Essays on Exchange Rate Pass Through, Monetary Policy Regimes, and Financial Development and Growth

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Abstract

Monetary policy has become a key component of economic policies. Modern monetary policy has been shaped by a substantial amount of theoretical and empirical research over the past few decades. The thesis focuses on three particular areas where the influences of monetary policy have become of great importance over the recent decades.

While the 1st chapter sets out the backdrop, the 2nd chapter focuses on exchange rate pass through elasticities and their macroeconomic determinants. Pass through is a source of inflation through imports in open economies and has reportedly been declining in a number of countries since the 1980s for aggregate prices level. Low average and persistent inflation has been suggested as one of the main reasons for this decline. Pass through is influenced by the monetary policy regimes. We first estimate the pass through elasticities and verify the evidence of declining pass through across different monetary policy regimes for 39 countries over the period 1981 to 2010 by constructing some relevant indices. We find the evidence of declining pass through over the period. Secondly, we verify the important macroeconomic determinants by including some macroeconomic variables and monetary policy regimes. Our findings reaffirmed the importance of inflation in determining pass through elasticities and suggest that inflation targeting monetary policy regime and greater central bank autonomy reduce pass through elasticities.

In the 3rd chapter, we first provide a classification of *de facto* monetary policy regimes for 124 countries, which includes 7 exchange rate regimes and 4 inflation targeting and monetary targeting regimes. The previous studies had only classified *de facto* exchange rate regimes and ignored the underlying monetary policy frameworks in their classifications exercises. However, the outcome of such classifications will not be accurate, as some of the identical exchange rate regimes will have different monetary policy frameworks, such as inflation targeting, which needs to be taken into account in any proper assessment of the impact of the regimes on growth and inflation. Secondly, we evaluate the regime performances on growth and inflation by using pooled mean group (PMG) estimation method instead of GMM. PMG is more suitable for panel analysis with a large number of time series observations (T) and the number of

groups(N). The findings suggest that monetary policy with nominal anchors is more conducive to growth.

The 4th chapter focuses on the relationship between financial development and economic growth in terms of both the quality and volume of financial development in eight Asian and south east Asian emerging economies for the period 2003 to 2012. We have estimated the cost and profit efficiencies of the banks in these countries for the first time to measure the quality of financial institutions. Broad money growth and bank credit to the private sector as a percentage of GDP have been used for the volume measures. The findings suggest the importance of both the volume and the quality of financial development for growth in these countries.

The 5th and the final chapter concludes.

To my late father

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List of Acronyms

BIS	Bank of International Settlements
BoE	Bank of England
BoG	Bank of Guatemala
CPI	Consumer Price Index
ERM	Exchange Rate Mechanism
CUSUM	Cumulative Sum Control Chart
ECB	European Central Bank
ERPT	Exchange Rate Pass Through
EU	European Union
FDI	Foreign Direct Investment
FPI	Foreign Price Index
IFS	International Financial Institutions
IMI	Import Price Index
GMM	Generalised Method of Moments
ICRG	International Country Risk Guide
IMF	International Monetary Fund
IT	Inflation Targeting
MT	Monetary Targeting
NEER	Nominal Effective Exchange Rates
NUTs	Nomenclature of Territorial Units for Statistics
NSSO	National Sample Survey Organisation, India
PTM	Pricing to Market
PMG	Pooled mean Group Estimation
PPI	Producer Price Index
SARB	South African Reserve Bank
SFA	Stochastic Frontier Analysis
TRG	Technical Rate of Growth
TWER	Trade Weighted Exchange Rate Index
VAR	Vector Auto Regression
VECM	Vector Error Correction Model
OECD	Organisation of Economic Co-Operation and Development
OLS	Ordinary List Squares
WB	World Bank
WDI	World Development Index

Chapter One: Introduction

1.1 Introduction

Over the last few decades monetary policy has played an important role in stabilizing output and inflation. The preference for monetary policy, as an option, has increased since the 1960s, partly because of the concerns over the limitations of fiscal policy and partly because of the fear that fiscal policy decisions are susceptible to political influences, making it difficult to achieve desirable outcomes using fiscal policy instruments. Among the policy variables, exchange rate is one of the fastest transmission channels for monetary policy. Typically, the monetary policy instrument is a financial market price (e.g., short term interest rates, bank credits etc.) directly set or closely controlled by the central bank (Hildebrand, 2006). The monetary policy instruments are interrelated and their deployment and effectiveness depend on various factors, such as exchange rate arrangements, monetary policy frameworks, controls and regulation over capital flows (Mishkin, 2007a; Walsh, 1998). Monetary policy regime has the ability to influence various aspects of an economy, such as growth, inflation and financial development. The thesis has focused on three areas where modern monetary policy has important roles to play.

