume the constant growth of potential output and is simple; however, it defines potential output as the maximum attainable level of output in the short-run, which is against the idea of the long-run sustainability.

2.2. Linear De-trending or the Deterministic Trend

This is one of the simplest methods of computing potential output and subsequently the output gap. This method assumes that output may be decomposed in linear trend and the cyclical component, as per the following equation:

$$Y_t = \beta_0 + \beta_1 t + \varepsilon_t \quad (1)$$

Here Y_t is the log of (real) GDP, while t is the trend. The fit of this equation is the potential GDP, while the residual ε_t is the estimated output gap.

Though the simplicity of this method makes it very easy to estimate the output gap and the potential output, it has some limitations that need to be taken into account while drawing

inferences on the basis of these estimates. For instance, this method forces a trend to the output series, which if not there, may distort the results. Secondly, this methodology fails to capture the impact due to structural and technological changes in the economy overtime, and the impact when the economy is facing high inflation. Finally the most important shortcoming of this method is that the results vary with the same time series over different ranges.

2.3. Moving Average

This method attempts to decompose the logarithm of output into a trend component and a cyclical component:

$$y_t = \tau_t + c_t \tag{2}$$

Here y_t is the log of output, c_t is the output gap, while τ_t is the moving average of output, i.e.

$$\tau_t = (\, y_t + y_{t-1} + y_{t-2} + y_{t-3})/4 \tag{3}$$

Though simple in estimation, this method has various limitations. Notably it accounts for the moving averages of the actual GDP and thus it is not free of the end-sample biases. While in most of the work the interest is usually in the recent observations or estimations, this method fails to provide the recent figures. Secondly, the arbitration in taking the range of moving average also exposes it to doubts, as the results change with change in number of years to be taken as range for the moving average.

2.4. Hodrick-Prescott Filter (HP)

HP filter (Hodrick and Prescott, 1997) has become very popular method of de-trending the economic time series. The reason is that it is flexible in tracking the characteristics of the fluctuations in trend output; the simplicity of its calculation and also its implementation in virtually any econometric software package. De Masi (1997), De Brouwer (1998), Scacciavillani and Swagel (1999), Cerra and Sawena (2000), Gounder and Morling (2000), Chagny *et al.* (2003), Cotis *et al.* (2003), Bjornland *et al.* (2005) and Njuguna *et al.* (2005) have used this method in their estimation of potential output and the subsequent output gap. HP filter assumes the smoothness of the growth components overtime. According to this framework a time series y_t can be expressed as the sum of potential output y_t^* and the cyclical component c_t, which is actually the difference of output and its potential.

$$y_t = y_t^* + c_t \tag{4}$$

Minimization of the following assumption gives the potential output:

$$\{y_t^p\}_{t=1}^{T} = \min \sum_{t=1}^{T}(y_t - y_t^p)^2 + \lambda \sum_{t=2}^{T-1}[(y_{t+1}^p - y_t^p) - (y_t^p - y_{t-1}^p)]^2 \qquad (5)$$

Here y_t^p is the output trend derived by using HP filter, which minimizes a combination of gap between actual output, trend output and the rate of change in trend output for the whole sample of observations, T. Here λ is the 'smoothing parameter' which softens the fluctuations in the growth component. The larger is the value of λ, the smoother is the growth component and more variable is the output gap. The value of λ for quarterly data is 1600, while for the annual data it is different and not fixed[4]. Once the y_t^p (potential output – trend output) is estimated, the output gap is then calculated by subtracting it from the actual output as per following equation:

$$\{y_t^g\}_{t=1}^{T} = \{y_t - y_t^p\}_{t=1}^{T} \qquad (6)$$

Like other methodologies, HP filter also contains certain serious limitations. Firstly and the more important one is the doubts due to the smoothing parameter λ. As stated earlier that usually it has the values 1600 and 100 for quarterly and annual data respectively; however any change in this value plays important role in the results for potential output.

Second problem arises due to the symmetric trending of this method, which results in end-sample biases. Due to this weakness the recent data of the series, cannot be taken into account for drawing conclusions. Moreover, HP filter also ignores the impact of structural changes in the economy overtime.

2.5. The Band-pass-filter

Band-pass-filter developed by Baxter and King (1995), commonly known as BK filter is another important method of computing the cyclical component of the macroeconomic time series. For fixed-length symmetric filter, the weight matrix is of dimension 1× (q+1), q where is the user-specified lag length order. For these filters, the weights on the leads and the lags are the same, so the returned matrix contains only the one-sided weights.

$$Z_t = \sum_{c=1}^{q+1} \mathrm{w}\ 1,\mathrm{c}\ \mathrm{y}_{\mathrm{t+1-c}} + \sum_{c=2}^{q+1} \mathrm{w}\ 1,\mathrm{c}\ \mathrm{y}_{\mathrm{t+c-1}} \qquad (7)$$

Where t = q+1,.....n-q.

[4] Maravall, Agustín, and Ana del Rio (2001)

However, as this technique estimates the potential output (trend) using the moving average, which according to the standard setting of Baxter and King (1995) is set to count at least six quarter longer fluctuations, which from both ends make it lose the twelve quarters from the overall series. The issue becomes more serious if the data is annual, as the trend for the first 3 and the last 3 years will be missing, which makes it less useful as compared to even the simple methods of estimation of output gap.

3. Review of Literature

Researchers have estimated potential output and the output gap using various statistical and econometric techniques. Every method has advantages and disadvantages, but still as output gap cannot be observed, application of a combination of different methodologies to estimate the gap and then to have a critical comparison can lead to some reliable inferences. For instance, Dupasquier *et al.* (1997) surveyed some of the techniques to measure the trend component of output (potential output). They focus on three simple multivariate methodologies: the multivariate Beveridge-Nelson methodology (MBN), Cochrane's methodology (CO), and the Structural Vector Autoregression (SVAR) methodology with long-run restrictions applied to output (LRRO). They used the variables of quarterly GDP, real consumption comprising of non-durables and services and the federal funds rate when a third variables added, money and inflation is also tried in the place of federal fund rate. According to the authors the LRRO estimates provide significant evidence of a diffusion process for shocks to potential output. This suggests that permanent shocks have more complex dynamics than a random walk, which is the basic assumption of the CO and MBN approaches. However, they found that the estimation of the output gap on the basis of an estimated VAR was imprecise, which is consistent with results obtained by Staiger, Stock and Watson (1996) with a different methodology. The spectra of the transitory components (output gaps) resulting from the empirical applications of the CO, MBN and LRRO methodologies differ from one another.

De Masi (1997) addressed the same question in a different and notably more convincing way. The author classifies different methods according to the different categories of the economies. For the industrial countries he used the Production function approach and its further extensions by accounting explicitly for the relationship between wage and price inflation, potential output and the natural rate of unemployment in the a consist framework. In terms of

unemployment additional variables were introduced, which include: unemployment insurance, replacement ratio, unionization rate, payroll taxes, minimum wages, and various demographic characteristics such as the age composition of the population. Specifically, this study estimates the potential output for industrial countries through the Cobb Douglas form production function, while for the developing countries, it is done through univariate detrending technique, univariate detrending technique over the production function and HP filter.

Over the medium term, potential output for the seven major industrial countries is projected to be in the range of 2 to 2.5 percent. For Germany and France potential output growth is projected to be 2.25 to 2.5 percent, which is a decline particularly in Germany as compared to the late 1980s owing to the more recent slowdown in investment. The growth rate of potential output is expected to pick up slightly to 2.25 to 2.5 percent in the United Kingdom and Canada. In Italy, the growth rate of potential is expected to remain at about 2 percent, and in the United States to remain at about 2.5 percent.

De Brouwer (1998) reviews five methods of estimating potential output for Australian GDP data. Unlike Dupasquier *et al.* (1997, 1999) he also used the statistical methods, including linear time trends, Hodrick-Prescott (HP) filter trends, multivariate HP filter trends beside the unobservable components models and a production function model.

Importantly, his estimates of the output gap show that they vary with the method used and are sensitive to changes in model specification and sample period. While gap estimates at any particular point in time are imprecise, the broad profile of the gap is similar across the range of methods examined. Inflation equations are substantially improved when any measure of the gap is included, and output gaps generally explain innovations in inflation better than output growth.

Scacciavillani and Swagel (1999) estimated the potential output for Israel, using the methodologies of aggregate production function, Univariate filters [(i) HP filter (ii) Running medium smoothing (iii) Wavelits filters] and Structural Vector Autoregression (SVAR). They used GDP, price level, stock of physical capital and the labour force and TFP estimates. Like De Brouwer (1998), their output gaps estimates also vary by methodology.

In his study Kichian (1999) used the general form of the State Space Framework to estimate the potential output and the gap, using quarterly real output, inflation rate, expected inflation

rate, nominal trade weighted exchange rate, and nominal oil prices. According to this estimate, there have been three important periods of excess supply in Canada around the dates of 1977, 1982 and 1991, the second being the most pronounced. The average duration of these downturns has been a little above four years.

Cerra and Saxena (2000) reviewed a number of methods which can be used to estimate potential output and output gap: the HP filter; the unobserved components method; the structural VAR approach by Blanchard and Quah (1989); the production function approach; demand side model; system estimates of potential output and the NAIRU GDP, GDP (Private and public), domestic inflation, unemployment, real exchange rate, relative output, relative price level, private capital stock, estimates of trend labour input, TFP estimates, NAWRU estimates, time dummies and import prices. Although the various methods produce a range of results for the output gap, the evidence also suggests that at least part of the large jump in unemployment occurring in conjunction with this recent recession has become permanent. And a future upswing in the business cycle may not be sufficient to restore unemployment to earlier levels; instead, structural policies to encourage a flexible and well-functioning labour market will likely be required.

Gounder and Morling (2000) reviews four methods to estimate potential output and the output gap, including linear trends, Hodrick-Prescott (HP) filters, aggregate production functions, and structural vector autoregressions. They used actual Output, Labour Force, Capital Stock, TFP, Inflation, Output Gap and TFP as variables. Their results reveal that measures of the output gap were imprecise and could give deceiving indications of the degree of slack in the economy.

Denis (2002) used the Cobb-Douglas production function to extract the potential output. This methodology involves extracting the structural component of labour potential and TFP, while the potential employment is extracted from NAIRU estimates. When comparing the growth contributions of labour, capital and TFP in the Euro15/Euro Zone over the last two decades compared with the experience of the USA over the same period, they found striking differences. They found that the US boom in the 1990s is clearly driven by capital formation and an acceleration of TFP, with the annual average growth rate increasing from 2.75 percent over the period 1991-1995 to 3.5 percent for the period 1996-2000. The figures for Europe are clearly less impressive in terms of the overall growth rate acceleration and the compositional changes are also different to that of the USA. While growth accelerated in both the EU15 and

the Eurozone in recent years, when one looks at period averages one sees that for 1996-2000 the potential growth rate averaged 2.2-2.3 percent in both areas which is virtually identical to the outturn achieved for 1991-1995. In terms of the composition of potential growth, both the EU15 and the Eurozone both witnessed an improvement of about a 0.25 of a percent point in the contribution of labour to growth over 1996-2000, with this gain being largely offset by small declines in the remaining components of growth.

Gosselin and Lalonde (2002) used eclectic approach to decompose potential output through the components of full employment labour input and average labour productivity at equilibrium. Disaggregating potential output into several components helps better identify its sources of fluctuation. The filter generating trend labour productivity is conditioned by the results of two SVARs. The first identifies trend labour productivity in the non-farm sector. This SVAR is based on a cointegration relationship between real wages and average non-farm labour productivity.

The second SVAR estimates the gap between the output level of the manufacturing sector and no accelerating inflation capacity (i.e., the non-accelerating inflation capacity utilization rate, NAICUR). The labour input depends on five SVARs—two to identify the NAIRU and three to identify the equilibrium participation rate. To account for demographic changes, they estimate an SVAR for the equilibrium unemployment rate of the labour force less than 25 years of age and another for those aged 25 and over. The NAIRUs generated by these two SVARs are then combined to yield a NAIRU for the labour force as a whole. The NAIRU thus obtained conditions the filter applied to the unemployment rate. Similarly, authors estimate an SVAR for the trend participation rate of those under 25, another for women 25 and over, and a third for men 25-plus. The results of these three SVARs are then combined to produce an equilibrium participation rate for the entire population. This participation rate conditions the filter generating the trend participation rate. Note that some determinants of the trend participation rate differ from one age group to the next. They used as variables the trend productivity, trend labour input, population, participation rate under-25 cohort trend participation rate, women's trend participation rate, men's trend participation rate, non-farm trend productivity. As expected, the year-over-year profile of potential output obtained by the eclectic approach is very smooth. It shows an acceleration in the pace of potential output growth during the period 1995–99, peaking at 4.0 per cent in 1997.

Filho (2002), through Aggregate Production Functions technique used the variables of actual GDP, labour force, capital stock, technology, capacity utilization, and natural rate of unemployment, for Brazil. The study found that, in the 1980-2000 period, most of the time, the Brazilian economy was below its potential.

Gradzewicz and Kolasa (2003) estimated the output gap using two methods: a method based on a two factor dynamic production function (estimated in the cointegrated VECM system, in which the potential GDP is calculated as the product resulting from maximum (in the Okun sense) level of production inputs. Second the GDP Permanent Transitory Decomposition, using long-term restrictions in the vector error correction model (VECM) imposed in an endogenous way by cointegrating relationships.

Chagny *et al.* (2003) in their paper assessed the statistical reliability of different measures of the output gap - the multivariate Hodrick-Prescott Filter, the multivariate unobserved components method and the structural vector autoregressive model - in the Euro area. Three criteria are used: the consistency of descriptive statistics, the forecasting performance in terms of inflation and some measures of uncertainty. They used the variables of GDP real, inflation rate (consumer price deflate), unemployment rate, capacity utilization, relative import price and NAIRU estimates. The results show that the output gap estimates could be improved further with the use of additional economic information; the results may differ across the different methods and within a given method with different specifications and that the multivariate UC models performs better than HPMV models in relative terms in order to reduce the filtered, smoothed uncertainty or quasi-real time estimates. However, it is difficult to conclude that a multivariate detrending method outperforms the others.

Rennison (2003) used the HP filter and two multivariate techniques: the Blanchard-Quah (1989), SVAR approach and the multivariate extensions of the HP filter (MVF). This study also considers an estimator that weighs a portfolio of inputs to estimate the output gap. This study shows that the favourable results for the combined approach at the end of sample are due in part to misspecification and parameter uncertainty in the SVAR. Two additional results have been reported: (i) relative to other estimation methodologies, the SVAR is surprisingly robust to violations in its identifying assumptions, and (ii) in terms of the absolute accuracy of an estimator at the end-of-sample, the costs associated with imposing an arbitrary smoothing restriction can be high.

Cotis *et al.* (2003) provides a critical review of variety of methods used in the literature [(1) Trend-Linear and Split, (2) Univariate Filters- Hodrick Prescott, Baxter-King filter, Beveridge Nelson decomposition, Kalman filter, 3) Multivariate filters- Hodrick Prescott, Beveridge Nelson decomposition, Kalman filter, 4) Full structural model, Production function with exogenous trends, structural VAR]. While they did not provide firm conclusions as to which method was preferable from a policymaker viewpoint, nonetheless highlights some important points: Although it is difficult to give a universal ranking of the methods, the statistical methods (trend and univariate filters) seem to be having more shortcomings than the economic methods (particularly, multivariate filters and production function approaches). This is particularly so on the 'consistency with priors' and the 'difference between real-time and final estimates' criteria.

Amongst the multivariate filters, the Kalman filter appears to pass most of the criteria but it is not the most transparent method and, when used as a two-sided filter, is affected by the end point problem. By contrast, the production function approach is somewhat more transparent and has no direct end-point problem, but does not provide information on uncertainties. Moreover, there is an issue as to how inputs to this approach are constructed. As a result, the choice between these methods will depend on the priors and priorities of the user. Whatever method is used, it is necessary to make a critical and a non mechanical use of it (in particular, it is important to bear in mind its underlying assumptions and its shortcomings). Most methods provide estimates with a similar overall profile of potential output and, to some extent output gaps, but there are large divergences on the assessment of the magnitude of the output gap.

Cayen and Norden (2004) investigate the reliability of current estimates of the output gap in Canada. They begin by assembling a new data base of quarterly real-time output estimates which spans the post-WWII period and contains data vintages dating back to 1972. The univariate and multivariates methods used include; Deterministic Trends, Mechanical Filters, the Beveridge-Nelson Decomposition, Unobserved Component Models, Unobserved Component Models with a Phillips Curve and the Structural VAR Approach. The nature and sources of these revisions are used to draw conclusions about the overall measurement errors associated with current estimates of the output gap. They used the variables of real GDP, consumer price index and interest rate. This study assembled and analyzed a new database of real-time estimates of Canadian output. Revisions to the level of GDP are highly persistent; in contrast, revisions to 1-quarter changes are negatively autocorrelated. Mean revisions are

positive, implying that GDP figures have historically tended to be revised upwards. Results from a variety of measures and a broad range of output gap estimates suggest that measurement error in Canadian data may be more severe than previously thought. Most Real-Time estimates have a less than 50 percent correlation with their corresponding final estimates, for most models these two gap estimates have opposite signs more than 40 percent of the time, and the noise-to-signal ratios for the Real-Time gaps are generally above 1. Further analysis of output gap forecasts and of model risk is not conclusive and results vary considerably from model to model.

Filho (2004) presents the basic definitions used in growth accounting and the methods used for measuring labour, capital and the output gap. He also analyzes the determinants of potential output under the assumption of fixed coefficients of production and describes the disaggregated input-output estimates of capacity utilization and employment rates derived from a Leontief production function. Further he analyzes the determinants of potential output under the assumption of flexible coefficients of production and describes the basic steps involved in growth-accounting exercises based on a Cobb-Douglas production function. In the next step it shifts the investigation to the main statistical filters used to estimate trends and cycles in univariate economic time series and discusses how this a-theoretical approach can substitute, or be combined with, theoretical approaches based on production functions. Then it merges theory and econometrics in a comparative analysis of recent estimates of the potential growth rate of Brazil. His variables are the GDP (gross and net), intermediate consumption, labour estimates and labour productivity estimates, capital and capital productivity estimates, unemployment, inflation rate, interest rate, capacity utilization, total imports, total exports, input-output estimates, average years of schooling, aggregate and disaggregate growth accounting estimates, per capita income, TFP estimates, and NAICU (non accelerating inflation rate of capacity utilization) estimates. The main conclusions are: (1) the annual potential growth rate of Brazil's GDP varies substantially depending on the method and hypotheses adopted and, what is most important, potential GDP is not separable from effective GDP in the long-run; (2) growth-accounting and time-series studies of Brazil result in low potential-output growth rates because they extrapolate the slow growth of 1981-2003 to the future; (3) capital seems to be the main constraint on growth in Brazil and, therefore, a demand-led increase in investment can raise both its effective and potential output levels; (4) however, because of the slow adjustment of the capital stock, an investment boom can also hit a supply constraint before the stock of capital has time to adjust to the growth rate

of investment; and (5) aggregate measures of potential output do not carry much information about the economy and, therefore, they should be complemented by sectoral estimates of capacity utilization to identify the bottlenecks in inter-industry flows and the corresponding demand pressures on inflation.

Bjornland *et al.* (2005) in their study present a set of internationally recognized and commonly used methods, then estimate alternative output gaps using Norwegian data and compare the different methods. Univariates methods include Hodrick-Prescott filter (HP), Band-pass filter (BP), Univariate "unobserved component" methods (UC) and Multivariate methods include Production function method (PF), Multivariate unobserved component method (MVUC), Structural Vector Autoregression (SVAR) model. The study used the variables of GDP, domestic inflation and unemployment, potential levels of work hours, total factor productivity, capital and unemployment gap. Different calculation methods, however, often produce different values for the output gap. In this article, a set of alternative methods for estimating the output gap are presented and compared. The different methods show a consistent pattern for the output gap, but there are also important differences. This study shows that if the assessment of economic pressures is solely based on developments in the output gap as measured by one method; there is a risk of misjudging the economic situation. Assessments of the output gap must therefore also be based on professional judgment and supplementary indicators.