The mutually exclusive chapters of the thesis cover the broader area of applied macroeconomics. They are focused on the empirical issues related to exchange rate pass through, classification and performances of monetary policy regimes, and the implications of financial development on growth.

1.2 Background

There is a global decline in average inflation from 14% in the early 1980s to 4% by the early 21st century (Rogoff, 2003). 'Inflation is always and everywhere a monetary phenomenon' a famous statement by Milton Friedman has become a cliché. Anti-inflationary fiscal and monetary policy played an important role in bringing down inflation in many countries over the past few decades. There has been a broad consensus that the choice of how to conduct monetary policy has important consequences for aggregate activity. A stream of empirical research beginning in the 1980s and a considerable improvement in the underlying theoretical frameworks used for policy analysis have substantiated the fact that monetary policy significantly influences the short term course of real economy (Clarida *et al.*, 1999). For a long time

macroeconomists have been acknowledging the important role of inflation expectations in the transmission process of wage and price inflation. They are, however, divided sharply over the role of monetary policy in controlling inflation expectation.

The existence of strict monetary rules over the 19th century left very little leeway for monetary policy. At the very onset, central banks gained their legitimacy by acting as the lenders of the last resort during the financial crises rather than by formulating monetary policy. The apparent irrelevance of monetary policy is brought out sharply by the work of leading economic historians such as Charles Goodhart (1987). Goodhart (1987) studied how the profit making central banks eventually transformed themselves into the modern public institutions. This transformation primarily took place during the 20thcentury. The roles of the central banks have been shaped by the financial crises, need for information and a lender of the last resort.

Practicing monetary policy is an effective tool for conducting economic policy is a recent phenomenon. The scepticism regarding the ability of monetary policy to control inflation was dominant well into the 1970s.[1] This scepticism was reflected in the deep division within the academic world over the supremacy and credibility of central banks to influence inflation expectations. The foundation of modern monetary policy was laid by the Keynesian and Monetary schools of thought during and after the Great Depression. Keynesian economists recognised the scope of monetary policy, whereas monetarist economists emphasised its limitations. While both schools are divided on the role of monetary policy, they are in consensus over the significance of monetary policy in policy making process. The reign of the Keynesians was undisputed until the rampant stagflation over the 1970s and early 80s and before the Monetarist critiques. In the midst of the confusion, created by the division between the Keynesian and Monetarist schools of thought, Rational expectations monetary theory examined the interrelationship between inflation psychology and monetary policy. Lucas (1976), and Lucas and Sargent (1981) theoretically demonstrated that inflation expectations can be controlled to maintain central bank's desired lower rate of inflation if the central bank can credibly commit to noninflationary rules. Therefore, in a credible disinflationary monetary policy money growth, expected inflation and actual inflation

[1] Inflation was largely believed to be aggravated by the factors such as fiscal deficits, commodity price shocks, inflation psychology, aggressive labour unions and monopolistically competitive firms (Goodfriend, 2007).

could all have a coherent movement without any adverse impact on employment. The fundamental question is how long it takes a central bank to achieve credibility to pursue this goal.

Some Keynesian economists like Tobin were pessimistic about the credibility of achieving low inflation and held the view that the response of inflationary expectations to any policy changes would be very slow. In contrast, Monetarists were divided over how readily a central bank could acquire credibility for low inflation. In a seminal work Kydland and Prescott (1977) demonstrated the 'time inconsistency problem' of the optimal monetary policy. The problem suggests that a central bank free to choose discretionary monetary policy will always have an incentive to pursue expansionary monetary policy to reduce unemployment despite the promise of pursuing a low inflationary policy. The promise has to be secured by a credible commitment to focus only on the low inflation target. Monetary policy can influence growth over the short run, but the ability is very limited over the long run. The temptation to pursue growth and unemployment over the long run will create inconsistency as the rational agents will adjust the wage and the price on the basis of their expectations. As a consequence, the economy will end up with higher inflation.

Therefore, credibility is regarded as one of the key factors for an effective monetary policy for reducing inflation and in improving the flexibility of monetary policy to stabilise employment over the business cycle (Goodfriend, 2007). Rogoff (1985) and Cukierman (1995) proposed the idea that independent central banks be governed by conservative central bankers. The reasoning paved the way for the two institutional revolutions that occurred over the period from the late 1980s until now. Institutional supports are designed to anchor inflation expectation and entrusted with the explicit mandate of price stability, such as inflation targeting.

1.3 Motivation for the Research

The monetary authorities of a number of industrialised countries were successful in battling inflation. Many industrialised countries started experiencing a period of relative price stability over the late 80s and the early 90s. Among a number of competing factors, many attribute the cause of low inflation to the adoption of credible monetary policy regimes aimed at influencing the inflation expectations of economic

agents.[2] Some countries, such as Australia, Canada, the UK, Brazil, and Chile achieved this credibility through adopting formal inflation-targeting framework for monetary policy. However, countries like the US, Switzerland and also the European Union (EU) achieved this goal through a credible and persistent commitment to pursue low inflation (Bailliu *et al*., 2004).

This low inflationary period has also coincided with several episodes of large exchange rate depreciations with much smaller impacts on consumer prices compared to the similar depreciations in the past. Prominent examples include the UK and Sweden after the 1992 European exchange rate mechanism crisis (ERM), and Brazil in 1999 after the currency crisis. Event studies by Cunningham and Haldane (1999) of the 1992 depreciation and 1996 appreciation in the UK, the 1992 depreciation in Sweden, and the 1999 depreciation in Brazil show a significant small pass-through of exchange rate changes to retail prices. In the UK, neither the 20% depreciation in 1992 nor the 20% appreciation in 1996 caused retail price inflation to deviate significantly from the 2.5% trend. The lack of response in the retail price is due a decline in exchange rate pass through (ERPT). Pioneering this view, the Taylor (2000) model demonstrates that the pricing power of the firms is reduced with low inflation and lower persistence of inflation, therefore, limiting their ability to pass through costs arising from exchange rate depreciations. Taylor (2000) emphasised the role of monetary policy regime and suggested that a change in the monetary policy was the primary cause of this declining pricing power of the firms. [3]

A number of subsequent studies found evidence in support of Taylor's (2000) proposition.[4] These findings imply that credible monetary policy regimes with an intention and the commitment of low inflation will experience lower exchange rate pass through. This provides the basis for the second chapter of the thesis.[5] Given the importance of the role of monetary policy regimes, in Chapter 3 we have conducted a classifications exercise of monetary policy regimes and evaluate the performances of

[2]Globalisation has been cited as another contributing factor, which reduced inflation by increasing competitiveness.

[3] The details will be discussed over the next sections.

[4] For example, see McCarthy (1999), Gagnon and Ihrig (2004).

[5] However, we have used the Reinhart and Rogoff (2002) *natural classifications* of exchange rate regimes, as well as inflation targeting (IT) regime, to observe the impact of monetary policy regimes on pass through elasticities. This discussion has been elaborated in the first chapter.

these regimes with respect to growth and inflation. In the 4th chapter we have carried out an empirical investigation on the role of financial development and economic growth, emphasising both the quality and volume measures of financial development.

1.4 Structure and contributions of the thesis

In the 2nd chapter we estimate the ERPT elasticities for 39 developed and developing countries over the period 1981 to 2010 across different monetary policy regimes and evaluate the impact of some macroeconomic variables on ERPT. The pass through elasticities into domestic inflation appear to have declined in many countries since the late 1980s. Taylor (2000) and the Bank of Canada (Monetary Policy report, 2000) have conjectured that anti-inflationary monetary policy may have changed the price setting behaviours of the firms. As mentioned previously, Taylor (2000) in a simple microeconomic staggered price-setting model, demonstrated the possibility that lower inflation has led to lower pricing power of the firms. His model indicates that observed changes in pricing power are due, in part, to the changes in expectation of the inflation persistence and cost movements. A simple explanation could be that the extent to which a firm tries to match an increase in costs or prices to other firms by increasing its own price, largely depends on how persistent the increase is expected to be. Lower and stable inflation is associated with lower inflation persistence, therefore, reducing the rise in the cost.