Njuguna *et al.* (2005) classified the different approaches to estimating potential output into two: statistical detrending and estimation of structural relationships. The difference is that the former approach attempts to separate the process into permanent and cyclical components while the latter isolates the effects of structural and cyclical influences on output using economic theory (Cerra & Saxena 2000). Some of the detrending methods include the Hodrick-Prescott filter and the unobserved components methods (univariate, bivariate, and common permanent and cyclical components). The approaches for estimating structural relationships include the linear method, structural vector autoregression (VAR) method and production function method. The variables incorporated are the GDP, private consumption, time trend, labour employed, and capital stock. This study attempts to estimate Kenyan potential output and output gap using different methods namely the linear time trends, HP method, univariate and multivariate Beveridge-Nelson, the structural VAR and the production function approach. Each method has advantages and disadvantages as discussed. The

estimation results for the values of potential output level and its growth, and the output gap vary from method to method.

It is not surprising that alternative methods lead to different estimates of the output gap. As in case of Dupasquier *et al.* (1997, 1999), De Brouwer (1998), Scacciavillain and Swagel (1999), Gounder and Morling (2000) the results vary with the methodologies used for estimation.

Furthermore, none of the studies have yet decided about the dominancy of any of the measure(s) over the other. While some support the structural methods, the statistical methods were also found useful by others, and vice versa. Therefore, in view of relatively strong assumptions made during the estimation process and time relationships analysis, caution is recommended while drawing any conclusions.

4. Estimation & Results

This section deals with the estimation of potential output and the subsequent output gap for Pakistan, by using different statistical and structural methods. However, before proceeding further to the estimation and the results thereof, it is pertinent to describe that we have used annual GDP (gross domestic product – real) data for the period 1951 – 2007. It is observed that usually the quarterly data has been used for such estimation; however, as the output data is compiled on annual basis in Pakistan, therefore no official quarterly series is available to serve the purpose.

4.1. Linear De-trending or the Deterministic Trend

We have used the following equation for estimating the linear trend and the cycles of actual output series.

$$Y_t = \beta_0 + \beta_1 t + \varepsilon_t \quad (8)$$

Here Y_t is the log of (real) GDP, while *t* is the trend. The fit of this equation is the potential GDP, while the residual ε_t is the estimated output gap.

$$Y_t = 12.5 + 0.05*t \quad (9)$$

$R^2 = 0.99$ DW= 0.23

Based on the annual data of real output, it is found that the coefficients of the equation are highly significant, and the regression line is near to a perfect fit; however the Durbin-Watson statistics reveal the presence of autocorrelation in the residuals, which implies the misspecification of the model.

The results show different episodes of spare capacity and that of excess demand as well. For instance during 1998 – 2007 the economy had a spare capacity, however after 2003 it shows a recovery (for detail see Figure 1).

4.2. Moving Average

In this method we have attempted to decompose the logarithm of output into a trend component and a cyclical component.

$$y_t = \tau_t + c_t \tag{10}$$

Here y_t is the log of output, c_t is the output gap, while τ_t is the moving average of output. As described in section 2, one of the main weaknesses of this method remained the end-sample biases, due to the use of moving averages; however, we have attempted to resolve this issue by taking the backward moving average.

$$\tau_t = (y_t + y_{t-1} + y_{t-2} + y_{t-3})/4 \tag{11}$$

Like the previous estimation, the results show that the coefficients of the equation are highly significant, and the regression line is near to a perfect fit; however the Durbin-Watson statistics show some evidence of autocorrelation in the residuals, which implies the misspecification of the model (for details see Figure 1).

4.3. Hodrick-Prescott Filter (HP)

Three different scenarios are estimated for the Hordick-Prescott Filter method. As discussed earlier that λ is a 'smoothing parameter' which softens the fluctuations in the growth component. The larger is the value of λ, the smoother is the growth component and more variable is the output gap. Usually the value of λ for quarterly data is 1600, while for the annual data it is not fixed. Therefore, three different values for the λ were taken into account: 10, 100 and 100000.

The results of the HP filter method obviously differ from that of the earlier estimations. All the scenarios of λ have resulted in the same trend of the output gap, yet with different magnitudes. Where $\lambda = 100000$ has recorded more variance as compared to those computed by using the smaller value of λ. It was found that since 2005 the economy was at over capacity, similarly during the periods of 1985 – 1997, 1965 – 1976 (with exception of 1973) were the periods of excess demand. Here we confirm De Brouwer (1998), that the cycles in output are sensitive to the smoothing weight.

4.4. The Band-pass-filter

The output estimates by the Baxter and King method also show different episodes of spare capacity and excess demand in the economy with rather more fluctuations than that of the other estimates. It has also been observed that the first and the last 3 values are missing.

In general it can be concluded that the results vary with the methodology adopted; however, taking into account the recent past (2000 – 2007), it is observed that although the economy has excess capacity in the start, but later on in 2003 it records an upward trend. High demand pressures in the economy pushes the negative output gap upward, even it remains negative under some methodologies, yet with an upward trend (see Figure 1).

5. Taylor Rule for Pakistan

This section deals with the estimation of Taylor rule for Pakistan economy. There is ample debate on the selection of either rules or discretion while framing the policies, in particular the monetary policy. However, there is huge support for a rules backed policy over the recent years i.e., Taylor (1993), Kydland and Prescott (1977), and Barro and Gordon (1983) etc.

Here an attempt has been made to find out if the central bank of Pakistan has been observing the Taylor rule what would the policy implications be resulting thereof. While having various measures of output gap in hand, it could lead to interesting results. Taylor rule can be described by the following equation:

$$i_t = r^* + \pi_t + \alpha_1 y_t + \alpha_2 \pi_t - \pi^* \qquad (12)$$

Here i_t is the Taylor interest rate, r^* is the long run equilibrium interest rate, π_t is the corresponding inflation rate, π^* is the target inflation rate, y_t is the output gap at time *t*.

In the Taylor rule it is assumed that the central bank has the information on the current output and inflation, while other parameters in the equation have fixed values:

$$r^* = \pi^* = 2;\ \alpha_1 = \alpha_2 = 0.5.$$

In case of Pakistan economy we estimated the Taylor interest rate by using the same value of the coefficients as assumed by Taylor (1993); however with different inflation targets. Actually we have used the same range of inflation targets that has been estimated as a threshold level of inflation for the developing economies by Khan and Senhadgi (2001). For the long run equilibrium interest rate, as the average interest rate over the period of estimation (1973 – 2007) remained around zero with negligible variance, so it has been considered zero. Thus with these assumptions the Taylor rule equation can be reduced as:

$$i_t = -3.5 + 0.5y_t + 1.5\pi_t \quad (13)$$

(Target inflation = 7%)

The computed rule based interest rates, through the above equation, using all the output gap estimates show somewhat similar results. The results reveal that the central bank of Pakistan has not been following Taylor rule while making changes in the interest rates. In the overall data it is observed that the monetary policy for most of the time remained accommodative, and an aggressive stance of curbing down inflation was not found.

However, in the perspective that central bank of Pakistan has never claimed to have adopted a monetary policy aimed at inflation targeting, the results are understandable (For details see Figures 3, 4, 5, 6, 7).

6. Conclusion

Central banks are today more responsible than before with the growing debate of autonomy and independence across the board. However, many banks, particularly those of the developing countries still lack expertise and required skills while framing economic policies. For the central banks to be effective in their monetary action, besides other things, credibility is one of the major inputs. For this purpose modern banking has been supported by vast research in different areas of interest. Measurement of potential output, the subsequent output

gap, macroeconomic forecasting models are the approaches that can be helpful for the central bankers in adjusting the monetary policy to achieve the objectives of low inflation and stable output growth. However, in the absence of complex macroeconomic models the output gap measures and that of the potential output could better give a rough picture of the economy and the future trends.

Besides, while several central banks and researchers have estimated the output gap for the economies on individual levels, yet a complete data for the majority of countries is not so far disseminated. Therefore, in this chapter we estimated the output gap for 158 countries including the developed and the developing countries across the board. In the later section we used the output gap series of Pakistan, as a case study, to estimate the rule based interest rates for the Pakistan economy.

Although the interest rate series as estimated by Taylor rule shows large differences from that of the actual one, it can be justified on the basis that the central bank of Pakistan has not yet claimed to be targeting inflation, rather the promotion of output growth has remained one of the main objectives of the bank. Still it can be suggested that in the absence of complex and reliable macroeconomic models the central banks in the developing countries can use the Taylor rule as a nominal anchor to probe the future trends of inflation, output gap and interest rates.

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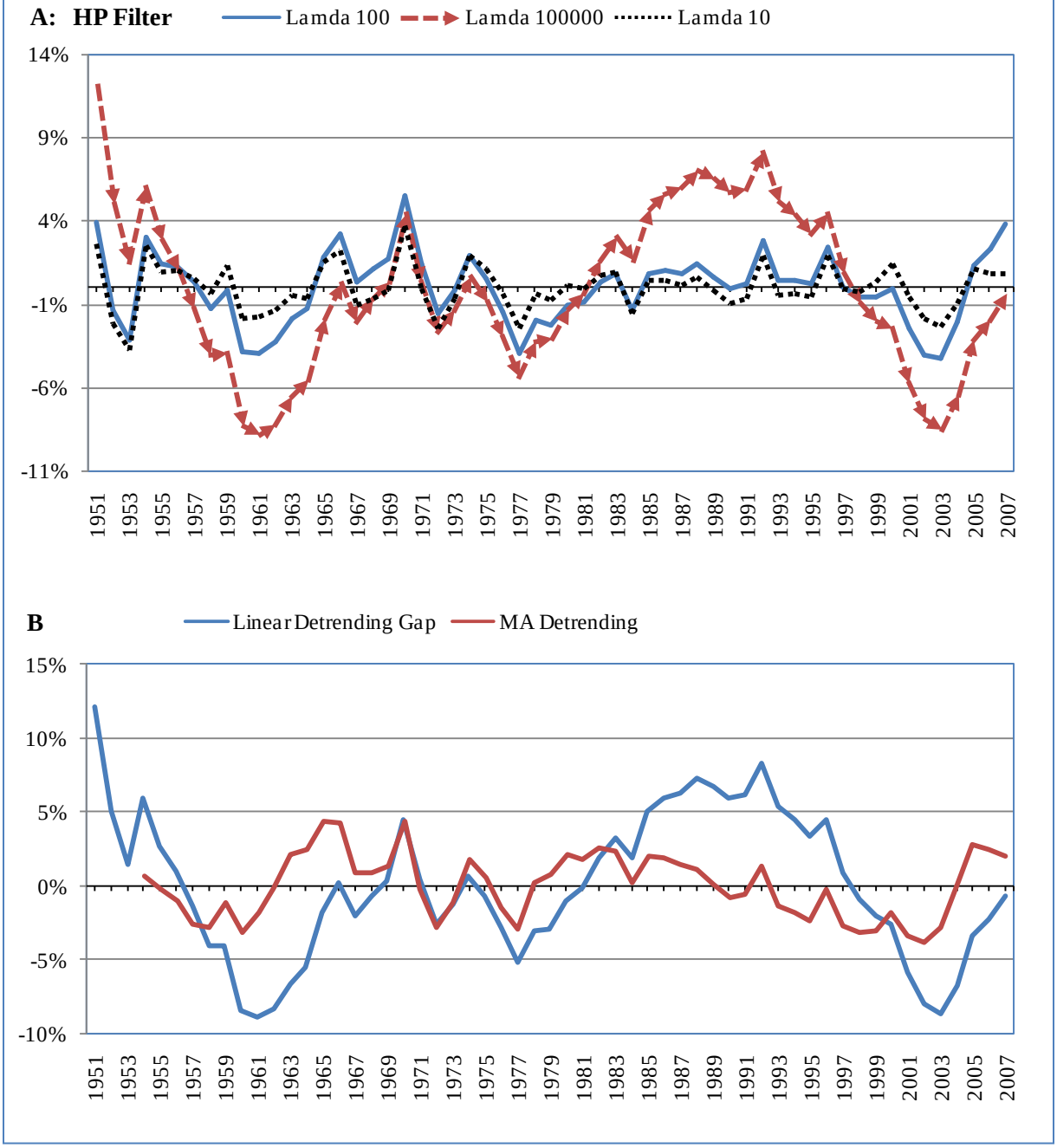
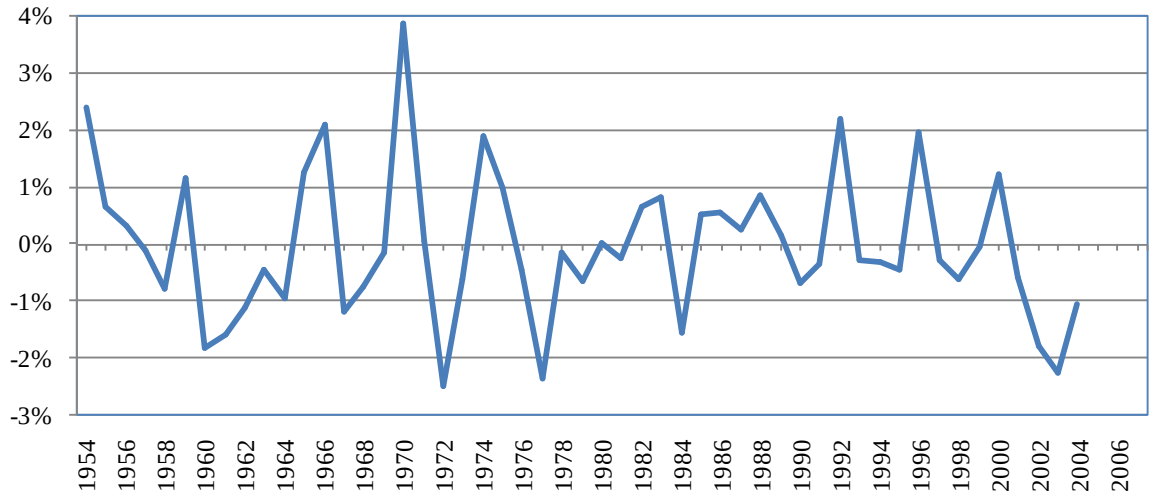
Appendix:

Figure 1: Output Gap



C: BP Filter



D: Moing average Gap

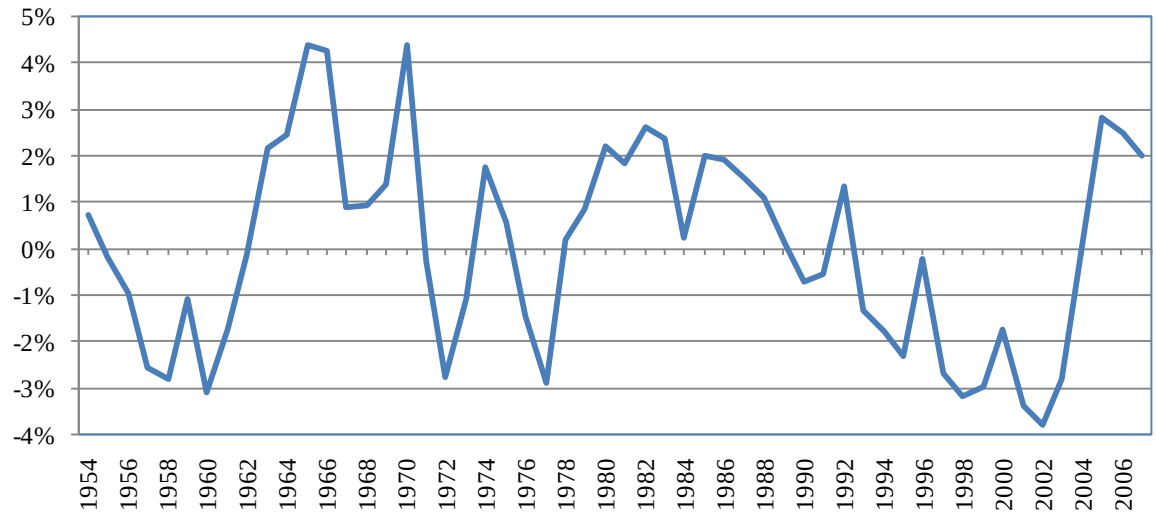


Figure 2: Comparative Interest Rates with ZERO Inflation Target

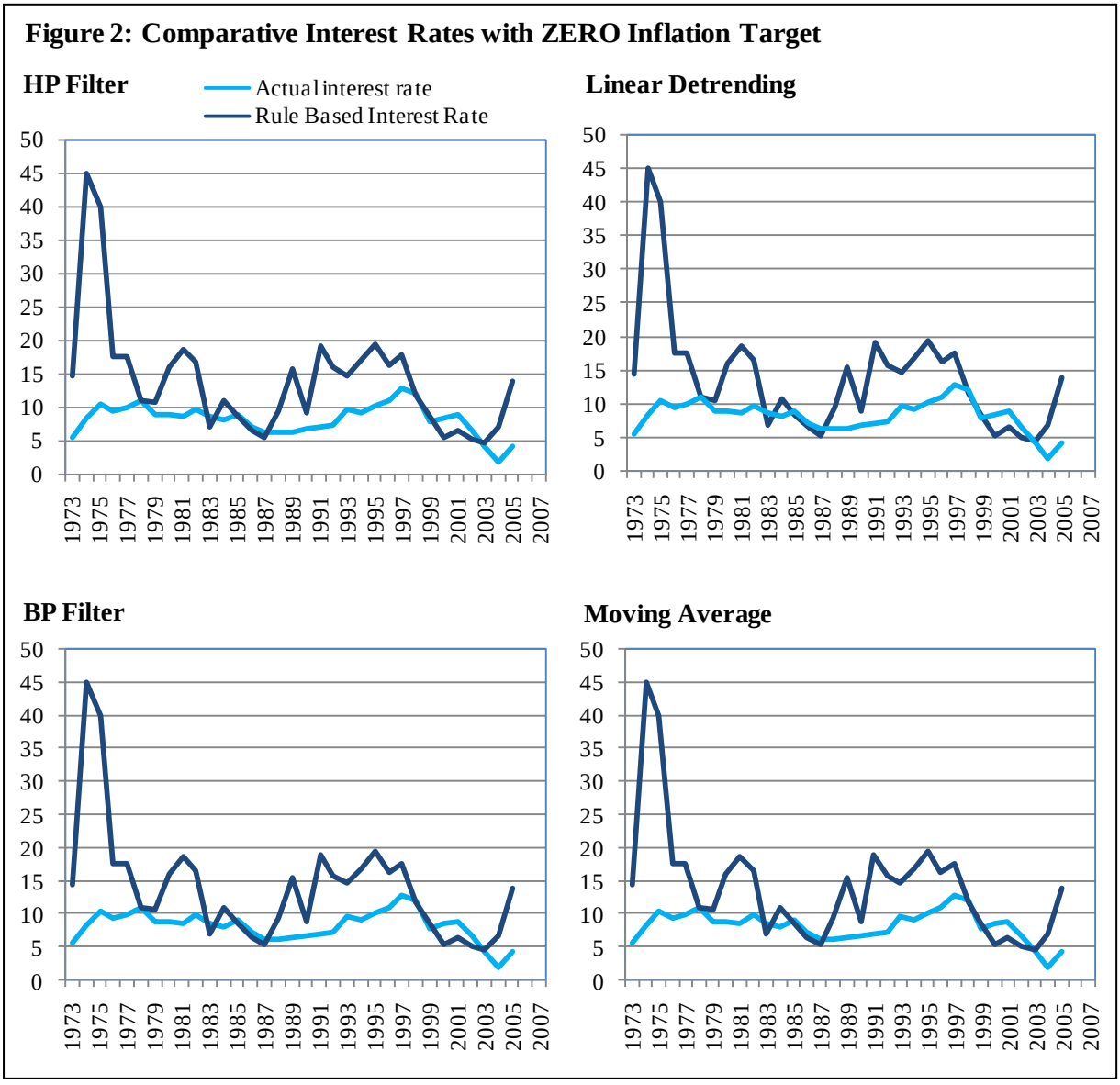


Figure 3: Comparative Interest Rates with Inflation Target = 7%

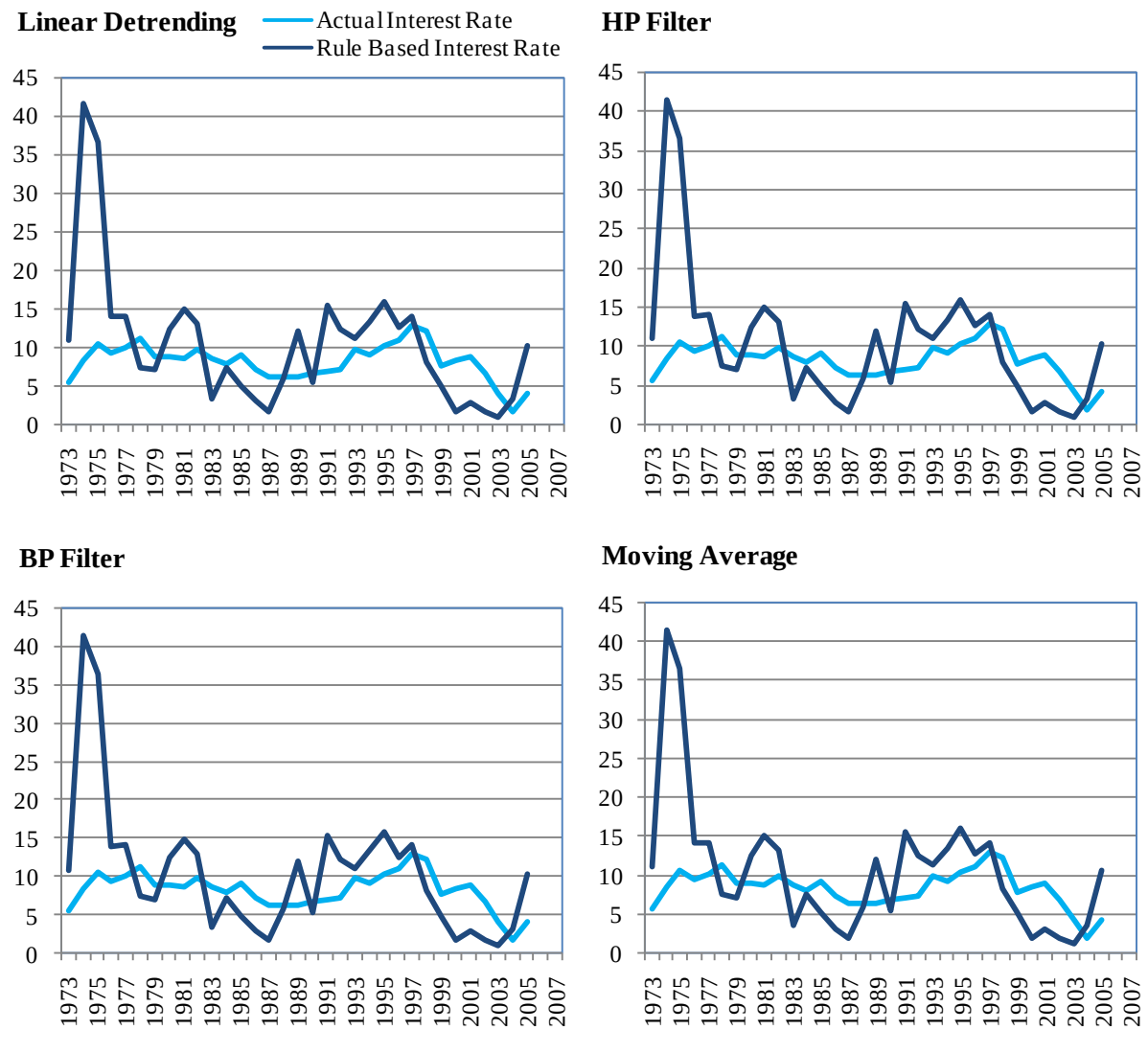


Figure 4: Comparative Interest Rates with Inflation Target = 8%

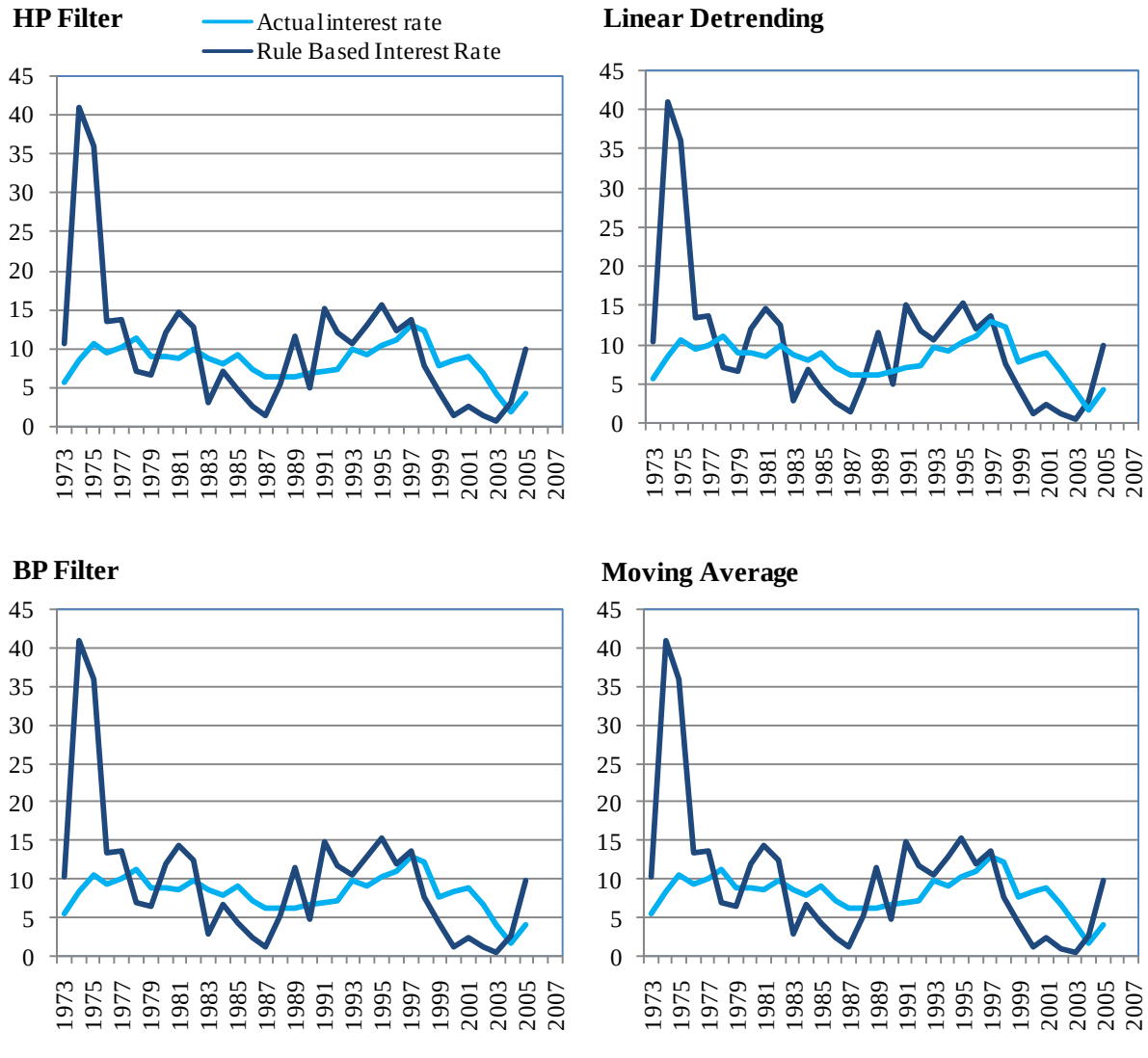


Figure 5: Comparative Interest Rates with Inflation Target = 9%

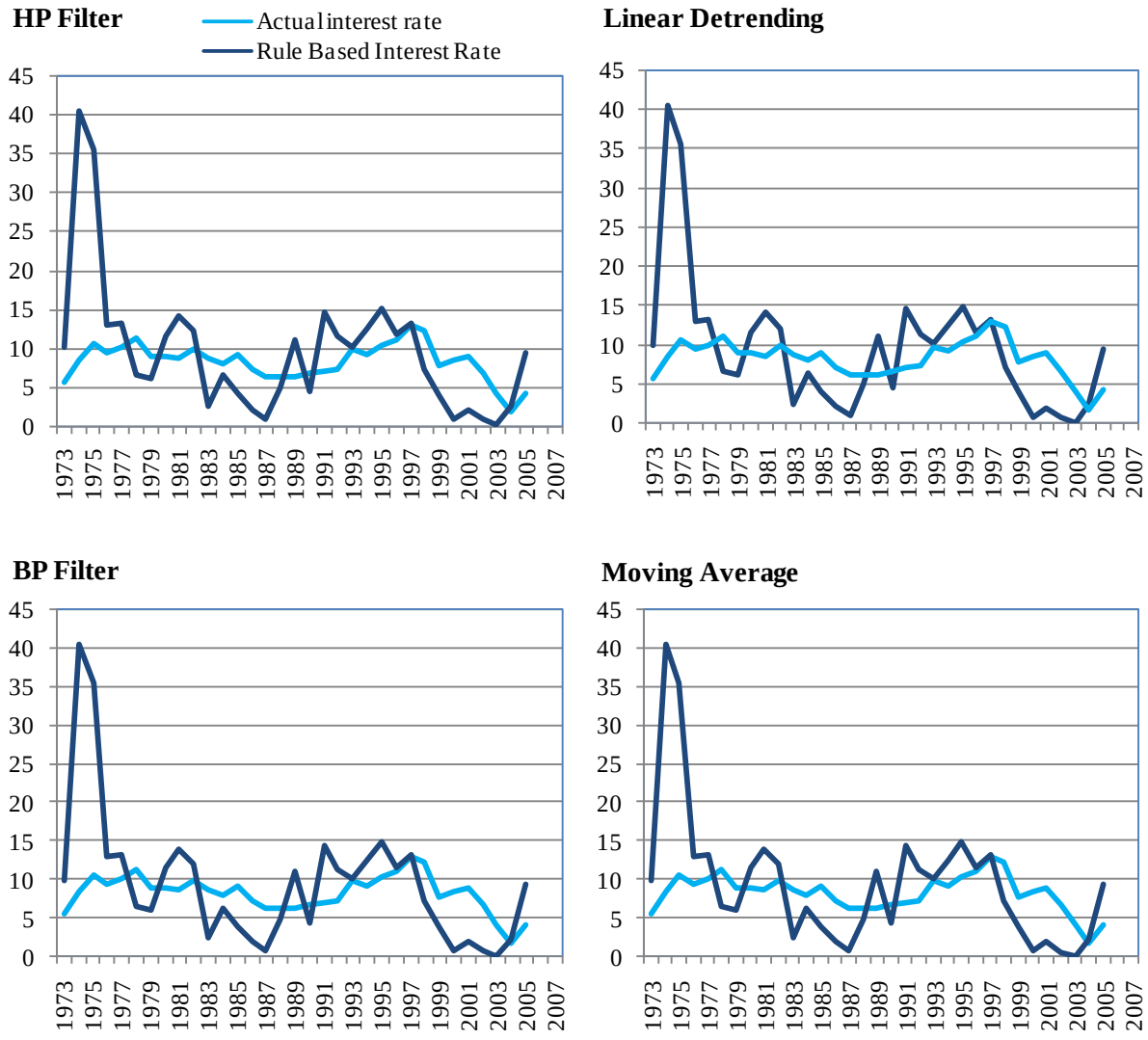


Figure 6: Comparative Interest Rates with Inflation Target = 10%

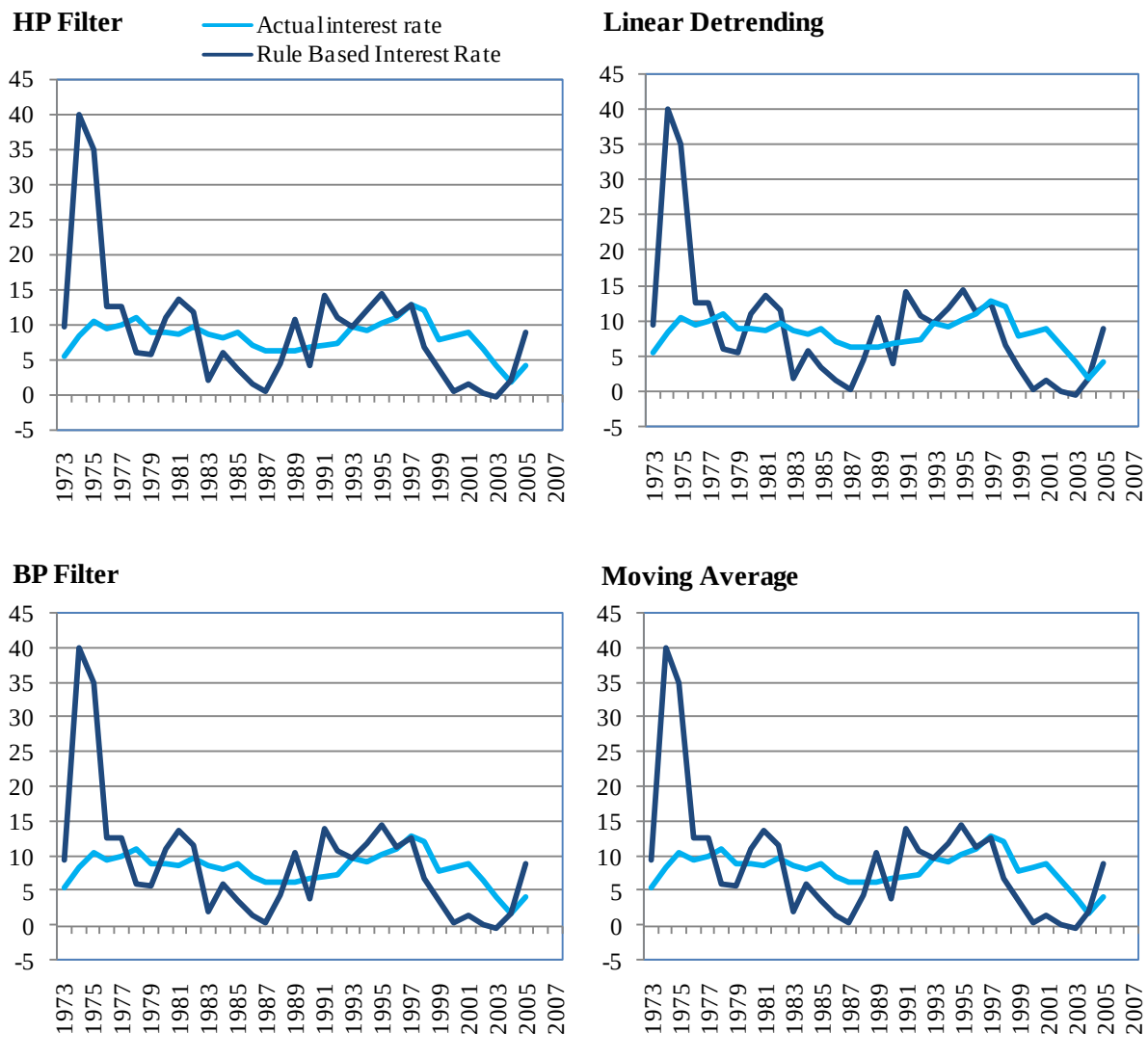


Figure 7: Comparative Interest Rates with Inflation Target = 11%

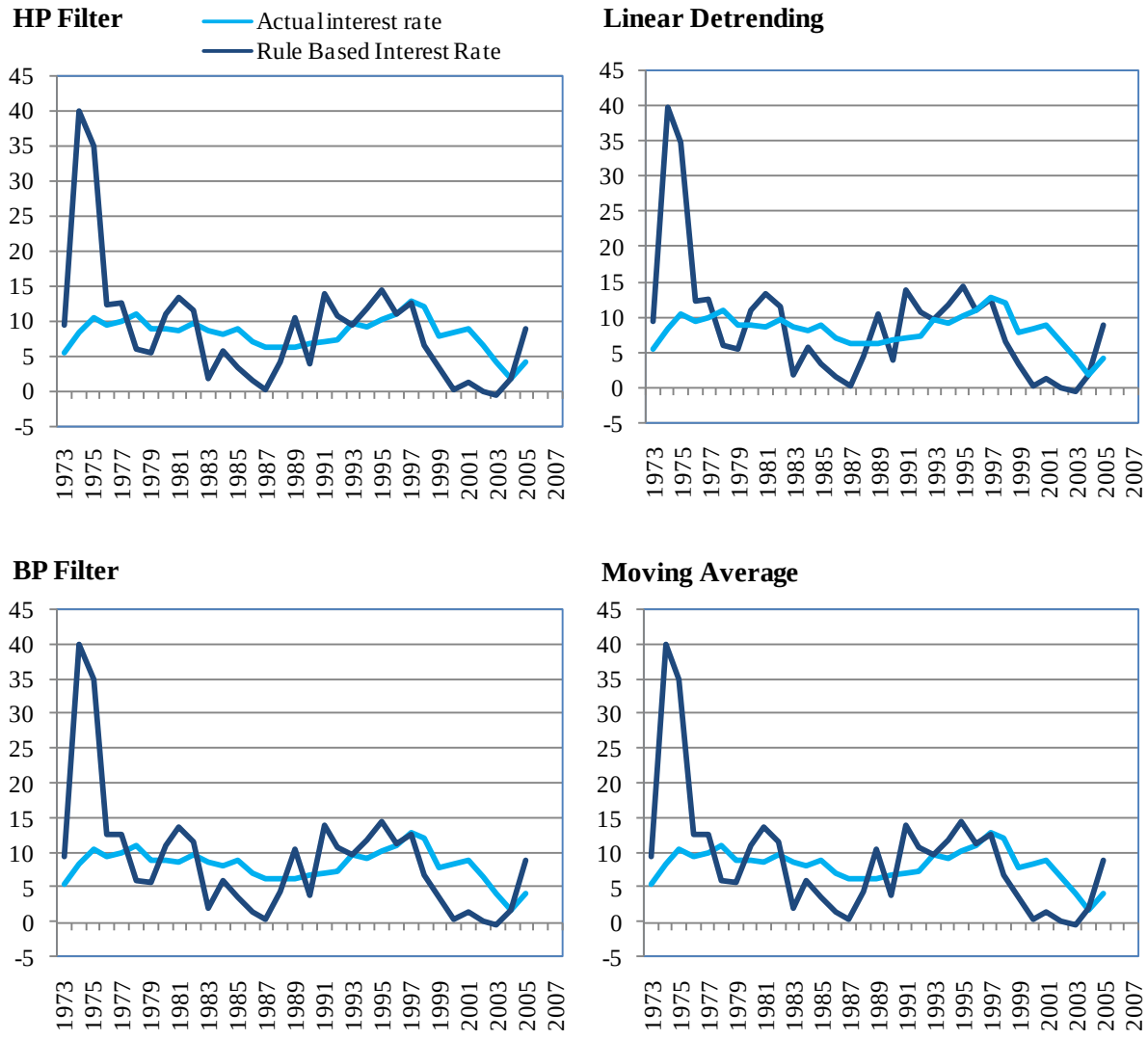


Table A1 : Region-wise* Output Gap by Linear De-trending Approach

	Africa	Asia	Developed	Developing	EMEs	Europe	EU-27	Latin America	Middle East	USSR	World
1970	-0,02	-0,03	-0,05	-0,03	-0,03	-0,05	-0,05	-0,15	-0,09	-0,15	-0,04
1971	-0,01	-0,02	-0,04	-0,02	-0,02	-0,03	-0,04	-0,12	-0,05	-0,13	-0,03
1972	0,00	0,00	-0,01	0,00	-0,01	-0,02	-0,02	-0,08	0,00	-0,11	-0,01
1973	0,01	0,03	0,02	0,02	0,01	0,02	0,02	-0,02	0,01	-0,08	0,02
1974	0,04	-0,01	0,00	0,02	0,01	0,01	0,01	0,01	0,00	-0,06	0,01
1975	0,03	-0,02	-0,02	0,02	0,01	-0,01	-0,01	0,01	0,02	-0,03	-0,02
1976	0,04	-0,02	-0,01	0,03	0,01	0,01	0,01	0,04	0,08	-0,01	0,00
1977	0,05	-0,01	0,00	0,04	0,02	0,01	0,01	0,06	0,07	0,01	0,01
1978	0,04	0,00	0,02	0,05	0,03	0,02	0,02	0,07	0,09	0,04	0,02
1979	0,05	0,01	0,03	0,06	0,04	0,03	0,04	0,11	0,13	0,06	0,03
1980	0,06	0,00	0,01	0,06	0,05	0,03	0,03	0,14	0,09	0,09	0,02
1981	0,04	0,00	0,00	0,04	0,04	0,01	0,01	0,12	0,07	0,11	0,01
1982	0,03	-0,01	-0,02	0,01	0,02	0,00	0,00	0,08	0,01	0,14	-0,01
1983	0,01	-0,02	-0,02	-0,02	0,00	-0,01	-0,01	0,02	0,01	0,16	-0,01
1984	0,02	-0,01	0,00	-0,01	0,01	0,00	0,00	0,03	0,00	0,18	0,00
1985	0,01	0,00	0,01	-0,02	0,02	0,00	0,00	0,04	-0,04	0,21	0,01
1986	0,01	0,00	0,01	-0,02	0,02	0,01	0,00	0,04	-0,03	0,23	0,01
1987	0,00	0,01	0,02	-0,02	0,03	0,01	0,01	0,05	-0,03	0,25	0,02
1988	0,01	0,04	0,03	-0,01	0,03	0,03	0,03	0,03	-0,03	0,28	0,03
1989	0,01	0,05	0,04	-0,02	0,03	0,04	0,04	0,01	-0,04	0,30	0,04
1990	-0,01	0,06	0,04	-0,03	0,01	0,04	0,04	-0,01	-0,02	0,26	0,03
1991	-0,03	0,06	0,03	-0,03	-0,02	0,02	0,02	-0,01	-0,01	0,19	0,01
1992	-0,06	0,05	0,02	-0,03	-0,05	0,01	0,01	-0,01	-0,01	0,03	0,00
1993	-0,10	0,04	0,00	-0,03	-0,05	-0,02	-0,02	-0,01	-0,01	-0,08	-0,01
1994	-0,10	0,04	0,01	-0,02	-0,05	-0,01	-0,01	0,01	-0,05	-0,23	-0,01
1995	-0,10	0,04	0,01	-0,01	-0,05	-0,01	-0,01	-0,01	-0,05	-0,30	-0,01
1996	-0,07	0,05	0,01	0,00	-0,04	-0,01	-0,01	-0,01	-0,02	-0,34	-0,01
1997	-0,07	0,04	0,01	0,01	-0,03	0,00	-0,01	0,01	-0,01	-0,33	0,00
1998	-0,06	0,00	0,02	-0,02	-0,07	0,00	0,00	0,01	0,00	-0,38	-0,01
1999	-0,07	-0,02	0,02	-0,03	-0,06	0,01	0,01	-0,02	-0,03	-0,33	0,00
2000	-0,06	-0,01	0,03	-0,02	-0,04	0,02	0,03	-0,01	-0,01	-0,25	0,01
2001	-0,05	-0,03	0,02	-0,04	-0,05	0,02	0,02	-0,03	-0,05	-0,20	0,00
2002	-0,05	-0,04	0,01	-0,04	-0,04	0,01	0,01	-0,05	-0,05	-0,15	-0,01
2003	-0,02	-0,04	0,00	-0,04	-0,03	0,00	0,00	-0,06	-0,04	-0,09	-0,01
2004	0,00	-0,03	0,00	-0,02	-0,01	0,00	0,00	-0,04	-0,01	-0,02	0,00
2005	0,02	-0,03	0,00	0,00	0,01	0,00	0,00	-0,03	0,01	0,04	0,00
2006	0,05	-0,01	0,00	0,03	0,03	0,01	0,01	-0,01	0,05	0,11	0,01
2007	0,08	0,00	0,00	0,05	0,06	0,01	0,01	0,01	0,06	0,19	0,02
2008	0,11	-0,01	-0,03	0,06	0,07	0,00	0,00	0,02	0,07	0,23	0,01
2009	0,10	-0,04	-0,09	0,03	0,05	-0,06	-0,07	-0,03	0,02	0,15	-0,04

* The list of countries as per their grouping is provided in the appendix of chapter 4.

Table A2 : Region-wise Output Gap by Moving Average Approach

	Africa	Asia	Developed	Developing	EMEs	Europe	EU-27	Latin America	Middle East	USSR	World
1971	0,07	-0,06	-0,11	-0,01	-0,04	-0,06	-0,07	-0,09	-0,08	0,00	-0,09
1972	-0,09	0,06	0,02	-0,03	-0,06	-0,03	-0,03	-0,06	0,42	-0,01	0,01
1973	-0,01	0,43	0,32	0,15	0,13	0,27	0,27	0,22	0,31	-0,01	0,27
1974	0,25	-0,08	0,06	0,05	0,05	0,14	0,13	0,21	-0,36	0,00	0,05
1975	-0,13	-0,13	-0,24	-0,09	-0,01	-0,23	-0,24	-0,08	-0,29	0,00	-0,20
1976	0,10	-0,11	-0,04	0,00	-0,06	-0,01	0,00	0,05	0,40	0,00	-0,03
1977	0,11	-0,06	-0,01	0,00	-0,02	0,01	0,01	-0,01	-0,11	0,00	-0,01
1978	-0,17	0,08	0,07	-0,01	0,01	0,00	0,01	-0,18	0,01	0,00	0,05
1979	0,05	0,12	0,16	0,14	0,03	0,15	0,16	0,11	0,63	0,00	0,14
1980	0,21	0,03	0,05	0,22	0,17	0,10	0,10	0,51	0,23	0,00	0,07
1981	0,03	0,00	0,03	0,12	0,11	-0,04	-0,05	0,35	0,04	0,00	0,03
1982	0,01	-0,07	-0,17	-0,10	-0,04	-0,09	-0,09	0,03	-0,42	0,00	-0,15
1983	-0,17	-0,08	-0,13	-0,19	-0,19	-0,06	-0,05	-0,50	0,07	0,00	-0,12
1984	0,02	0,01	0,04	-0,01	-0,04	-0,01	-0,01	-0,16	0,16	0,01	0,03
1985	0,07	0,01	0,04	-0,06	0,02	-0,01	-0,02	0,01	-0,35	0,02	0,02
1986	-0,01	-0,12	-0,03	-0,03	-0,02	-0,02	-0,03	0,10	-0,07	-0,01	-0,02
1987	-0,18	-0,08	-0,06	0,04	0,02	-0,06	-0,07	0,18	0,04	-0,01	-0,04
1988	0,07	0,09	0,04	0,09	0,09	0,04	0,04	0,02	0,00	0,20	0,05
1989	0,22	0,07	0,11	0,02	0,19	0,11	0,12	0,00	-0,21	0,62	0,11
1990	0,16	0,08	0,10	-0,07	0,08	0,13	0,13	-0,16	0,05	0,67	0,09
1991	0,12	0,07	-0,01	-0,04	-0,04	0,04	0,04	-0,04	0,10	0,72	-0,01
1992	-0,04	0,01	-0,01	-0,04	-0,18	-0,01	-0,01	-0,09	0,13	-0,02	-0,03
1993	-0,30	-0,05	-0,09	-0,02	-0,11	-0,17	-0,18	-0,03	0,30	0,00	-0,08
1994	-0,28	-0,06	-0,01	0,00	-0,03	-0,04	-0,04	0,19	-0,37	-0,78	-0,03
1995	-0,12	0,00	-0,01	-0,03	-0,03	0,04	0,04	-0,12	-0,31	-0,61	-0,02
1996	0,13	0,16	-0,03	0,10	0,09	-0,04	-0,04	-0,12	0,11	-0,36	-0,01
1997	0,05	0,21	0,01	0,20	0,20	-0,03	-0,03	0,21	0,20	0,06	0,04
1998	0,04	-0,18	-0,03	-0,08	-0,22	-0,02	-0,02	0,10	0,17	-0,81	-0,05
1999	-0,06	-0,12	0,01	-0,11	-0,13	-0,03	-0,03	-0,13	-0,17	-0,52	-0,02
2000	-0,03	0,09	0,13	0,11	0,13	0,11	0,12	0,17	0,24	0,20	0,12
2001	-0,05	-0,03	0,04	-0,04	-0,03	0,09	0,09	0,08	-0,15	0,09	0,02
2002	-0,12	-0,09	-0,04	-0,12	-0,09	-0,01	-0,01	-0,18	-0,25	-0,19	-0,06
2003	-0,06	-0,07	-0,06	-0,12	-0,08	-0,06	-0,06	-0,28	-0,21	-0,05	-0,07
2004	-0,04	-0,01	0,00	-0,03	-0,02	-0,02	-0,02	0,00	-0,03	0,05	-0,01
2005	-0,04	-0,04	-0,01	-0,04	-0,06	-0,06	-0,06	-0,04	-0,01	-0,10	-0,02
2006	-0,03	0,03	0,05	0,03	0,01	0,03	0,03	-0,01	0,16	0,01	0,04
2007	0,12	0,19	0,20	0,17	0,20	0,24	0,24	0,23	0,23	0,59	0,18
2008	0,23	0,07	0,14	0,12	0,14	0,23	0,23	0,28	0,31	0,83	0,14
2009	0,19	-0,03	-0,22	0,08	0,05	-0,24	-0,25	-0,17	-0,07	-0,48	-0,14

Table A3 : Region-wise Output Gap by Band-Pass Filter Approach

	Africa	Asia	Developed	Developing	EMEs	Europe	EU-27	Latin America	Middle East	USSR	World
1970	0,09	0,19	0,00	0,05	0,04	0,04	0,04	0,03	-0,09	0,01	0,01
1971	0,02	-0,08	-0,05	-0,01	-0,02	-0,03	-0,03	-0,04	-0,08	0,00	-0,04
1972	-0,03	-0,04	-0,03	-0,04	-0,06	-0,05	-0,05	-0,05	0,20	0,00	-0,03