Taylor's (2000) hypothesis has been subjected to extensive empirical testing to find the linkage between ERPT of import or consumers prices and monetary policy regimes (for example, average and the variability of inflation, and average exchange rate depreciations and the variability of exchange rate changes). However, these studies are, mostly, concentrated on the developed countries. Very few studies examined this issue in the context of developing countries. The role of ERPT, in the context of developing countries, is much more important since many of these countries adopted flexible exchange rate regimes and abolished the capital controls. As a result, these countries have become much more susceptible to the exchange rate changes and imported inflationary pressure.

Choudhri and Hakura (2001) verify Taylor's (2000) proposition in the context of a Dynamic General Equilibrium (DGE) model with imperfect competition and staggered contracts. In the model they demonstrate that a low inflation regime reduces

ERPT because the pass through reflects the expected effect of monetary shocks on current and future costs, which in turn are compensated by low inflationary environment. The empirical verification of the model has been done on 71 countries over the period 1979 to 2000. In general, the macroeconomic determinants in most of the macro based ERPT studies are comprised of the effects of inflation, inflation volatility, exchange rate changes, exchange rate volatilities, size of the country (proxied by nominal GDP) and trade-openness (for example, Gagnon and Ihrig (2001), Campa and Goldberg (2002), Choudhri and Hakura (2006) among others).

Nevertheless, there is a debate whether the apparent decline in ERPT is, truly, a macro or micro economic phenomenon. For example, Campa and Goldberg (2002) find that the main determinants of changes in pass through over time are microeconomic and related to the alteration of the trading basket from homogenous raw materials towards differentiated manufactured goods and services. Their study provides extensive cross country and industry level data on 25 OECD countries over the period of 1975 through 1999. However, their finding has been subjected to various criticism and a number of studies substantiated that the decline in pricing power of the firms has helped keep inflation low in some countries, therefore, linked the decline in ERPT to the monetary policy regimes. ERPT analysis based on aggregate macro data is important from the context of monetary policy. Studying the implications of ERPT on consumer prices is essential to the effective monetary policy making. The effectiveness of the trade balance adjustment through expenditure switching also depends on the extent of ERPT, hence on the exchange rate policy.

We extend the existing literature on ERPT by estimating pass through elasticities of consumer price index (CPI) across different monetary policy regimes for 39 developed and developing countries over the period 1981 to 2010. We verify the evidence of declining pass through across the different monetary policy regimes. The policy regimes are determined on the basis of inflation. Furthermore, we assessed the important macroeconomic determinants of ERPT. In order to calculate the pass through coefficients, we have constructed trade-weighted exchange rates index (TWER) for each country using the weights of import share of the trading partners of each country to the percentage change of exchange rate. We have used the TWER instead of nominal effective exchange rates (NEER) for our analysis. TWER is more appropriate as the exchange rate pass through stems from the import prices. The foreign inflation indices

are also calculated by the weights of the importers shares and the percentage change of their producers' price index (PPI). Different sub-sample periods for monetary policy regimes have been created with CUSUM test for breaks and according to the dates of the official adoption of inflation targeting regimes and other monetary policy regimes. Vector error correction model (VECM) has been used to calculate the pass through coefficients. In the second stage, we have included average and volatility of inflation, volatility of exchange rates, size of the economy, openness to identify what determines pass through elasticities for these countries. Additionally, we have used different exchange rate and monetary policy regimes and central banks autonomy index to observe their impacts on the pass through coefficients. Pooled OLS regression analysis has been used to evaluate the pass through determinants.

The findings from cross-country ERPT analysis suggest a decline of pass through along with the inflation rates. Average short run (over a quarter) pass through elasticity is 24% and average long run (over a year) pass through elasticity is 35%. However, pass through elasticities have increased during the recent financial crisis, suggesting that a depreciation could have a larger impact during the crisis period. In the long run, ERPT has a positive relationship with average inflation. Greater central bank autonomy is found to be associated with the reduction of long run pass through elasticities. In the short run, low inflation volatility and Inflation Targeting (IT) regime reduces exchange rate pass through. Therefore, the finding suggests that credible monetary policy regimes indeed, have a role to play in reducing pass through elasticities over the last three decades. The findings also suggest that the inflation targeting regime has the ability to influence the short run ERPT, whereas central bank autonomy is helpful to reduce long run pass through.