1973	-0,07	0,29	0,18	0,09	0,09	0,13	0,14	0,10	0,16	0,00	0,15
1974	0,22	-0,14	0,02	0,02	0,00	0,09	0,09	0,12	-0,17	0,00	0,02
1975	-0,17	-0,01	-0,15	-0,07	0,00	-0,18	-0,18	-0,10	-0,21	0,00	-0,13
1976	0,09	-0,05	0,04	0,03	-0,03	0,06	0,06	0,06	0,33	0,00	0,03
1977	0,07	-0,03	-0,02	0,00	0,00	-0,01	-0,01	0,01	-0,14	0,00	-0,02
1978	-0,13	0,04	0,02	-0,02	0,01	-0,02	-0,02	-0,11	-0,08	0,00	0,01
1979	0,03	0,06	0,08	0,05	-0,02	0,07	0,08	0,01	0,38	0,00	0,07
1980	0,12	-0,01	-0,02	0,09	0,09	0,04	0,04	0,24	-0,04	0,00	0,00
1981	-0,04	0,02	0,05	0,04	0,03	-0,02	-0,03	0,08	0,14	0,00	0,04
1982	0,06	-0,03	-0,09	-0,03	0,01	-0,04	-0,03	0,09	-0,30	0,00	-0,08
1983	-0,13	-0,04	-0,05	-0,11	-0,11	-0,02	-0,02	-0,31	0,09	0,00	-0,05
1984	0,05	0,01	0,03	0,05	0,01	0,00	0,00	0,02	0,14	0,00	0,03
1985	0,01	0,02	0,01	-0,05	0,02	-0,01	-0,01	-0,01	-0,25	0,01	0,00
1986	0,04	-0,06	-0,01	0,00	-0,02	0,00	0,00	0,03	0,05	-0,01	-0,01
1987	-0,13	-0,05	-0,04	0,01	0,01	-0,04	-0,05	0,10	-0,01	-0,01	-0,03
1988	0,05	0,07	0,02	0,04	0,01	0,02	0,03	-0,04	0,05	0,01	0,02
1989	0,09	0,00	0,03	0,01	0,10	0,03	0,03	0,05	-0,16	0,29	0,04
1990	0,04	0,04	0,06	-0,04	0,01	0,06	0,06	-0,11	0,06	0,12	0,04
1991	0,05	0,02	-0,03	-0,01	0,01	-0,01	-0,01	0,03	0,04	0,43	-0,02
1992	0,01	0,01	0,02	-0,02	-0,09	0,03	0,04	-0,04	-0,03	-0,23	0,01
1993	-0,14	-0,02	-0,06	-0,01	-0,03	-0,11	-0,11	-0,05	0,26	0,23	-0,05
1994	-0,08	-0,02	0,02	0,01	0,00	0,00	0,01	0,15	-0,25	-0,47	0,00
1995	-0,07	-0,01	-0,01	-0,03	-0,02	0,03	0,03	-0,09	-0,11	-0,09	-0,01
1996	0,10	0,04	-0,02	0,02	0,00	-0,03	-0,03	-0,07	0,08	-0,26	-0,01
1997	-0,02	0,14	0,01	0,12	0,16	-0,01	-0,01	0,12	0,03	0,28	0,04
1998	0,04	-0,13	-0,02	-0,06	-0,15	0,01	0,00	0,06	0,16	-0,47	-0,03
1999	-0,05	-0,05	-0,02	-0,07	-0,05	-0,04	-0,04	-0,14	-0,23	-0,18	-0,03
2000	0,00	0,08	0,08	0,10	0,10	0,07	0,07	0,13	0,26	0,16	0,08
2001	0,00	-0,03	0,00	-0,05	-0,05	0,02	0,02	0,01	-0,15	0,03	-0,01
2002	-0,06	-0,03	-0,01	-0,03	-0,02	0,00	0,00	-0,05	-0,05	-0,11	-0,02
2003	-0,01	-0,03	-0,03	-0,06	-0,05	-0,04	-0,04	-0,16	-0,11	0,00	-0,04
2004	-0,02	0,01	0,02	0,02	0,02	0,02	0,02	0,07	0,04	0,05	0,01
2005	-0,01	-0,02	-0,01	-0,03	-0,04	-0,04	-0,04	-0,04	-0,05	-0,06	-0,02
2006	-0,02	0,00	0,01	0,01	-0,01	0,01	0,01	-0,01	0,10	-0,01	0,01
2007	0,02	0,08	0,07	0,06	0,07	0,07	0,07	0,05	0,01	0,13	0,06
2008	0,15	0,07	0,12	0,10	0,12	0,17	0,17	0,24	0,24	0,58	0,11
2009	-0,11	-0,19	-0,19	-0,15	-0,19	-0,20	-0,21	-0,30	-0,24	-0,53	-0,17

Table A4 : Region-wise Output Gap by Hodrick – Prescott Filter Approach

	Africa	Asia	Developed	Developing	EMEs	Europe	EU-27	Latin America	Middle East	USSR	World
1970	-0,06	0,05	-0,12	-0,10	-0,05	-0,10	-0,11	-0,30	-0,48	0,06	-0,10
1971	-0,04	0,01	-0,10	-0,09	-0,08	-0,08	-0,09	-0,28	-0,22	0,02	-0,09
1972	-0,08	0,22	0,08	-0,04	-0,07	0,04	0,03	-0,12	0,29	-0,02	0,06
1973	0,00	0,56	0,37	0,15	0,13	0,32	0,32	0,21	0,22	-0,04	0,29
1974	0,30	0,02	0,11	0,07	0,05	0,21	0,20	0,26	-0,32	-0,07	0,09
1975	-0,04	-0,08	-0,20	-0,06	0,00	-0,17	-0,17	0,00	-0,27	-0,11	-0,17
1976	0,17	-0,15	-0,03	0,05	-0,06	0,02	0,03	0,11	0,48	-0,15	-0,03
1977	0,14	-0,07	0,02	0,10	-0,01	0,03	0,04	0,08	0,25	-0,20	0,02
1978	-0,08	0,10	0,16	0,18	0,07	0,09	0,10	0,07	0,53	-0,24	0,14
1979	0,12	0,17	0,24	0,36	0,13	0,22	0,24	0,46	1,11	-0,28	0,23
1980	0,25	0,06	0,08	0,40	0,26	0,14	0,13	0,85	0,59	-0,32	0,11
1981	0,04	-0,03	-0,03	0,20	0,12	-0,06	-0,07	0,56	0,27	-0,34	0,00
1982	-0,02	-0,17	-0,30	-0,12	-0,08	-0,18	-0,18	0,08	-0,43	-0,34	-0,24
1983	-0,25	-0,23	-0,28	-0,33	-0,29	-0,20	-0,20	-0,65	-0,18	-0,28	-0,25
1984	-0,06	-0,17	-0,11	-0,20	-0,16	-0,16	-0,16	-0,41	-0,21	-0,16	-0,11
1985	-0,02	-0,17	-0,05	-0,23	-0,05	-0,12	-0,14	-0,22	-0,69	0,06	-0,06
1986	0,01	-0,23	-0,04	-0,12	0,01	-0,07	-0,08	0,00	-0,40	0,34	-0,03
1987	-0,06	-0,13	0,00	-0,02	0,16	-0,02	-0,03	0,14	-0,31	0,79	0,02
1988	0,28	0,12	0,15	0,06	0,28	0,15	0,16	-0,03	-0,20	1,41	0,16
1989	0,48	0,17	0,23	-0,01	0,37	0,26	0,27	-0,08	-0,28	2,17	0,23
1990	0,41	0,23	0,22	-0,11	0,17	0,28	0,28	-0,30	0,10	2,20	0,20
1991	0,21	0,19	0,05	-0,10	-0,04	0,11	0,12	-0,20	0,25	1,99	0,04
1992	-0,13	0,11	-0,02	-0,09	-0,28	-0,03	-0,02	-0,20	0,27	0,53	-0,05
1993	-0,53	0,03	-0,16	-0,03	-0,24	-0,26	-0,27	-0,09	0,37	-0,19	-0,16
1994	-0,53	0,03	-0,12	0,07	-0,13	-0,18	-0,18	0,18	-0,32	-1,68	-0,12
1995	-0,34	0,13	-0,12	0,12	-0,04	-0,11	-0,11	-0,03	-0,24	-1,86	-0,11
1996	0,04	0,26	-0,11	0,26	0,10	-0,15	-0,15	0,04	0,16	-1,95	-0,07
1997	0,05	0,26	-0,05	0,33	0,20	-0,10	-0,12	0,34	0,30	-1,46	0,00
1998	0,08	-0,16	-0,03	0,04	-0,20	-0,04	-0,05	0,28	0,35	-2,03	-0,04
1999	-0,05	-0,19	0,03	-0,07	-0,16	0,00	0,00	0,02	-0,09	-1,38	0,00
2000	-0,07	-0,08	0,16	0,03	0,03	0,17	0,18	0,20	0,16	-0,40	0,12
2001	-0,13	-0,20	0,07	-0,18	-0,13	0,14	0,15	-0,05	-0,40	-0,08	0,02
2002	-0,22	-0,24	-0,01	-0,28	-0,17	0,04	0,05	-0,34	-0,50	-0,01	-0,06
2003	-0,14	-0,21	-0,05	-0,29	-0,18	-0,04	-0,03	-0,49	-0,48	0,32	-0,09
2004	-0,08	-0,09	0,03	-0,14	-0,06	0,00	0,01	-0,19	-0,14	0,58	0,00
2005	0,01	-0,02	0,08	-0,06	-0,01	0,01	0,02	-0,10	0,06	0,66	0,04
2006	0,11	0,11	0,17	0,11	0,14	0,16	0,16	0,11	0,41	0,93	0,15
2007	0,27	0,26	0,25	0,25	0,30	0,30	0,30	0,33	0,45	1,25	0,25
2008	0,36	0,15	0,13	0,22	0,25	0,23	0,23	0,40	0,47	1,20	0,16
2009	-0,01	-0,18	-0,34	-0,11	-0,17	-0,34	-0,35	-0,26	-0,26	-0,62	-0,26

CHAPTER NO. 04

The Globalization-Inflation Nexus: An Empirical Investigation

1. Introduction

The path breaking work of Romer (1993), opens up the fact that globalization causes a decline in inflation. The role of globalization as a check on inflation has recently attracted attention of many (Ball, 2006; Rogoff, 2006). Inflation process has been under a continuous change and it is true that inflation in both the developed and the emerging economies has witnessed a sharp deceleration since the 1980s, and that it remains subdued, despite temporary spikes in the prices of liquid fuels and / or raw materials. The parallelism between the recent globalization wave and the reduction in inflation has led to a perception that the determinants of the slowdown in inflation were not only the domestic ones but could also be part of the fruits of globalization. Taking into account the liberalization and deregulation of markets (Loungani & Razin, 2005), the international competition leading to higher productivity growth, an increased labour supply and the resulting check on wage pressures (Borio & Filardo, 2006), sound fiscal policies (IMF, 2006) and the improved governance of monetary authorities (Crowe & Meade, 2007), one can depict several factors that may have led to the fall of inflation across countries. Such trends thus reinforce the links between openness and inflation that were notably exhibited by Romer (1993).

Although, the argument that globalization results in a slowdown in inflation in developed countries could be subsided to some extent by the observation that monetary unions are also on the back of this reduction (see Diana & Zimmer, 2005), some evidence reveal that inflation has also declined in countries where institutions have not yet been liberalized, in countries where central banks are less independent and where the quality of governance has not shown any significant positive change[1]. This fact raises the question that if globalization plays a significant role in dampening inflation in developed countries, how does it affect inflation in developing ones? This question provides the motivation for this investigation and thus evolves the subject matter of this study.

Lane (1997) supports the earlier studies (Romer, 1993) by claiming that the negative relation between inflation and trade openness holds not only for large countries, but also for economies too small to affect international relative prices. However, besides the advocacy of a relationship between openness and inflation, from some quarters there is ample evidence in

[1] Notably, in Africa, Latin America and in transition economies, where reforms have not gone at the same pace as in other parts of the world, inflation has declined from high double and even triple digits to single digits (see Rogoff, 2004, and Daunfeldt and de Luna, 2008).

contrast to this claim as well. Ball (1994 & 2006) though recognises that financial openness may effect inflation indirectly, denies any relationship between openness and inflation on the whole, and argues that changes in import prices might effect inflation, but not necessarily if they reflect smooth changes in trade. Temple (2002) finds weak existence of the relationship, but with high degree of uncertainty. Daniels *et al.* (2006) conclude that, if controlled for the central bank independence, the relationship between globalization and inflation becomes positive.

Apparently, these contrasting findings explain the complexity of the issue and signal an interesting puzzle. So far the research has mostly taken into consideration the developed countries[2]. However, given the role of emerging economies and particularly those from Asia and Latin America in international trade over the last decades, it implies that a part of the evidence may still be missing[3]. This is all the more puzzling, as to assess the impact of globalization on inflation one can only gain by comparing different sets of regions and countries. As it can be argued that globalization can reduce inflation in developed (high cost) countries, thanks to cheap imports from developing (low cost) countries, it may be the case that, in the low cost countries, the unification of markets has triggered raises in the prices of tradable goods. Given the size and role of emerging market economies in particular and the developing countries in general in international trade, comparing the inflationary impact of globalization in these and in developed countries is thus an important piece of evidence to be added to the debate on the benefits of globalization.

The purpose of this study is to make an attempt to find out the missing piece of this puzzle. The contribution of this study is manifold. First contribution is to assess most of the possible channels of openness transmission mechanism. Secondly, we attempt to investigate that in case of a relationship between globalization and inflation (as shown in the literature) what is its nature. Does globalization impact the dynamics of inflation in the developed and the developing countries both in the same way? How different is the impact on different regions and continents? And lastly to draw if it holds any lessons for monetary policy thereof!

Therefore, in this study we compare how inflation dynamics are affected by globalization in the whole sample of 158 countries. Further we divide the sample into developing and the

[2] See, e.g., Ball (2006), Milani (2009), Rogoff (2006).
[3] Emerging Asian countries exports presently account for more than one-third of world trade flows.

developed countries, while later on to further investigate we divide the sample into six sub samples based on their regional configurations (see Table A1 - A3 in appendix).

Accordingly with the literature on the topic, we estimate a standard Phillips curve, augmented with the variables capturing the impact of globalization, and compare the results for the whole sample with the ones obtained on the several sub samples. The results confirm a global negative impact of trade openness on inflation.

The paper is structured as follows. Section 2 discusses some of the channels through which globalization can impact inflation. Section 3 describes the data and the methodology. Section 4 presents the results, while section 5 concludes.

2. Globalization Transmission Channels

Though globalization is not a new phenomenon, both the scope and the rate of change of the globalization process have increased over time (Taylor, 2007). Global trade and the flows of foreign direct investments (FDI) have witnessed significant increases since the early 1980s (IMF, 2006), and no open economy can be figured out to be unaffected by the process. However, the manifold impacts of globalization can be different from one country to the other, depending on the structure of the economy, and thus of the relative strength of (notably) the following channels:

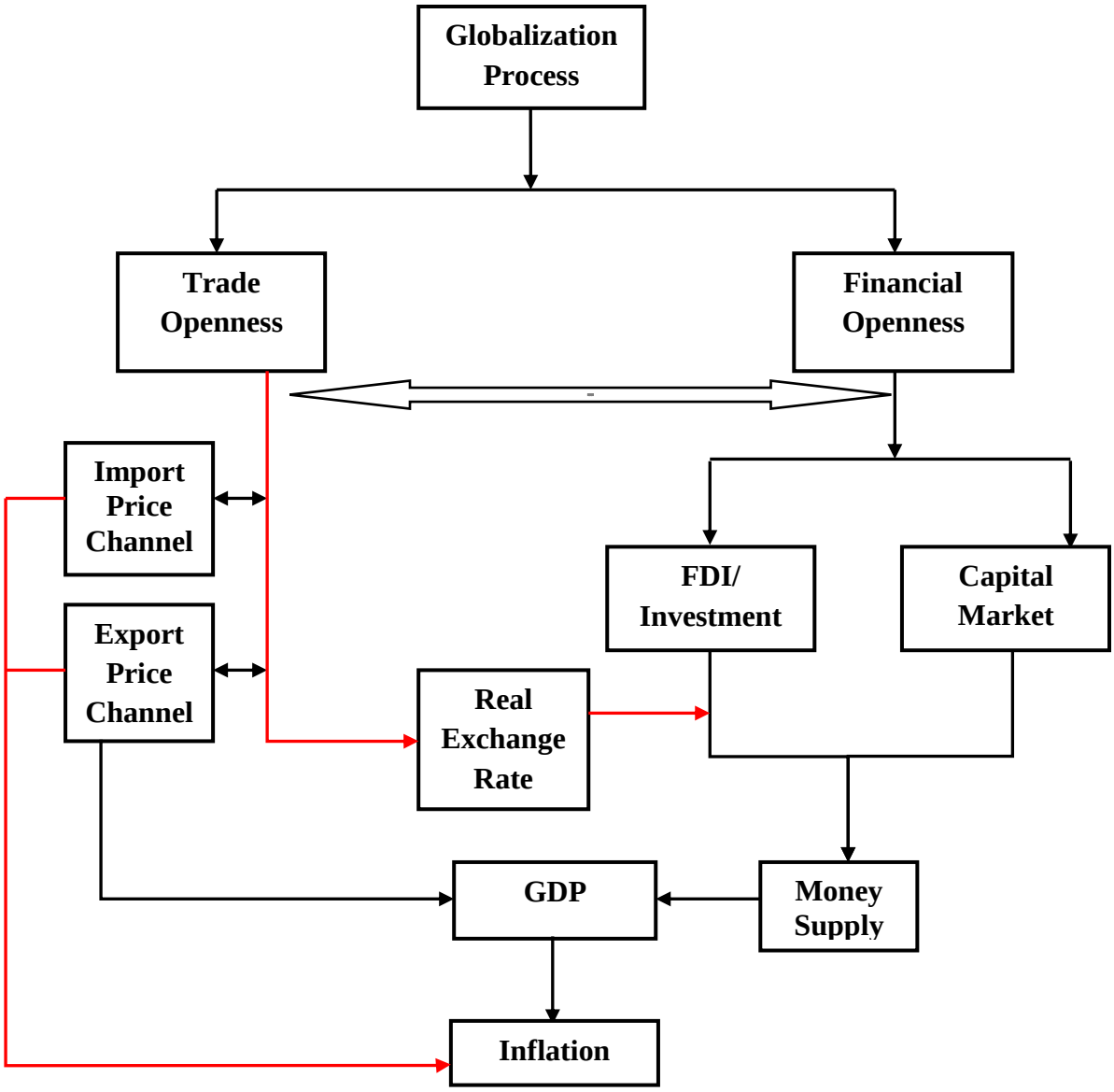
First, globalization has a direct impact on inflation through import prices. With the integration of economies of different nature (say, the low cost and the high cost economies), the flow of low cost imports dampens the inflation in the high cost countries – countries having a high cost of production due to high wages and prices. This 'trade integration' channel is probably the basic channel through which globalization influences inflation, and the decline in the past two decades' inflation is also usually referred to be (at least partly) the result of this effect. Moreover, even if, as observed by Rogoff (2006), this channel may impact the relative price and not the absolute price level, it is reinforced as globalization also puts a check on the central banks' ability to 'grease the wheels' of the economy through expansionary policies (Rogoff, 2004)[4].

As a second channel, one has to notice that labour markets also play a vital role in the transmission of the impact of globalization to inflation. Due to the integration of labour

[4] Note that this channel can be reinforced by an expectations-led one: globalization may dampen expectations if and when agents believe that it results into a decline in inflation. This is all the more true that agents trust the monetary authorities to be more proactive to target and to control inflation in such a context.

markets, the huge influx of labour from the low-cost countries has resulted into an ease in the wage pressures in the high cost countries, which consequently drags the cost of production down and dampens inflation (IMF, 2006).

Figure 1: Openness Transmission Mechanism (OTM)



The third channel works through the enhanced competition process: where the markets are integrated, stronger competition leads to technological progress and extends the scope for economies of scale. Thus the profit margins are squeezed and this may put a downward pressure on inflation (IMF, 2006). Stronger competition due to globalization affects the balance between the global supply and demand of goods and services and may help contain inflation, at least as long as the emerging economies produce more than their domestic

demand. This channel is completed through the capital markets integration, which results into a greater availability of credit, thus affecting the aggregate demand (Glatzer *et al.*, 2006).

A fourth channel has not yet been discussed in the context of globalization. It is the export-price channel. Globalization merges markets across the globe and may help provide cheaper goods to high cost countries. However, at the same time, it gives extra incentives to exporters in the low cost countries, where either the goods are produced at low cost because of a cheap labour force or due to the low purchasing power of the inhabitants. In a scenario where globalization reinforces the sensitivity of domestic prices to international demand and supply, high prices in the high cost countries with high per capita incomes may induce opportunistic behaviour in low cost producers. This would raise the prices of those goods in the low cost countries and push the domestic inflation up (see Figure 1).

This last channel in particular pleads for different strengths of the globalization impact in different types of countries, but the other channels too. In a nutshell, then, the issue appears to be: One world, one market, one price, while different pockets of different sizes. The following sections provide evidence supporting a positive answer to this question.

3. Data and Methodology

As is now customary in the literature, we estimate a standard Phillips curve. The sample covers 158 countries, including 23 industrially developed and 135 developing (see Table A1 – A3 in appendix). To have a comprehensive look into the effects of globalization on inflation in both the developed and the developing countries, we further break down the sample to the regional analysis. In this regards we estimate the same equation for six regions including developed, developing countries and the emerging market economies as well[5].

Data comes from IMF, CHELEM and OECD databases, for the period 1980 to 2007. We use annual data for inflation rate based on consumer price index (CPI) (and GDP deflator for robustness purpose), real exchange rate, and real GDP. The most important part of this estimation remains the computation of output gaps and openness variables.

Output gap, which is the difference between actual and potential output, is one of the important variables needed to have a rough estimate of any impact of increased openness on

[5] These regions include Asia, Europe, Africa, Latin America, Emerging Market Economies and Former USSR States.

inflation. So far there is no source to obtain the already computed data on this variable for all the countries of our sample. In literature there are various methodologies available to compute it, however, due to data and the technical limitation it is sometimes not possible to estimate exact potential output for especially all the developing countries (Syed, 2009). Therefore for the robustness purpose we estimate and use the output gap by three different methods, fortunately we find only slight differences of only the magnitude of our coefficients while using these different estimates of output gap[6].

Moreover, trade openness is computed as per IMF defined methodology (the sum of exports and imports relative to GDP). The data for Financial Openness comes from Chinn and Ito (2008). Besides trade openness and financial openness we, for the first time, use the globalization indices computed by Dreher *et al.* (2008). They compute the overall globalization index by adding various sub-indices of social, political and economic globalization (for details see table A4 in appendix).

3.1. Estimation Methodology

We initialize our estimation with a baseline model:

$$\pi_{it} = \alpha_i + \beta_\circ \pi_{i,t-1} + \beta_1 y_{it} + \upsilon_{it} \quad (1)$$

Where π designates the current consumer price index (CPI) inflation, and *y* the output gap. Our baseline equation reflects the impact of output gap on inflation, and also that of the inflation persistence. However, to reveal the direct impact of globalization on inflation, we augment the baseline equation by introducing different variables of globalization as well as trade openness and financial openness as explanatory variables. Hence, our extended equation reads:

$$\pi_{it} = \alpha_i + \beta_\circ \pi_{i,t-1} + \beta_1 y_{it} + \beta_2 OGI_{it} + \beta_3 EGI_{it} + \beta_4 SGI_{it} + \beta_5 PGI_{it} + \beta_6 TO_{it} + \beta_7 FO_{it} + \lambda_{it} + \varepsilon_{it} \quad (2)$$

Equation 2 shows the complete model with all the variables used simultaneously and in various configurations depending on the issues regarding the strong relationship or dependency of some explanatory variables. Here *OGI* is the overall globalization index, *EGI*

[6] We estimate here the output gap for 158 countries as per chapter 3. We use three methods of (i) linear de-trending, (ii) Hodrick-Prescott filter process and (iii) The Band-pass filter method.

represents economic globalization index, *SGI* is social globalization index, *PGI* indicates the political globalization index, *TO* means trade openness, *FO* is the financial openness, while the fixed effects are contained in the error term in equation (1), which consists of the unobserved country-specific effects, λ_i, and the observation-specific errors, ε_{it}:

$$\upsilon_{it} = \lambda_i + \varepsilon_{it}$$

Estimating equation (2) with OLS or WITHIN estimators is now known to lead to inconsistent estimates due to the presence of both fixed effects such as geography and demographics. Secondly, the GDP based variables are assumed to be endogenous, but causality may run in both directions – GDP to inflation vice versa. Therefore, these regressors may be correlated with the error term. Thus in order to cope with these two issues, we move to the instrumental variables (IV) method.

The exogenous instruments we use are the Freedom House index and RER (real exchange rate) and their lags. However, the first-stage statistics of the 2SLS regressions show that the instruments were weak. With weak instruments, the fixed-effects IV estimators are likely to be biased in the way of the OLS estimators. Also, the presence of the lag dependent variable on the right hand side could lead to auto-correlation. Provided the short time dimension (T =28) and the larger population dimension (see Table A1 – A3 in appendix) of our panel data-set, the Arellano and Bond's (1991) GMM could be a better solution. The GMM has the advantage that it does not require the normal distribution assumption. Moreover it tolerates heteroscedasticity of any form and that in case if the model cannot be solved from the first order conditions analytically, it can still estimate parameters. This flexibility makes GMM more attractive and applicable to the large cross-sectional panel data sets.

Therefore, we use the Arellano – Bond (1991) difference GMM estimator first proposed by Holtz-Eakin, Newey and Rosen (1988). Instead of using only the exogenous instruments listed above, lagged levels of the output and openness are also added. This makes the endogenous variables pre-determined and, therefore, not correlated with the error term in equation (2).

We use the Arellano and Bond 1 step estimation; however, as the Arellano – Bond estimator was designed for small-T and large-N panels[7], as in relatively larger T panels a shock to the country's fixed effect, which shows in the error term, will decline over the time. Similarly, the correlation between the lagged dependent variable and the error term will be insignificant (see Roodman, 2006). Therefore in the latter cases, one does not necessarily have to use the Arellano – Bond estimator. Therefore, for comparison purposes, for the sub-samples having larger T than N we use both the IV and GMM methods[8]. We find quantitatively the same results for the sub-samples using both IV and GMM.

To handle the fixed effects problem, the difference GMM uses first-differences to transform equation (2) as follows:

$$\Delta\pi_{it} = \Delta\beta_1\pi_{i,t-1} + \Delta\beta_2 y_{it} + \Delta\beta_3 OGI_{it} + \cdots + \Delta\upsilon'_{it} \quad (3)$$

Finally, the first-differenced lagged dependent variable is also instrumented with its past levels, thus to cope the issue of correlation.

As a cautionary note, here it is pertinent to state that we make use of the lag of inflation, while the recent literature on Phillips curves has stressed the importance of forward-looking curves (or at least of hybrid curves), and thus considers expected inflation as a right hand side variable. Our specification is however more robust than forward-looking equations (as the appearance of hybrid curves has shown, see for example Goodhart & Hofmann, 2005). Moreover, once again, such a specification is the closest to the one commonly used in the literature on the globalization-inflation debate; and as such can be directly compared to what the literature finds.

4. Empirical Findings

This section describes the findings of our estimations conducted for the whole sample and all the subsamples. Starting with the overall pool we move over to the developed countries and then describe the overview of developing countries and subsequently for the 6 sub-samples. Here it is mentionable that the differentiation between developed and developing countries is still a matter under debate. Different institutions and sources hold diverse definitions. In this

[7] T represents the number of time intervals, while N represents the number of individuals in the population.
[8] Besides, we test the correlated random effects via the Hausman test and the redundant fixed effects through the likelihood ratio, finding strong evidence in favor of country specific fixed effects. Here for the larger T panels we report the GMM while we show the IV results for the smaller samples.

regard one criterion is to distinguish in the basis of per capita income; second on (Gross Domestic Product) GDP, another on the basis of industrialization, while recently it is also done on the basis of human development index (HDI). Here we differentiate the economies on the basis of IMF classification.

4.1. Overall Pool Analysis

As described earlier that the overall pool of developed and developing countries comprises of 158 economies from all the subcontinents of the world. This section presents the results of the whole pool, while the description of these economic and regional groups is given in the respective sub-sections ahead. Here as the majority of the sample belongs to the developing countries (134), therefore, the results in this section are particularly influenced by the dynamics of the developing economies.

The overall results are partly in confirmation with the literature on this subject (see Table 1). Inflation persistence, which shows the tendency of inflation to revert to its usual course after facing a shock, is relatively stronger than the sub-sample of African economies while weaker as compared to the developed economies. Hence, in totality it represents the mean level of inflation persistence. In addition, output gap has a positive relation with domestic inflation, which reveals that changes in the domestic output are still relevant to inflation variations. This results while confirms the earlier findings of the literature claiming a relationship between domestic output and inflation, at the same time it refutes the observation of a flat Phillips curve which is based on the argument that the domestic output gap has no significant impacts on inflation in the current era of increased openness.

Further to check the direct impact of globalization in developing economies we regress the domestic inflation on different variables of globalization. We find that increased openness has a negative and statistically significant impact on inflation. Overall results reveal that a positive change in all the variables of globalization (KoF Indices of globalization) put a downward pressure on inflation. Besides the overall globalization index, the social and the political globalization indices are also negatively related to inflation. This while confirms the earlier findings in this regard, also establishes and provides a further piece of information that globalization has not only impacted the developed but the developing world as well. The economic globalization index (EGI), although, shows a negative relationship, it is weaker and statistically less significant as compared to the rest of indices. In fact it is due to the data deficiency for some of the developing countries on this index, which could be seen in table 1.

Here the sample falls from 158 to 135 when included EGI. However, all the other variables retain their sign and to a greater extent the magnitude in various regression as per table 1.

Table 1. Inflation-Globalization Relationship in the Overall Pool

	(1)	(2)	(3)	(4)
1 *Lagged Inflation*	0,49*** (0,02)	0,48*** (0,02)	0,49*** (0,02)	0,4*** (0,02)
2 *Output Gap*	0,26*** (0,03)	0,28*** (0,03)	0,26*** (0,038)	0,22** (0,04)
3 *Globalization*	-0,06*** (0,004)	-0,04*** (0,01)		
4 *Economic Globalization*			-0,01* (0,005)	
5 *Social Globalization*		-0,02* (0,009)	-0,03*** (0,007)	-0,04*** (0,006)
6 *Political Globalization*		-0,01** (0,004)	-0,02*** (0,004)	-0,01** (0,004)
7 *Trade Openness*				0,004** (0,001)
8 *Financial Openness*				-0,19*** (0,03)
Number of Cross Sections	*158*	*158*	*135*	*155*

1) *Robust S.E in parentheses*
2) A series of procedures were estimated that included the verification of heteroscedastic errors, two-step procedures for parameter calculation; however, the results remain the same for all measures.
3) Arellano-Bond difference GMM applied; constant term suppressed. Sargan test of over-identifying restrictions confirm statistically valid identification of model.
**** Significant at 1 %; ** Significant at 5%; * Significant at 10%.*

An interesting feature of this estimation is observed in the last regression as recorded in the last column of table 1. While we replace the overall globalization index and economic globalization index with the trade openness and financial openness variables, we find, though weak, contrasting results in relation to trade openness and inflation[9]. This result raises two questions: (i) why there is a variation among the regression outcomes while moving on from using globalization indices to the trade openness measure? (ii) What could be the possible mechanism explaining these different outcomes? The answer to the first question is the computational differences of the two variables (globalization indices and trade openness). The indices of globalization, though take into account trade openness (trade as a percent of GDP),

[9] The difference between the globalization indices and trade openness has been described in the data & methodology section.

give weight to this measure of merely 3.5 % in the overall index, which clearly dilutes the impact of trade openness on inflation (see Table A5 in appendix).