In the 3rd chapter of the thesis, we have conducted a *de facto* classification exercise of monetary policy regimes for 123 countries over the period 1970 to 2012. The chapter contributes to the existing literature by incorporating other monetary policy regimes in addition to exchange rate regimes and evaluating the impact of these regimes on growth and inflation by using PMG. Despite an extensive literature on de facto classification of exchange rate, no such effort has been made so far to classifying other monetary policy regimes, such as inflation targeting or monetary targeting regimes. The previous *de facto* exchange rate regimes classification studies ignored the underlying monetary policy frameworks when evaluating the impact of the regimes on

growth and inflation. However, the outcome of such classifications will not be accurate, as some of the identical exchange rate regimes will have different monetary policy frameworks and which needs to be taken into account in any proper assessment of the impact of the regimes on growth and inflation. We try to overcome the deficiencies of the previous studies.

The literature on *de facto* and *de jure* classification of exchange rate regimes is quite extensive. Studies like Calvo and Reinhart (2000), Eichengreen and Frankel (1999), Hausmann (1999), and Mackinnon (2000) demonstrate that many countries officially have a flexible rate but that they intervene in the exchange rate markets so persistently that in practice the exchange rate is effectively fixed. On the contrary, the frequent and periodic devaluation of fixed exchange rates in inflation prone countries due to the monetary policy intervention renders the exchange rate more flexible than fixed. 'Fear of floating' phenomenon, demonstrated by Calvo and Reinhart (2000) explains how emerging economies often actively intervene in the exchange rate market to reduce the volatility of their exchange rate. Lack of credible monetary policy is one of the most important reasons for this occurrence. In the absence of credible monetary policy, stabilisation of exchange rate provides a clear nominal anchor for inflation in these countries. High ERPT, the inability of emerging countries to borrow in their own currencies and risk of currency crisis are also some important reasons behind the exchange rates intervention. Therefore, the *de jure* classifications of exchange rates are often misleading and the classification of *de facto* regimes has become quite extensive.

Recognising the deficiencies of the *de jure* exchange rate classifications, IMF official classification started taking into account the *de facto* classification from 1999. There are two approaches, mainly followed by the *de facto* classification of exchange rate regimes studies. One is the mixed *de jure-de facto* classification and the other one is pure *de facto* classification of exchange rate regimes (Tavlas *et al*., 2008). Mixed *de jure-de facto* classification uses the reference of the IMF *de jure* classification to categorise similarities and differences. Ghosh *et al.* (1997), Reinhart and Rogoff (2002, 2004) are some examples of the mixed *de jure-de facto* approach to classifying exchange rate regimes. Pure *de facto* classifications are independent from the official classification and mainly follow tripartite system where a regime is classified either as pegged, intermediate or freely floating. Levy Yeyati *et al*. (2005), Shambaugh (2004), De Grauwe and Schnble (2005) are some examples of pure *de facto* classification.

Our classification of monetary policy regimes is defined by a number of specific classification criterion, which are based on exchange rate, policy interest rates and monetary growth. We classify seven exchange rate regimes and four inflation targeting and monetary targeting regimes. For classifying exchange rate regimes we have used volatility of exchange rates, volatility of changes of exchange rates, the ratio of the volatility of changes of exchange rates and reserves. Two of the inflation targeting regimes are classified on the basis of average inflation and policy interest rates, and two of the monetary targeting regimes are classified on the basis of both broad money and narrow money growth as well as using relevant policy rates. 45% of the time our classification compares to the Reinhart and Rogoff's (2002) classification and 30% of the time to the IMF *de facto* classification. More than 10% of the regimes are classified as inflation targeting and monetary targeting regimes, which have been classified by some form of exchange rate regimes by the previous studies. With regards to growth and inflation, we have used pooled mean group estimation (PMG). PMG is more suitable here compare to the conventional generalised method of moments (GMM) estimation (which has previously been used by the other studies) due to large sample size (N) and time periods (T). Our findings suggest monetary policy with some form of nominal anchor is beneficial.