However, the second question strongly supports the rationale behind going for this study. As discussed earlier that literature while establishes a negative link between globalization and inflation, does not differentiate the impact on economies of different size and structures, rather it mostly takes into account the developed economies. The weak positive impact of trade openness on inflation in this section also does not explain where this impact is coming from. Nevertheless, it makes the investigation interesting and therefore in the sections ahead, we investigate this impact from region to region and within the developed and the developing economies as well.

As stated that trade openness translates a small part of the EGI, another small portion of this index is explained by the variable of financial openness, hence the two variables bifurcate the EGI to a greater extent and in this way helps studying the impact of any variation in this index on inflation in an inclusive way. The coefficient of financial openness depicts the same relation as that of globalization indices with inflation, yet we find a larger coefficient as compared to the coefficients of globalization indices. This result indicates and further confirms that overall globalization although has a negative impact on inflation, some where the trade openness has a relationship in contrary with inflation.

4.2. Developed Economies

Developed economies form although a smaller part of our sample, it has ample importance keeping in view the size and structures of these economies. We use 23 cross-sections in this group; out of these 17 are those that we use in the group of European economies as well. So the results expectedly would show a greater resemblance in these two groups. The rest of the seven economies include USA, Canada, Japan, New Zealand, Australia and Singapore.

Most of these developed economies have already been enjoying the fruits of economic integration. European Union is a huge example of regional integration. Europe is the second largest economy of the world after the USA, contributing 32.4% of the world GDP, in 1999. Germany is the economic heart of the zone and claims being fourth in terms of nominal GDP and purchasing power parity (PPP) in the world. France is the second largest economy of the region, ranked fifth in the world followed by United Kingdom and Spain.

USA and Canada has also signed free trade agreement like North American Free Trade Agreement (NAFTA). The Canada-United States Free Trade Agreement of 1989 and the subsequent expansion to the NAFTA, which is an agreement between Canada, Mexico and the United States to eliminate tariffs on goods traded between them, has triggered a dramatic increase in trade between these three countries. Over 85% of Canadian exports in 2006 went to the United States. The USA has the largest economy in the world, with a per capita GDP of $46,900. The services sector contributes 76% to the nation's GDP, followed by industry and agriculture at 21.9% and 1.2% respectively during 2009. Canada is equipped with a high tech industrial economy, and resembles the USA in its market oriented economic system, production pattern and high living standards. Canada enjoyed solid economic growth from 1993-2007. After showing 12 years of surplus, Ottawa featured its first fiscal deficit in 2009, consequent to the global financial crisis. Canada's GDP-PPP in 2009 was $1.287 trillion, down from $1.319 trillion in 2008. The services sector contributes 69.6% to the nation's GDP, followed by industry and agriculture at 28.4% and 2% respectively.

The other economies in this group including Australia, Singapore and New Zealand, while being the members to WTO have signed free trade agreement amongst them and with ASEAN (Association of South – East Asian Nations) and USA. In short these economies have already had the required homework and experience of free trade, before going for the larger globalization strategy. Therefore, the gains from increased openness are expected to be higher for these countries.

To investigate this effect we ran four different regressions while shuffling the variables accordingly, and the results reflect a strong inflation persistence, which is as expected, while considering the proper documentation, clear policy objectives and established institutions in these economies. Therefore, inflation has a higher tendency to revert to its usual course after facing any exogenous shock, which is witnessed in the results.

In addition, the output gap has a positive sign with respect to inflation, and this shows the indirect link of enhanced openness. Again it denies the claim that with the increased openness inflation would become less sensitive to the domestic demand pressures (Lakova 2007).

Furthermore, all the globalization variables including those of trade openness and financial openness show a consensus on a negative impact of globalization on inflation in these economies. This result confirms the earlier observation on this subject (Romer, 1993).

Table 2. Inflation-Globalization Relationship in Developed Countries

	(1)	(2)	(3)	(4)
1 *Lagged Inflation*	0,4*** (0,038)	0,4*** (0,03)	0,4*** (0,034)	0,45*** (0,037)
2 *Output Gap*	0,4*** (0,11)	0,4*** (0,12)	0,45*** (0,11)	0,37** (0,13)
3 *Globalization*	-0,04*** (0,004)			
4 *Economic Globalization*		-0,03*** (0,004)	-0,02*** (0,005)	
5 *Social Globalization*			-0,02*** (0,005)	
6 *Political Globalization*			-0,012*** (0,004)	-0,013*** (0,004)
7 *Trade Openness*				-0,001 (0,002)
8 *Financial Openness*				-0,19** (0,03)
Number of Cross Sections	*23*	*23*	*23*	*23*

1) Robust S.E in parantheses
2) Both IV and Panel OLS regressions were conducted as well as the Arellano-Bond GMM.
**** Significant at 1 %; ** Significant at 5%; * Significant at 10%.*

Overall globalization index has a negative sign and the coefficient is higher as compared to the sub-indices of globalization, which is mainly backed by the variations in the indices of economic and social globalization, as the political globalization has relatively a smaller coefficient. However, all the indices show a negative relationship with inflation. Further bifurcation of the economic globalization index in terms of trade openness and financial openness also reveals and confirms this relationship. Here for the trade openness we find a negative sign, yet statistically insignificant. However, financial openness has shown strong negative relationship with inflation which is highly statistically significant.

These results in general support the functioning of globalization transmission channels in these economies and are evident of the fact that increased openness as well as the overall globalization has helped bringing down inflation. The impetus for this openness elastic inflation could be from any of the channels as discussed in the earlier part of the chapter, still the import price pass-through impact could be a vital part of this declining inflation as witnessed though the negative sign of economic globalization index and further supported by

the openness variables. However, as discussed earlier, the impact of this increased openness on inflation in developing and the transition economies and in the various regional groups would form and interesting part of this investigation.

Therefore, in the sub-sections ahead we describe the general background of these economies and than we estimate the same relationships as we did in this sub-section for the developing, transition, and the regional economies.

4.3. Developing Economies

This section forms the one of the most important parts of this study, and to some extent it provides its rationale and the motivation as discussed in the start that in literature there is ample evidence available regarding globalization - inflation relationship but mainly limited to the developed countries.

Globalization in its essence is the mutual sharing of benefits of international trade backed by the theories of specialization. Removal of trade and capital account barriers bring the benefits to both trading sides through the cost differences and at the same time through the enhanced competition among the economies and even within economies. Although, in the earlier section of openness transmission channels it has been deliberated upon as how the cheap labour and consequently the cheap products from the low cost countries has a cooling effect on the global prices and the beneficiaries at first hand would be the high cost economies, it is at the same time important to look into the effect of this increased trade and conglomeration of local and international markets on these low cost supposedly exporting economies, here referred to as developing economies.

The developing economies form the largest part of our sample as it is indeed the largest part of the overall population as well. We include the 135 developing countries from all the continents. This is a highly diversified sample as it includes the small and weaker economies from Africa, while at the same time it includes the oil rich Middle-East, the emerging economies as China, India and other important economies from Europe and Latin America. To cut short, this sample includes developing economies, least developed countries, and the emerging markets economies.

Table 3. Inflation-Globalization Relationship in Developing Countries

	(1)	(2)	(3)	(4)
1 *Lagged Inflation*	0,49*** (0,04)	0,48*** (0,03)	0,42*** (0,007)	0,4*** (0,008)
2 *Output Gap*	0,24*** (0,05)	0,3*** (0,04)	0,23*** (0,009)	0,23*** (0,009)
3 *Globalization*	-0,07*** (0,005)			
4 *Social Globalization*		-0,04*** (0,007)		-0,04*** (0,007)
5 *Political Globalization*		-0,03*** (0,004)	-0,02*** (0,001)	-0,01*** (0,007)
6 *Trade Openness*			0,001*** (0,0001)	
7 *Financial Openness*			-0,25*** (0,015)	-0,2*** (0,014)
Number of Cross Sections	*134*	*133*	*130*	*131*

1) Robust S.E in parentheses
2) A series of procedures were estimated that included the verification of heteroscedastic errors, two-step procedures for parameter calculation; however, the results remain the same for all measures.
3) Sargan test of over-identifying restrictions confirm statistically valid identification of model.
**** Significant at 1 %; ** Significant at 5%; * Significant at 10%.*

The results suggest average inflation persistence in these economies as compared to the rest of samples, while the output gap has a strong positive influence on inflation (see Table 3). This while explains the presence of excess capacity in these economies, is at the same time reflective of the globalization impact in these economies indirectly. This is an important observation as it establishes the relevancy of domestic output gap in the inflation dynamic, despite increased openness. This result confirms Ball (2006) explanation that domestic output has a positive impact on the marginal cost of firms, which has a direct impact on domestic inflation.

Moving forward, the direct impact of globalization in developing economies, though weaker as compared to European economies, is negative and statistically. Overall results reveal that all the variables of globalization (KoF Indices of globalization) put a downward pressure on inflation. However, we find the contrary when we replace these globalization measures for trade openness. There could be several explanations for this result, and different mechanisms could be discussed or hypothesized in this regard, yet one possible mechanism behind this impact, is as discussed earlier that the import price channel is one of the most important ones that makes the difference in economies' inflation dynamics. Cheap imports from the low cost

countries would no doubt place a cooling effect on inflation in the high cost countries, but at the same time, it warms the exporting economies by enhancing competition and by raising the output to feed the rise in exports. However, this rising output may place at first a positive upward impact on domestic inflation by raising the employment and consequently the purchasing power and standard of living. Although we find a small coefficient for the trade openness variable which is highly significant, this result is interesting in first place, and raises the need of further exploration of this issue. In this regard, the next sub-sections where we estimate the same equations for different regional and economic groups could be helpful to detect where this impact is coming from and whether it is common for the developing countries on the whole or it is particular with any specific group.

The coefficient of financial openness has although the same sign (negative) as that of the other sub-samples; it still contains an indication in this case. Based on the hypothesis that the influx of capital as a consequence of liberalization of capital account in the developing countries may consist of mainly the portfolio investments; it would result into increase of money supply unless some sterilization policy could be implemented effectively and would help rise inflation. However, a portfolio investment in the relatively feebler economies with weaker institutions would keep the economies always under a severe risk of failure, particularly in the presence of a convertible capital account[10]. Nevertheless, as per this estimation it reveals that though the overall increased globalization has a negative impact on inflation, financial openness is one of the supporting factor in this negative relationship, while some quarters showing the contrary are backed by the trade openness impact.

4.4. European Economies

It would not be unfair to state that Europe can be divided into two parts: European Union and the rest. European Union forms a block of 27 nations out of which 17 are part of the European Monetary Union (EMU or Eurozone): Austria, Belgium, Cyprus, Estonia, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Malta, the Netherlands, Portugal, Slovakia, Slovenia and Spain has adopted the euro as their official currency. Overall Europe is the second largest economy of the world after the USA. Gradually showing increasing GDP rates over the last two decades, it now contributes is 32.4% of the world GDP. Being the first industrialized continent of the globe, the Europe has become the richest region with the nominal GDP worth of $18.88 trillion in 2009. Germany is the economic powerhouse of the zone and claimed fourth position globally in terms of nominal GDP and purchasing power

[10] Asian financial crisis of 1997-98 could be relevant example in this regard.

parity (PPP).France is the second largest economy of the region, ranked fifth in the world followed by United Kingdom and Spain.

Overall these 5 countries are among the world's top 10 economies, therefore European economies account for half of the 10 wealthiest ones. The end of World War II was the historic event which brought European countries closer together, thinking for a unified and integrated block which ultimately culminated in the formation of the EMU in 1999 and the introduction of a unified currency the euro. European Union collectively forms so far the wealthiest and largest economy in the world even in the present bad times of recession remained the richest region of the world. Out of 500 largest corporations earning largest revenues, headquarters of 184 are located in Europe. Over the past decade European economic integration has seen considerable a model of institutional success and is in many ways a unique experiment. It has gradually progressed from a custom union in the 1950s to a single market in the 1980s and finally culminating into a monetary union and single currency block in 1999 and 2002 respectively.

Tariff and non tariff trade barriers within the union reduced as the union evolved over the time and the gains attained from these reforms led to greater integration and the creation of a single market but the economic performance with in the EU has been varied. EU's earning powers enhanced profoundly after assimilating into an integrated block, the elimination of barriers to trade as a result of the single market program and the adoption of the single currency has also reduce the potential for price discrimination across EU markets. But its un-expectedly slow and unsatisfactory economic growth during the last decades is a sign of its failure to transform into an innovation-based economy. Now to remain more competitive globally the EU needed now is more opportunity for new entrants, greater mobility of employees within and across firms, more retraining, greater reliance on market financing, and higher investment in both research and development (R&D) and higher education. This requires a massive and urgent change in economic policies in Europe and demand for more coordinated efforts.

Globalization has benefited Europe and the EU could even boost annual household income in coming years if the right approach to shape and respond to globalization is build with a more integrated, open and coordinated policy measures. Europe is in a position to capitalize on globalization's economic gains at the same times minimizing its problems with in the block. EU exports to the developing world quadrupled to $B 1,000 between 1990 and 2008. As a

proportion of total exports they grew from 52 per cent to 64 per cent of EU exports. Over the past two decades, Western European trade has become increasingly integrated with emerging market economies. EU exports are rising at 8% a year is only because block is benefiting from the new markets that globalization is creating in the growing emerging world. For the EU, globalization has some special dimensions during the last two decades. First it's increasing integration with the former Warsaw Pact Nations and also with Turkey and second dimension for the EU is the rise of cheap imports from East Asia, in particular from China.

The emerging economies of Asia are also a huge market for EU goods. More than 50 million Chinese already have the buying power of the European middle class, and they represent a growing market for high-value European exports. EU remains a highly competitive manufacturer and exporter and, so long as European companies have fair access to these markets EU stand to benefit. However the challenge is that in a highly competitive global economy, European governments and businesses are investing too little in the knowledge and skills needed to maintain and extend Europe's competitive lead in key sectors. Globalization is keeping the Europe more than a float but to reap the most out of globalization, it has a long list of challenges also.

As the largest economy in the EU, Germany's exports enhanced greatly after joining the block. Known as the economic powerhouse of the union, Germany is leading the GDP growth rates of the block. EU is at the center stage of the globalization and Germany has benefited a lot from this position. It has opted for the policies like rapid technological diffusion, greater trade opportunities, and lower barriers to investment, and domestic policy reforms which have generated greater flows of goods and services globally and within the block. Robust growth in exports, stronger outflows and inflows of investment and greater technological diffusion led the Germany to harvest maximum from the process of globalization. At the same time tighter monetary policy pursued by the Bundesbank in the 90's had contained inflation, but high labour costs and taxes contributed to stagnating growth in western Germany, which slowed from over 4.6% in 1990 to around 2% for the rest of the decade. Present financial crises have also hit the Germany and its economic recovery may depend heavily on emerging-market customers.

France is the second giant of the union. The GDP in France expanded at an annual rate of 0.40 percent in 2010. From 1978 until 2010, France's average quarterly GDP Growth was 0.49 percent reaching an historical high of 1.6 percent in June of 1978 and a record low of -1.6

percent in December of 2008. France is one of the beigest investing nations of the EU and globe, with massive inflows and outflows. Despite its strengths in nuclear energy, aerospace and transport, automotive, food products, and luxury goods it has shown a modest performance on innovations and slower R&D expenditure particularly in the business sector. An industrialized economy having a large and diverse industrial base, it is highly regulated economy of the European Union which has prevented it to reap full benefits of the integration. Its highly centralized and regulated planning and economic policy making has prevented French economy to attain increasing growth rates over the last decade and economy mostly remained steady and sluggish.

In order to study the impact of globalization on European economies we estimate Arellano and Bond GMM for 39 European countries. Although most of the European economies have already attained the development level, the developing countries of Europe also enjoy a relatively higher standard of living as compared to the rest of developing world. High inflation persistence is an understandable phenomenon in the European economies, where the regional integration has started spreading the effects by and large. The results reveal strong

Table 4. Inflation-Globalization Relationship in Europe

	(1)	(2)	(3)	(4)	(5)
1 *Lagged Inflation*	0,67***	0,62***	0,6***	0,68***	0,5***
	(0,03)	(0,046)	(0,03)	(0,019)	(0,03)
2 *Output Gap*	0,34***	0,3***	0,3***	0,23***	0,3***
	(0,03)	(0,02)	(0,01)	(0,07)	(0,067)
3 *Globalization*	-0,39***				
	(0,003)				
4 *Economic Globalization*		-0,013***	-0,015***	-0,017***	-0,017***
		(0,002)	(0,002)	(0,002)	(0,002)
5 *Social Globalization*		-0,023***			
		(0,003)			
6 *Political Globalization*			-0,03***		
			(0,002)		
7 *Trade Openness*				-0,01***	
				(0,019)	
8 *Financial Openness*					-0,1***
					(0,02)
Number of Cross Sections	*39*	*39*	*39*	*38*	*37*

1) Robust S.E in parentheses
2) Sargan test of over-identifying restrictions confirm statistically valid identification of model.
**** Significant at 1 %; ** Significant at 5%; * Significant at 10%.*

inflation persistence in European economies (see Table 4). It means that inflation in these economies has a tendency to remain stable even after having a shock that would affect the trend, but due to strong inflation persistence it would avoid fluctuations. This fact has a vital importance for the rest of the results for this region. In addition we find a strong and statistically significant relationship between output gap and inflation in the European economies.

Going further in our enquiry, we find that all the globalization variables observe a strong negative and statistically highly significant relationship with inflation. This reveals that globalization effects are recorded in these economies, as we find a strong co-efficient of overall globalization. This result in particular confirms the earlier findings of the literature, where researchers observe a negative impact of globalization on inflation.

Moreover, the variables of trade openness and financial openness that we estimate at the end, as robustness check, also endorse the earlier results. It explains that although globalization places a negative impact on inflation in these mostly high cost economies, economically, socially, and politically, the trend inflation has the required capacity to absorb these impacts, and thus the monetary policy remains still relevant.

4.5. Emerging Market Economies (EMEs)

The term "emerging markets" was first coined by the World Bank's International Finance Corporation in the early 1980s. Emerging markets consists of the economies in the process of development showing rapid growth and industrialization. These comprise of large economies like China and India, whereas some countries of Latin America, Southeast Asia, most countries in Eastern Europe, Russia, some countries in the Middle East, and parts of Africa are also included in the list of EMEs.

Emerging markets became the focal of global investment in the late 1980s and recorded outstanding returns in the early 1990s. However these markets seemed to stagger from one period to another due to intense crisis[11] as the EMEs show remarkable performance during the financial crises of 2007-08.

Emerging market economies have shown their dominant presence in the world economy since the decade of 1980's. Currently they account for a significant share of world output and have

[11] These crises include the Mexican peso devaluation of 1994, the Asian financial crisis of 1997-1998, and the Russian ruble devaluation and debt default of 1998, which also transmitted the effects through creating a systemic risk into the developed markets via long term capital management debacle.

got a leading role in the global economic growth due to their high growth rates during the last decade. The shares of emerging markets in the world GDP, private consumption, investment, and trade almost doubled during a span of less than two decades, which is translated in the jumping share of world foreign exchange reserves held by emerging markets from about 20 percent in 1990 to nearly 75 percent in 2008. Due to their increased economic activity, EMEs now play an increasingly important role in international trade and financial flows, thereby implying major shifts in the patterns of global linkages. Trade and financial linkages between advanced economies and EMEs have become stronger than ever before, thus placing a catalytic impact on the process of global integration.

The EMEs started showing signs of promise in economic growth even since the 1960's, as they recorded far greater cumulative growth than other developing countries and the advanced economies. However, although the performance of EMEs, on the whole, remained much better than the other developing economies, it becomes less interesting if exclude Brazil, China and India—three of the largest and dynamic economies.

In addition to the above listed three economies, the rapid integration into world markets by Brazil, Indonesia and South Africa was an important component of globalization during the past two decades. Overall, China and India recorded the best performance. The economic performance of EMEs did not go unhindered by the current recession resulting from the financial crises of 2007, which placed strong though quite diverse effects on the developing and transition economies. The impact was seen in falling remittances, this financial shock was severe, mainly for middle-income emerging economies, heavily dependent on foreign remittances, and however, the impact was short and the massive bailouts of financial institutions in industrial countries, resulted in softening of the shock, leaving the EMEs to play their role in the global economic integration.

Financial openness remained the most dynamic part of the economic trends involved in globalization, and EMEs have best performed in this area. Financial liberalization and increased openness led to the deeper integration of EMEs which resulted in the rapid growth in their gross non-official inflows and outflows. The structure of capital flows has been much influenced by financial reforms in the emerging markets. Whereas the size of the derivatives market in EMEs has grown annually by 28% since 2004, net private flows towards the EMEs exceeded US $400 billion, almost four times larger since the 1990s. At the same time, the

aggregate annual current account position of EMEs has improved from deficit during the 1980s and 1990s to substantial surplus.

Over the past decade, the diversity of capital inflows to the EMEs could largely be attributed to the development of local financial markets and the greater openness to foreign investors, which contributed significantly to the accumulation of large for-ex reserves as described earlier. This resulted in broadening of the scope of financial derivatives based on EME exchange rates.

Due to the increased integration both international trading in EME financial assets and trading by EMEs entities in international assets have risen. Although the late 90s experiences of Latin America and Asia provide enough evidence that countries in the process of integration are increasingly exposed to internal and external economic shocks, this strengthening of external balance sheets has no doubt provided a cushion to the EMEs against macroeconomic shocks.

Here we take into account 19 EMEs to establish if there any relationship between globalization and inflation. The results suggest strong inflation persistence and a random walk in the inflation series of these economies (see Table 5). The relatively higher value of the coefficient of lagged dependent variable in these economies as compared with other regional

Table 5. Inflation-Globalization Relationship in Emerging Markets Economies (EMEs)

	(1)	(2)	(3)	(4)
1 *Lagged Inflation*	0,69***	0,67***	0,69***	0,65***
	(0,04)	(0,035)	(0,035)	(0,036)
2 *Output Gap*	0,19*	0,18*	0,19*	0,19*
	(0,098)	(0,098)	(0,09)	(0,099)
3 *Globalization*	-0,01***			
	(0,004)			
4 *Economic Globalization*		-0,016***		
		(0,004)		
5 *Social Globalization*			-0,01**	
			(0,005)	
6 *Trade Openness*				-0,004**
				(0,002)
7 *Financial Openness*				-0,16***
				(0,036)
Number of Cross Sections	*19*	*19*	*19*	*19*

1) Robust S.E in parentheses
*** Significant at 1 %; ** Significant at 5%; * Significant at 10%.

or economic groups reflects that inflation takes long to revert to its normal trend. While we do not find a highly statistically significant coefficient for output gap variable in EMEs, in all the four regressions we find consistent relationship between inflation and output, which is weakly significant.

The variables of globalization witness a negative and statistically significant impact on headline inflation. Overall globalization index shows a negative relationship with inflation, which is later explained by the same relationships witnessed between the sub-indices of globalization and inflation. The results for this sub-sample reveal a closer resemblance with those of the developed countries. While we observe a negative sign for the variable of trade, the coefficient of financial openness is still recorded high as in the other sub-samples and the overall pool.

4.6. Globalization Impact on African Countries

Despite having remarkably valuable exports like petroleum, minerals, metals and even diamonds, no African country has yet joined the ranks of developed economies. Rather the region is utterly impoverished and the distribution of wealth is largely uneven. Many factors including natural and human calamities play an important role in the miseries of these economies. However, some of the African economies like Mauritania, Angola, Sudan and Mozambique have recorded significant growth over the last few years[12].

Besides high growth rate from some of the countries based on mining, drilling and FDI, some economies including Tunisia and Morocco that are closely linked to the economies of Europe and Middle East, in the north, while South Africa being the highest GDP economy and Egypt have substantial manufacturing structures. Moreover, despite the fact that the largest sector of the African economy, which is agriculture, is heavily composed of subsistence farming, still the concept of globalization has been traced back by some of the African countries to the Cocoa-boom of 17th century. In this way the African link with European and Middle Eastern economies, and recently with Asia, the constant inflow of FDI, rising GDP in some of its economies, while the rest having a substantial potential in terms of natural and human resources, and backed by this fact the increased exports and imports makes it important from the point of view of economic integration and interesting for the subject matter of this study.

[12] According to AFDB, during 2007, Mauritania recorded output growth of 19.8%, Angola 17.6%, Mozambique 7.9%, Sudan 9.6% and Malawi 7.8%, which is much larger than the average global growth.

Inflation remained and still it is highly variable in some of the African economies, while it remained in triple digits in Congo over 1990 – 2002; still in most of the countries it wiggles around 10 percent. This high fluctuation in inflation while reflecting the variety of shock that these economies suffer from, also signals the weak inflation persistence in African economies as compared to the other regions, and this is one of the main findings of this study in the context of Africa.

Table 6. Inflation-Globalization Relationship in African Economies

	(1)	(2)	(3)	(4)	(5)	(6)
1 *Lagged Inflation*	0,33*** (0,015)	0,38*** (0,037)	0,32*** (0,035)	0,4*** (0,02)	0,3*** (0,018)	0,3*** (0,016)
2 *Output Gap*	0,1*** (0,02)	0,1*** (0,02)	0,1*** (0,02)	0,1*** (0,02)	0,1*** (0,018)	0,1*** (0,01)
3 *Globalization*	-0,04*** (0,007)					
4 *Economic Globalization*		-0,02*** (0,005)				
5 *Social Globalization*			-0,05*** (0,01)	-0,05*** (0,01)		
6 *Political Globalization*			-0,01*** (0,001)	-0,01*** (0,001)		
7 *Trade Openness*				0,004*** (0,001)	0,002*** (0,0005)	
8 *Financial Openness*					-0,21*** (0,03)	-0,2*** (0,04)
Number of Cross-sections	*48*	*48*	*48*	*48*	*48*	*48*

1) Robust S.E in parentheses
2) A series of procedures were estimated that included the verification of heteroscedastic errors, two-step procedures for parameter calculation; however, the results remain the same for all measures.
3) Sargan test of over-identifying restrictions confirm statistically valid identification of model.
**** Significant at 1 %; **Significant at 5%; * Significant at 10%.*

Our results are based on the data of 48 African countries over the period of 1980 – 2007. As discussed earlier, the large N in this sample allows us to apply GMM to estimate the Phillips curve. The results reveal important and interesting facts (see Table 6). Besides the relatively weak inflation persistence, inflation in this continent is positively related to output gap. This is coherent with the literature and the economic theory where increased output growth puts upward pressure on the general price level. However, we find the impact much lower than that Ball (2006) finds for the same relationship but only for the developing countries. This provides another reason for the weak inflation persistence as described earlier.

Furthermore, the results based on the different globalization variables points out the integration of African economies with the rest of the world. We find that increased openness puts downward pressure on inflation in domestic economies. While the results for the impact of economic globalization on inflation are almost the same as expected, the relatively high value of social globalization reveals interesting facts. Firstly, the increased social globalization could place a check on the monopolistic practices in these weaker economies, while secondly Africa having a huge colonial past has been liberated to some extent over the last couple of decades, the economies have yet to flourish, however the level of awareness is improving and this fact could be complemented by enhanced competition which may be resulting into a decline in the overall price level.

The variable of trade openness has a positive sign and is highly significant. This explains the weak positive impact of trade openness on inflation in the developing countries sample on the whole. However, for the African economies this result imparts serious implications. At its face, it reveals the high growth potential in these economies. Apparently it could be the consequence of increased economic activity on the back of globalization strategy, which may lead to a rise in purchasing power and in turn in inflation.

4.7. Asia & Pacific

Asia being the largest continent with almost 60 % of the world population has been recording significant growth since the 1980s. Although the engine to the Asian growth remains China and India, some of the other economies have also contributed significantly to the current boom. In this regard South Korea, Hong Kong, Singapore and Taiwan recorded a GDP growth of over 7% over the same period. The interesting feature of this rising economic activity is that these economies achieved export-lead growth. The earlier agriculture relying economies shown their manufacturing ability and also the availability of cheap labour attracted the multinational companies, which were earlier concentrated in the developed world, to establish in this part of the world. This while makes Asia one of the largest producers and exporters of machinery, automobiles and electronics; it provides ample support to the advantages of globalization at the same time.

As described above, the emergence of a stronger Chinese economy on the global market was the one important new development during the last two decades. Chinese economic boom does not only influence the international trade but the regional as well, as in 2002 China became Japan's largest source of imports, as China-Japan trade reached US$101.91 billion in

2002. The rapid economic growth of China over the past 25 years since the beginning of economic reforms in 1978, on average 9.37% per year, is undeniable. Its share in global growth 1995-2002 has been estimated at 25%, compared to 20% for the USA.

Japan achieved an average annual rate of growth of real GDP more than 10 percent during the decade of 1960-1970, until, hindered by the two oil shocks and the average annual rates of growth in the two subsequent decades declined significantly to less than 5%, while since 1990 the average annual rate of growth has been below 2%.

Notwithstanding the considerable slowdown in the Japanese economy, the rest of East Asia recorded a growth significantly faster than Japan in the decades of the 1980s and 1990s[13], where China is one example. These East Asian economies achieved respectable average annual rates of growth ranging between 4% and 8% in the decade of the 1990s despite the East Asian currency crisis of 1997-1998. Over the last two decades, the shares of intra exports of East Asian economies have been increasing rapidly. By the late 1990s, this export volume arrived at approximately 50% of the exports of the East Asian economies.

Another part of Asia that includes the Southern economies initially started their development drive, more or less as closed economies. South Asia's experience of globalization has not been encouraging so far. Although globalization has accelerated economic growth in South Asia and contributed to poverty reduction over the last three decades but most benefits go to only a marginal section. The leveling of incomes that was supposed to occur with the rise in productivity, reforms and an increase in the south Asia's shares in global trade, finance and services, has not taken place. Foreign capital inflows[14] to South Asia surged in recent years, but collapsed in the aftermath of the global financial crisis.

For the sub-sample of 31 Asian countries, we use GMM to observe the relationship between inflation and globalization. The most interesting feature of this analysis emerges where the results show divergence from literature when considering the Asian part of our sample. It appears that the relationship varies depending on the structure of the economies. The results for the Asian developing countries, notably establish a significant degree of inflation persistence, though significantly inferior to the estimates for developed countries and the whole sample, exposing the vulnerability of these economies to exogenous inflationary shocks.

[13] With the exceptions of Brunei, Macau, Myanmar and the Philippines,
[14] This includes remittances, internationally syndicated bank lending, private capital investments, and bond issues.

The relationship between output gap and inflation reveals important facts. Firstly it describes the fact that the domestic inflation in Asian economies is still sensitive to the output gap movements. Any rise in output above the potential would give rise to higher inflation domestically. Secondly, the coefficient of the output gap in these economies is still lower as compared to that of the one recorded for the developed Western economies, which explains the fact that the benefits of globalization are yet to be reaped by the developing Asia to that extent that the west has been obtaining (see Table 7).

Table 7. Inflation-Globalization Relationship in the Asian Panel

		(1)	(2)	(3)	(4)
1	*Lagged Inflation*	0,04*** (0,032)	0,4*** (0,103)	0,4*** (0,05)	0,3*** (0,92)
2	*Output Gap*	0,2*** (0,04)	0,2** (0,13)	0,2*** (0,05)	0,1** (0,05)
3	*Globalization*	-0,04*** (0,007)			
4	*Economic Globalization*		-0,02** (0,01)		
5	*Social Globalization*			-0,02** (0,01)	
6	*Political Globalization*			-0,01** (0,01)	
7	*Trade Openness*				-0,002 (0,01)
8	*Financial Openness*				-0,09* (0,05)
Number of Cross Sections		*31*	*23*	*31*	*29*

1) S.E in parentheses
2) A series of procedures were estimated that included the verification of heteroscedastic errors, two-step procedures for parameter calculation; however, the results remain the same for all measures.
3) Sargan test of over-identifying restrictions confirm statistically valid identification of model.
**** Significant at 1 %; ** Significant at 5%; * Significant at 10%.*
Robust standard errors are estimated for all the regressions in the above table.

Nevertheless, overall globalization negatively effects the domestic inflation in this sub-sample. This is inline with the other sub-samples and the overall population as well. In addition, the economic globalization, social globalization and political globalization places also a negative impact on the domestic inflation. These results are inline with the existing literature for developed countries, and at the same time it conforms to the economic intuition. Trade in this new era of globalization no more remains a zero sum game, but the enhanced economic integration leads towards a paradigm shift towards the concept of a win-win

situation for all at least to the extent of reducing inflation. As per the debate on the channels of openness transmission the enhanced competition leading to greater specialization would no doubt result in softening the inflation pressures in the economies at large, and this is what we find in our estimations.

This result reveals a two-fold fact. In the first instant it is encouraging that globalization pressures are registered everywhere and they have helped bringing down the inflation figure in both the developed and the developing countries. However, a second explanation to this result entails relatively serious and alarming indication, based on the hypothesis that the influx of capital as a consequence of liberalization of capital account in the developing countries may consist of mainly the portfolio investments. As in case of a real investment it would result into increase of money supply unless some sterilization policy could be implemented effectively and would help rise inflation, and at the same time it provides a push to the economic activity and resultantly a higher inflation. However, a portfolio investment in the relatively weaker economies with weaker institutions would keep the economies always under a severe risk of failure and particularly in the presence of a convertible capital account. This fact is evident to some extent in table 4 where we find a weak negative relationship between financial openness and overall domestic inflation. However, for the trade openness we find a negative sign yet the results are statistically insignificant.

4.8. Latin America

Latin America has traces of high rates of inflation, and even that of hyperinflation particularly, and also that of presenting unreliable economic growth rates during the 1980s and in the first half of the 1990s. This includes mainly Argentina, Bolivia, Brazil and Peru. However, macroeconomic stabilisation came only in the middle of the 1990s when their output growth rates started showing a positive trend, consequent to economic integration and good luck. However, not all countries benefit from globalization to the same extent, and According to the UN Human Development Report 2002, during the last 20 years the 24 developing countries that have become most integrated in the world economy showed the greatest improvements in living standards. Their average per capita income rose by 5% per year, compared to 2% in developed countries.

In Latin America, the structural reforms of the last decade which opened this region to international investment, technology and trade resulted in a rise of output growth in many economies. However, the impact was not recorded above board due to incomplete or weak

reforms in some areas, inadequate legal and institutional framework, corruption, the over-regulation of economic activities, and the rigidity of their labour markets[15]. In most of the economies the consistent negative output gap reflects the potential in these economies on one hand while on the other it explains the fact that although their economic performance improved during the last decade, most countries in Latin America missed many of the benefits of liberalization and integration to the global economy.

While the decade of the 1980's is known as the "Lost Decade", for the Latin Americas, decade of the 1990's resulted in a re-integration of the region into in World Economy, and this integration translated in visible economic activity by the start of 2000. Driven by a combination of higher commodity prices and better macroeconomic management in 2000s Latin America actually experienced one of its strongest spells of economic growth since the 1960s. Consequent upon improved integration Latin American economies gained momentum in 2004. Initially the economic activity was bolstered by strong global demand and rising

Table 8. Inflation-Globalization Relationship in Latin American Economies

	(1)	(2)	(3)	(4)
1 *Lagged Inflation*	0,5*** (0,045)	0,5*** (0,04)	0,5*** (0,04)	0,5*** (0,04)
2 *Output Gap*	0,1 (0,1)	0,1 (0,1)	0,1 (0,1)	0,1 (0,1)
3 *Globalization*	-0,05*** (0,007)			
4 *Economic Globalization*		-0,01 (0,01)	-0,01 (0,01)	
5 *Social Globalization*		-0,04*** (0,01)	-0,04*** (0,01)	-0,03*** (0,007)
6 *Political Globalization*			-0,01 (0,01)	-0,002 (0,006)
7 *Trade Openness*				-0,005* (0,002)
8 *Financial Openness*				-0,13* (0,05)
Number of Cross Sections	*25*	*22*	*22*	*25*

1) Robust S.E in parentheses

2) A series of procedures were estimated that included the verification of heteroscedastic errors, two-step procedures for parameter calculation; however, the results remain the same for all measures.

3) Both IV regressions were conducted as well as the Arellano-Bond GMM.

**** Significant at 1 %; ** Significant at 5%; * Significant at 10%.*

[15] Mexico is one example where the gains of globalization are at the same time set aside by the constraints that prevent Latin American countries from fully benefiting from it.

commodities prices, followed by a sharp surge in private consumption and business investment. Indeed, while industrial countries have slowed noticeably over recent period, Latin America's growth momentum has remained strong.

Our estimations are based on the cross-sections of 25 countries from Latin America. Unfortunately some of the most important relationships that we find are insignificant (see Table 8). There could be various explanations for this kind of results, however, one reason points out towards the data discrepancies over the same period as described earlier.

Nonetheless, inflation persistence remains higher than the Asian sample and lower as compared to the European part, which may be termed as the transition of these economies from a volatile state to a more stable one. Output gap although has a positive sign, statistically it is insignificant. Globalization that is the important subject matter of this study, shows a negative relationship with inflation, which means that the effects of increased openness have been recorded in these economies as well.

The integration move as discussed earlier has no doubt started showing its signs, and that is also evident from the relatively weaker, yet statistically significant results regarding trade and financial openness in the later part of the table 6.

4.9. Former USSR

Based on the communist ideology, the economic model of former Union of Soviet Socialist Republics (USSR) was built on a system of state ownership of the means of production, collective farming, and industrial manufacturing and centralized administrative planning. From 1928 to 1991, economic strategy embodied in implementation of well thought out five years economic plans worked wonder and it took the agrarian society of the USSR to the position of one of the world's three top manufacturers of capital goods, heavy industrial products and weapons. However the last 20 years of its existence were mired by pervasive corruption and economic stagnation which eventually led to disintegration of USSR into more then dozen independent states. Transitional phase from a purely centralized to market oriented economic structure was not an easy task for the economy. Predecessor to a regulated economy Russia inherited severe problems which continued to haunt the economy and the financial market particularly in the early five years.

Events of the 1998 currency crisis (massive devaluation of ruble) exposed the inherent and structural weakness of the country and showed that it's still very far from a successful change to the market economy. During this period of economic difficulties it's lost 30 percent of its real GDP and this heavy cost of transition was the reminiscent the Great Depression of the 1930s in the United States. Besides loss in the growth rates the decade of 90s was also a period of high inflationary tendencies in the economy. Unprecedented in the history of USSR inflation (hyper inflation rather) reached over 200% in 1992 and over 800% in 1993, later on declining towards a more tolerable level. Average Inflation rate remained around 20% by the end of the 90s which eventually forced to take unpopular economic decision by devaluing the ruble on January 1, 1998. This resulted in loss of welfare and savings evaporation for common people because now 1 new ruble equal 1000 old rubles. Between 1993 and 1999 the disposable income of the average Russian declined by 25% in real terms.

Besides all these difficulties Russia emerged as one of the fastest growing emerging markets of the world with a strong desire to be integrated in the global markets and attain more openness. Its Gross Domestic Product is worth 1231 billion dollars or 1.99% of the world economy, according to the World Bank. From 1995 to 2010, Russia's average annual GDP growth was 3.28%, attained an historical high of 12% in December of 1999 and a record low of -10.80 percent in June of 2009. The high oil prices were a major factor in the economic growth during these years, later on the collapse of world oil and commodity prices in 2008 exposed the Russia's dependence on the production and export of oil, gas, and other natural resources.

Russia underwent extensive economic and financial reforms over the last decade. Notably the elimination of price controls on most goods, elimination of cartels started in 1992 and more market oriented strategies were opted, but a careful examination of the domestic economic and business scenario reveals that Russia is still not entirely ready and is ill-prepared to handle with the challenges of globalization and integration to world economy.

Russia has its strengths also which are helping it to not only carve a niche but also preserve it in the changing international economic milieu. It has commodities on its export list which never go out of demand and the same high demand of raw materials on the world market gave the opportunity to Russia to build a strong economic growth in the early years of 2000s. This has encouraged Russian participation in globalization with more vigor and actually this participation is deepening at an impressive rate. Its negotiations for the accession to WTO is

another land mark in its journey toward a market based economy and its new role as international energy supplier make it one of the most important player and its proximity to European union has enhanced its position even further. Higher oil prices in 2005-2009 allowed Russia to earn even more from the same exports volumes.