In the 4th chapter, we assessed the impact of financial development on growth for eight south Asian countries over the period 2003 to 2014. We have used cost and profit efficiencies of 193 banks of these regions, for the first time, as the quality measure of the financial institutions.

McKinnon (1973) suggests that financial market liberalisation allows financial deepening and reflects in an increasing use of financial intermediation by savers and investors. It also allows monetisation of the economy and ensures efficient flow of resources among people and institutions over time. The process enhances savings and reduces the constraints of capital accumulation, therefore, improves allocative efficiency of investment by transferring capital to more productive sectors. Nevertheless, the relationship between financial development and growth has been the subject of an extensive debate over the last two centuries. While many argue that finance is a strong contributor to growth (e.g., Baghehot, 1873; Schumpeter, 1912; Hicks, 1969, Miller, 1998; Levine, 2005), some (e.g., Robinson, 1952; Lucas, 1988) argue on the limited capacity of financial intermediation on economic growth.

Robinson (1952) suggests that growth leads to financial development and Lucas (1988) demonstrates that finance is over stressed for explaining growth.

One of the early cross country studies by Goldsmith (1969) shows that the size of the financial system positively contributes to economic growth, but unable to exert a significant relationship between financial structure and economic growth. King and Levine (1993) try to rectify the work of Goldsmith (1969) by enlarging the sample to 77 countries and by introducing control factors. They used three growth indicators (real per capita growth, growth in capital accumulation and total productivity growth) and introduced new financial development measures (liquid liabilities over GDP, the ratio of bank credit to bank credit plus central bank domestic assets and the ratio of private sector credit to GDP). Their findings suggest a strong positive relationship between each financial measure and the three growth indicators. The findings are robust to the alternative econometric specifications (such as GMM, OLS). However, King and Levine (1993) focused only on the banking sectors of the economy and have not addressed the causality issue. The concern also relates to the measurement of financial development in terms of quality.

Some argue that a mere expansion of credit need not indicate a qualitative improvement of intermediaries' abilities to channel funds from savers to borrowers (Hasan *et al.*, 2009). Therefore, Hasan *et al.* (2009) suggest a more direct measure of the quality of financial institution, thereby addressing the sub-optimal empirical proxies for theoretical counterparts raised by Levine (2005). Their study on 11 European Union (EU) countries over the period of 1996 to 2004 tests whether better banking efficiency, estimated at firms' level, significantly spurs economic growth. They argue that this relative measure of bank performance gauges the quality of financial institutions better than the quantity of funds intermediation. The quantity of financial development has been measured by bank credit volume relative to GDP. In order to measure bank efficiency, they used the data of, approximately, 7000 banks of 11 EU countries over the period 1996 to 2004. To assess the quality more directly, they measure a bank's relative efficiency in converting input into a production set while maximising profits, using fixed effects panel frontier of a translog production function developed by Greene (2005). The findings from the Generalised Method of Moments estimation (GMM) of panel data suggest that the individual profit efficiency effects of financial quality, as well as the interaction between the banking quality and volume on

regional growth are positive and significant. A 1% increase in Banks' ability to convert inputs into financial services spurs regional growth in total by almost 0.06%. The quality effect is stronger than the quantity effects. A 1% increase in profit efficiency of banks has more than four times the effect on growth that a relative increase in lending volumes does. However, the study by Hasan *et al.* (2009) only focused on the mature EU economies.

We extend this literature by addressing this issue to gauge the effect of quality of financial institutions on economic growth for 8 developing countries of south and south-east Asia over the period 2003 to 2014. Similar to Hasan *et al.* (2009) we have calculated banking efficiency for this country to measure the quality of financial development. Broad money to GDP ratio and volume of bank credit to the private sector has been used for the quantitative measure of financial development. Our findings from the GMM estimations suggest that both quality and quantity are important for economic growth in these regions. Therefore, this chapter provides new evidence on the complementarities and importance of both quality and volume of financial development in the developing countries.