Table 9. Inflation-Globalization Relationship in Former USSR

	(1)	(2)	(3)	(4)
1 *Lagged Inflation*	0,54*** (0,064)	0,53*** (0,07)	0,52*** (0,026)	0,53*** (0,06)
2 *Output Gap*	0,1*** (0,009)	0,1*** (0,012)	0,1*** (0,039)	0,1** (0,039)
3 *Globalization*	-0,07*** (0,015)			
4 *Economic Globalization*		-0,07** (0,018)		
5 *Social Globalization*		-0,02*** (0,01)		
6 *Political Globalization*			-0,01* (0,04)	
7 *Trade Openness*			-0,05* (0,026)	-0,003 (0,003)
8 *Financial Openness*				-0,16*** (0,05)
Number of Observation	*191*	*173*	*168*	*116*

1) Robust S.E in parentheses
2) A series of procedures were estimated that included the verification of heteroscedastic errors, two-step procedures for parameter calculation; however, the results remain the same for all measures.
3) Both IV regressions were conducted as well as the Arellano-Bond GMM.
**** Significant at 1 %; ** Significant at 5%; * Significant at 10%.*

Defense Industry is another Strength of Russia but there is still lack of an adequately devised strategy to meet the challenges of technological revolution and globalization. After years of intense negotiations for the membership of the WTO, Russia is eagerly aspiring to join formally the trade body most probably in 2011. Russia has already agreed on many concessions and is committed to phase out most of its export tariffs, waive flyover royalties which will certainly benefit not only the Russia but also the European community as a whole. After Accession to WTO the estimates point to 11% GDP growth over the long term for Russia. Russian revenue depends on two-three main commodity groups that are highly

sensitive to international price fluctuations and other negative trends on the world markets (petrol can be good example here to understand Russian position).

The Russian economy has been also hit hard by the recent (2007) global financial crisis and recession like the other EMEs, and the after effects of this crisis are visible since later half of the of 2008. The crises have halted the increasing average annual economic growth rate which was maintained from 1999 to 2008. Real GDP decreased during the first quarter of 2009 and 2010, expanded only by 2.7% in the third quarter of 2010. Strong fundamentals of the economy due to rising oil prices in international markets and its formal entry in WTO in 2011 are the ominous signs for the Russian economy.

One distinctive feature of this group in our study is that as USSR does no more exist by the start of 1990s, therefore we use 12 former USSR states including Russia for the period 1990-2007. The results are coherent with those of the majority of the other groups, relatively average inflation persistence, and weaker output gap impact on inflation is found. In addition, all the variables of openness including the trade and financial openness have a negative and significant sign.

5. Conclusion

This study estimates the impact of globalization on inflation in both developed and developing countries. Although already ample research has been conducted in this regard, the earlier studies mostly take developed countries into account while investigating this question, and ignore the other part of the equation – the developing countries. Globalization is considered a strategy having a negative impact on inflation. One of the most vital arguments for this claim is that in the absence of tariff and trade barriers cheap imports from the low cost countries would help cool down inflationary pressures in the high cost countries. This claim in the absence of an enquiry of inflation dynamics in the low cost economies, which are supposedly the developing economies, raises questions on the credibility of the globalization strategy to be offering a win-win situation for the economies across the board.

Therefore, the main objectives of this study were to apply a panel data approach in order to (i) verify the hypothesis proposed in the so far literature including Romer (1993), that there is a negative relation between inflation and trade openness; (ii) to let not limit this hypothesis to only the developed economies, but to extend the earlier research to the developing countries

as well; (iii) to assess and to estimate the effects of globalization on inflation on various economic groups divided on the basis of regions and structures; and (iv) to draw inferences for the contemporary monetary policies in the preview of this new era of enhanced openness.

The results obtained, besides substantiating Romer's proposition, proved to be extremely robust to different specifications and to the application of different estimators. This study while further supports the results obtained by Romer (1993, 1998), indicating that there is a negative relation between openness and inflation, it also establishes a negative relation between inflation and globalization using various variables of openness, most of which were never used for such a study. The results are statistically significant and robust to almost all the regional sub-samples that we analyzed over here, with the only exception of African sub-sample, where we observed a positive relationship between trade openness and inflation (explained in section 3). This is while surprising it is at the same time logical, for the economies with huge potential to grow, could have a strong tendency to record a boost in their output growth due to increased openness. This rise in output where on one hand may lead to decline in unemployment, would be resulting in rising inflationary pressures in the economy on the other.

By the same token, we observe that financial openness has a negative relationship in both the developed and the developing countries. Although the results are weakly significant for the developing countries, they signal the need of surveillance of capital markets in the developing countries, so as to comprehend that the investments are real or portfolio.

The results while are in conformity with the literature on the subject, have at the same time lessons for the current monetary policy. In view of a negative impact of globalization on inflation it makes the inflation targeting central banks more vulnerable to under-shoot the target in spite of meeting or even over shooting it which remained a matter of concern during the era of emerging inflation targeting policies. This while takes away the escape clause from the inflation targeting central banks, also advocates the Walsh (2003) – Speed Limit Policy - which central banks would need to be more specific towards not only controlling inflation but the output volatility as well.

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Appendix:

Group-wise List of Countries in the Sample

Table A1. Sub-Samples

S.No	Latin America	S.No	Developed Countries	S.No	EMEs	S.No	USSR States
1	Argentina	1	Australia	1	Brazil	1	Azerbaijan
2	Barbados	2	Austria	2	Chile	2	Belarus
3	Belize	3	Belgium	3	China	3	Georgia
4	Bolivia	4	Canada	4	Colombia	4	Kazakhstan
5	Brazil	5	Denmark	5	Czech Rep.	5	Kyrgyzistan
6	Chile	6	Finland	6	Egypt	6	Moldova
7	Colombia	7	France	7	Hungary	7	Romania
8	Dominican Rep.	8	Germany	8	Indonesia	8	Russia
9	Dominica	9	Greece	9	India	9	Tajikistan
10	El Salvador	10	Iceland	10	Korea. Rep.	10	Turkmenistan
11	Ecuador	11	Ireland	11	Mexico	11	Ukraine
12	Grenada	12	Italy	12	Malaysia	12	Uzbekistan
13	Guatemala	13	Japan	13	Morocco		
14	Guyana	14	Netherlands	14	Peru		
15	Honduras	15	Norway	15	Philippines		
16	Haiti	16	New Zealand	16	Poland		
17	Jamaica	17	Portugal	17	South Africa		
18	Mexico	18	Singapore	18	Thailand		
19	Nicaragua	19	Spain	19	Turkey		
20	Panama	20	Sweden				
21	Peru	21	Switzerland				
22	Paraguay	22	United Kingdom				
23	Suriname	23	United States				
24	Tobago						
25	Uruguay						
26	Venezuela						

Table A2. Sub-Sample of Developing Countries

S.No	Countries	S.No	Countries	S.No	Countries	S.No	Countries
1	Albania	39	Eritrea	77	Madagascar	115	Suriname
2	Algeria	40	Estonia	78	Mexico	116	Swaziland
3	Angola	41	Ethiopia	79	Maldives	117	Syria
4	Argentina	42	Ecuador	80	Malta	118	Tajikistan
5	Armenia	43	Fiji	81	Malawi	119	Tanzania
6	Azerbaijan	44	Gabon	82	Malaysia	120	Thailand
7	Bahrain	45	Gambia	83	Mongolia	121	Turkey
8	Barbados	46	Georgia	84	Moldova	122	Togo
9	Benin	47	Ghana	85	Morocco	123	Tobago
10	Burkina Faso	48	Grenada	86	Mozambique	124	Tunisia
11	Belarus	49	Guatemala	87	Mauritius	125	Turkmenistan
12	Belize	50	Guinea-Bissau	88	Myanmar	126	Uganda
13	Bangladesh	51	Guinea	89	Namibia	127	Uruguay
14	Bolivia	52	Guyana	90	Nigeria	128	Ukraine
15	Bosnia	53	Honduras	91	Nicaragua	129	Uzbekistan
16	Botswana	54	Haiti	92	Niger	130	Vanuatu
17	Brazil	55	Hungary	93	Nepal	131	Venezuela. RB
18	Burundi	56	Indonesia	94	Pakistan	132	Vietnam
19	Bulgaria	57	India	95	Panama	133	Yemen. Rep.
20	Cambodia	58	Iran	96	Peru	134	Zambia
21	Cameroon	59	Israel	97	Paraguay		
22	Cote d'Ivoire	60	Jamaica	98	Philippines		
23	Chad	61	Jordan	99	Papua New Guinea		
24	Chile	62	Kazakhstan	100	Poland		
25	China	63	Kenya	101	Romania		
26	Colombia	64	Kiribati	102	Samoa		
27	Comoros	65	Korea. Rep.	103	Saudi Arabia		
28	Congo. D. Rep.	66	Kuwait	104	Senegal		
29	Congo. Rep.	67	Kyrgyzistan	105	Serbia		
30	Croatia	68	Latvia	106	Seychelles		
31	Cyprus	69	Lebanon	107	Sierra Leone		
32	Czech Republic	70	Libya	108	Slovenia		
33	Dominican Rep.	71	Lesotho	109	Slovak Republic		
34	Djibouti	72	Lithuania	110	South Africa		
35	Dominica	73	Luxembourg	111	Solomon Islands		
36	Egypt. Arab Rep.	74	Macedonia.	112	Sri Lanka		
37	El Salvador	75	Mali	113	Sao Tome and Principe		
38	Equat. Guinea	76	Mauritania	114	Sudan		

Table A3. Sub-Samples

S.No	Africa	S.No	Africa	S.No	Europe	S.No	Asia
1	Algeria	40	Sierra Leone	1	Albania	1	Australia
2	Angola	41	South Africa	2	Armenia	2	Bhutan
3	Benin	42	S. T. and Principe	3	Austria	3	Bangladesh
4	Burkina Faso	43	Sudan	4	Belarus	4	Brunei
5	Botswana	44	Swaziland	5	Belgium	5	Cambodia
6	Burundi	45	Tanzania	6	Bosnia	6	China
7	Cameroon	46	Togo	7	Bulgaria	7	Fiji
8	Cape Verde	47	Tunisia	8	Croatia	8	Indonesia
9	Cote d'Ivoire	48	Uganda	9	Cyprus	9	India
10	Cen. African Rep.	49	Zambia	10	Czech Republic	10	Japan
11	Chad			11	Denmark	11	Kazakhstan
12	Comoros			12	Estonia	12	Kiribati
13	Congo. Dem. Rep.			13	Finland	13	Korea. Rep.
14	Congo. Rep.			14	France	14	Kyrgyzistan
15	Djibouti			15	Georgia	15	Maldives
16	Egypt. Arab Rep.			16	Germany	16	Malaysia
17	Equatorial Guinea			17	Greece	17	Mongolia
18	Eritrea			18	Hungary	18	Myanmar
19	Ethiopia			19	Iceland	19	Nepal
20	Gabon			20	Ireland	20	New Zealand
21	Gambia			21	Italy	21	Pakistan
22	Ghana			22	Latvia	22	Philippines
23	Guinea-Bissau			23	Lithuania	23	P. New Guinea
24	Guinea			24	Luxembourg	24	Samoa
25	Kenya			25	Macedonia.	25	Singapore
26	Libya			26	Malta	26	Solomon Isds
27	Lesotho			27	Netherlands	27	Sri Lanka
28	Mali			28	Norway	28	Tajikistan
29	Mauritania			29	Poland	29	Thailand
30	Madagascar			30	Portugal	30	Turkmenistan
31	Malawi			31	Romania	31	Vanuatu
32	Morocco			32	Russia	32	Vietnam
33	Mozambique			33	Serbia		
34	Mauritius			34	Slovenia		
35	Namibia			35	Spain		
36	Nigeria			36	Sweden		
37	Niger			37	Switzerland		
38	Senegal			38	United Kingdom		
39	Seychelles			39	Ukraine		

Table A4. KOF Globalization Index

	List of Variables	Weights
A.	**Economic Globalization**	**[37%]**
	i) Actual Flows	(50%)
	Trade (percent of GDP)	(19%)
	Foreign Direct Investment, flows (percent of GDP)	(20%)
	Foreign Direct Investment, stocks (percent of GDP)	(24%)
	Portfolio Investment (percent of GDP)	(17%)
	Income Payments to Foreign Nationals (percent of GDP)	(20%)
	ii) Restrictions	(50%)
	Hidden Import Barriers	(22%)
	Mean Tariff Rate	(28%)
	Taxes on International Trade (percent of current revenue)	(27%)
	Capital Account Restrictions	(22%)
B.	**Social Globalization**	**[39%]**
	i) Data on Personal Contact	(33%)
	Telephone Traffic	(26%)
	Transfers (percent of GDP)	(3%)
	International Tourism	(26%)
	Foreign Population (percent of total population)	(20%)
	International letters (per capita)	(25%)
	ii) Data on Information Flows	(36%)
	Internet Users (per 1000 people)	(36%)
	Television (per 1000 people)	(36%)
	Trade in Newspapers (percent of GDP)	(28%)
	iii) Data on Cultural Proximity	(31%)
	Number of McDonald's Restaurants (per capita)	(43%)
	Number of Ikea (per capita)	(44%)
	Trade in books (percent of GDP)	(12%)
C.	**Political Globalization**	**[25%]**
	Embassies in Country	(25%)
	Membership in International Organizations	(28%)
	Participation in U.N. Security Council Missions	(22%)
	International Treaties	(25%)

Source:
Dreher, Axel; Noel Gaston and Pim Martens, 2008, Measuring Globalization - Gauging its Consequence, New York: Springer.

Table A5. Pool Unit Root Test

Null: Unit root (assumes common unit root process)				
	π	**y**	**OGI**	**RER**
1. Levin, Lin & Chu	-766.071 (0.0000)	-14.3589 (0.0000)	-44.1538 (0.0000)	82.5571 (1.0000)
Null: Unit root (assumes individual unit root process)				
2. Im, Pesaran and Shin W-stat	-114.691 (0.0000)	-27.7602 (0.0000)	-43.6580 (0.0000)	-36.8786 (0.0000)
3. ADF - Fisher Chi-square	1674.40 (0.0000)	1411.82 (0.0000)	2256.61 (0.0000)	1905.25 (0.0000)
4. PP - Fisher Chi-square	1462.66 (0.0000)	992.849 (0.0000)	2456.60 (0.0000)	2271.86 (0.0000)
Null: No unit root (assumes common unit root process)				
5. Hadri Z-stat	-1.99583 (0.9770)	-3.78577 (0.9999)	-1.39336 (0.8652)	-4.90278 (1.0000)
Cross-sections	***158***	***158***	***158***	***158***
Probabilities in parenthesis				

** Probabilities for Fisher tests are computed using an asymptotic Chi-square distribution. All other tests assume asymptotic normality.

Table A6. Redundant Fixed Effects Tests

Sample	Effects Test	Statistic	d.f.	Prob.
Pool	Cross-section F	2.3	-160,33	0.0000
	Cross-section Chi-square	365.0	160	0.0000
Developed	Cross-section F	4.76	-22,54	0.0000
	Cross-section Chi-square	100.6	22	0.0000
Developing	Cross-section F	2.31	-137,27	0.0000

Table A7. Correlated Random Effects - Hausman Test

Sample	Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Pool	Cross-section random	0.00	2	1.0000
Developed	Cross-section random	0.00	4	1.0000
Developing	Cross-section random	0.00	2	1.0000

GENERAL CONCLUSION

This thesis, besides making a survey analysis of the existing monetary transmission mechanism and the channels thereof, has addressed some theoretical and empirical questions related to the transmission mechanism of the increased openness to inflation in industrialized as well as the developing countries over the recent decades. In this regard the monetary transmission mechanism of Pakistan was discussed and analyzed in some depth as a case study. In chapter 1 the focus has been placed upon the effects of monetary shocks to real economic activity and consequently on inflation through different transmission channels, including current account and exchange rate fluctuations in general, while credit and money channel in particular. Chapter 2 has shifted the analysis to a theoretical framework explaining the effects of non monetary disturbance in particular globalization and its role for variations in inflation dynamics, under a non-linear Phillips curve. We establish that increased sensitivity of output spending as a response to the exchange rate fluctuations would lead to acceleration in domestic inflation in the presence of globalization strategy, provided that the current rate of unemployment is more than the natural as well as the minimum rate of unemployment.

Furthermore, we confirm the earlier observation of a negative relation in openness and inflation; however as the model does not differentiate the developing and the developed countries, which remained a weakness of the earlier endeavours in this regard, we conduct a comprehensive empirical analysis of openness – inflation nexus in the chapters ahead.

In chapter 3 we attempted to create the data series of output gap, particularly for Pakistan, and subsequently for a sample of 158 countries by using different statistical and econometric methods. We found differences among the results of different methods even within the statistical and structural methods; however, interestingly the trends do not differ showing some degree of correlation. In general it was the magnitude of results that varies from one to another method.

Finally, chapter 4 studies the main macroeconomic factors driving general price level prices in most of the developing and the developed countries and also in almost all the regional economic groups, with a particular emphasis upon the role of real and financial determinants in the wake of increased international openness. Besides confirming the earlier results, this

part provides more information on the behaviour of inflation in developing countries in the changed environment of globalization. The results are interesting and somewhere contrasting as well with the existing literature, particularly in African sub-sample, where we find that although the indices of globalization show a negative relationship with the headline inflation, we found a weak yet positive and statistically significant relationship between trade openness and inflation in this sub-sample. In this regard a thorough analysis of this region could be useful to further investigate the matter. Furthermore, due to the data deficiencies, particular to the developing countries, we could not empirically test the direct role of export price channel on inflation in our sample, which could be a possible extension of this work.

Abstract:
Despite the prevalent consensus on the short to medium-run effects of monetary policy shocks on the real economy and long-run effects on inflation; the relative importance of the channels of monetary transmission mechanism (MTM) still remains open to debate. In this regard, recent findings of the monetary literature and the important developments in the economic and financial structure of the economies on the whole invoke new insights and important questions on the relevance of monetary policy. The new era of increased openness has also started posing new challenges to the existing monetary transmission mechanism and the policy effects thereof. However, this area has yet not been explored on merit by the researchers, and the existing literature explains only a small part of this globalization – inflation puzzle.
Therefore, this thesis aims to make a contribution to this debate. Starting with the analysis of monetary transmission the corresponding channels and the lags we develop a theoretical model to explain the developments and challenges to the monetary policy in the current scenario of increased globalization. The succeeding section deals with the data of a large set of economies, where in the first instance we compute the potential output and subsequently the output gap for the whole sample. Going ahead we conduct panel estimation using Phillips curve equation for our sample to investigate the globalization impacts on the economies, first on the whole and, then, in parts based on the regional and economic groups.

Keywords: Monetary transmission mechanism; potential output; output gap; globalization; inflation; Phillips curve.

Résumé:
Malgré le consensus qui prévaut sur les effets de la politique monétaire, à court et moyen termes sur l'économie réelle, et à long terme sur l'inflation, le poids relatif des canaux de transmission de politique monétaire reste en débat. Aujourd'hui les derniers résultats de la littérature sur la politique monétaire et les évolutions importantes constatées dans la structure financière et économique des pays du monde, conduisent à de nouvelles idées et interrogations sur l'importance du rôle de la politique monétaire. L'ouverture croissante des économies nationales pose en effet de nouveaux défis aux mécanismes de transmission de politique monétaire existants. Cependant, les chercheurs ont encore peu exploité cette nouvelle dimension et la littérature actuelle n'explique qu'une partie de la relation mondialisation - inflation.
Cette thèse vise à apporter une contribution à ce débat. En débutant par une analyse des mécanismes de transmission monétaire, des canaux et des décalages correspondants, nous développons un modèle théorique qui explique les évolutions et les défis de la politique monétaire dans un contexte de mondialisation. Nous utilisons ensuite une base de données couvrant un large échantillon de pays pour calculer dans un premier temps la production potentielle et l'écart de production pour l'ensemble de l'échantillon. Puis, dans un second temps, à l'aide d'estimations en données de panel fondées sur une équation de la courbe de Philips, nous étudions les impacts de la mondialisation sur l'inflation pour l'ensemble des économies du panel mais aussi pour des sous-ensembles régionaux.

Mots-clés : Mécanismes de transmission de politique monétaire ; production potentielle ; l'écart de production ; mondialisation ; inflation ; courbe de Philips.

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