Chapter Two: Exchange Rate Pass Through and the Macroeconomic Determinants

2.1 Introduction

Since the collapse of the Bretton Woods system, all major industrialised countries have, at least officially, adopted flexible exchange rate regimes at one time or another. Despite optimism, the demise of the Bretton Woods system marked the beginning of a period of more than two decades of exchange rate volatility, high inflation, low growth and trade conflicts. The transmission of exchange rate movements to domestic prices, known as exchange rate pass through (ERPT), has become an important policy concern ever since.[6] ERPT is directly related to domestic inflation. Petursson (2009) for example, finds ERPT to be a significant explanatory factor in accounting for cross-country variations in inflation volatility.[7] However, a growing body of empirical research reports a declining trend in ERPT since the late 1980s due to a low and stable inflationary environment in many countries. The evidence from these empirical verifications suggest that domestic inflation also influences ERPT and has therefore contributed toward the apparent decline in pass through elasticities in many countries.

There are various determining factors of pass through elasticities. Pricing to market, originally proposed by Krugman (1986) and Dornbusch (1987), suggests that exporters adjust their prices to the prevailing prices of their export markets. Foreign exporters' decisions to cut their export prices or profit margins (instead of increasing the price) following a depreciation of the importer's currency depend on how permanent any changes in costs are. Any temporary changes in costs will be absorbed in the profit margin, whilst a permanent change will be passed on to import prices. The choice of invoicing also determines the extent of pass through. Exporters can invoice in their own home currency (producer currency pricing – PCP), in the currency of their importer (local currency pricing - LCP), or in a third-party currency (vehicle currency pricing – VCP). When exporters set prices in LCP, they do not fluctuate as frequently as exchange rates, at least in the short run. Invoicing in LCP, therefore, reduces pass through.

[6] Exchange rate pass through refers to the degree to which a variation in exchange rate influences international trade prices and, through them, other domestic prices.

[7] The other two are credible monetary policy and exchange rate risk premium.

Goldberg and Tille (2008) find that exporters consider the competitive structure of the import market in currency-invoicing decisions. This is cited as a 'herding' strategy. The price is set in a currency that is going to keep demand for the product relatively stable despite exchange rate fluctuations. Cross border production can also lead to lower pass through elasticities. If the production process is distributed in a number of countries, then the cost of the final goods does not rely on a single currency. It is less likely that all the currencies will move at the same time. Thus, retail prices do not reflect any changes in the exchange rate (Bodnar, *et al*., 2002; Hegji, 2003).

Many studies since the early 1980s assumed pass through to be a micro, rather than a macro, phenomenon. Micro-oriented studies mostly focused on disaggregated firm or industry level data and import prices (for example; Woo, 1984; Feenstra, 1989; Gron and Swenson, 1996; Goldberg and Verboven, 2001; Frankel *et al.*, 2006). The new open economy macroeconomics provided the theoretical basis for empirical macroeconomic research on ERPT (e.g. Obstfeld, 2002). The staggered pricing model of Taylor (2000) generated further interest. Macro studies of pass through focused on import or consumer prices in more aggregated data (McCarthy, 1999; Pollard and Coughlin, 2005; Campa and Goldberg, 2005, 2006; Marazzi *et al.*, 2005; Gagnon and Ihrig, 2001, 2006; Edwards, 2006). Their analysis mainly focused on the US and other major industrialised countries. One of the main focuses of macroeconomic explanation is the role of the credible and transparent monetary policy regime.

A number of studies since the early 1990s have provided evidence of declining ERPT (for example McCarthy, 1999; Marazzi *et al.*, 2005; Gagnon and Ihrig, 2001, 2006; Edwards, 2006). Large depreciations in many countries are no longer accompanied by an increase in import prices or consumer prices. A number of empirical studies attribute slow pass through to the success of monetary policy in achieving low and stable inflation in many countries (Cunningham and Haldane, 1999; McCarthy, 1999; Gagnon and Ihrig, 2001, 2004; Taylor, 2000; Chowdhury and Hakura, 2006; Gagnon *et al*., 2007; Frankel *et al.*, 2005). Both aggregate and industry level studies indicate that the response of prices to changes in exchange rate components or other costs are quite low. Goldberg and Hellerstein (2007), for example, find that the pass through of changes in exporter's costs to the retail price of imported beer is only 7% in the US. Devereux and Engel (2001) find that the currency-invoicing choice is in fact endogenous to the monetary stability of a country. Exporters

generally wish to set prices in the currency of a country that has the most stable economic situations.

McCarthy (1999) presents time series evidence on nine OECD countries, showing a decline in exchange rate pass through over the period 1983-1998 compared to 1976-1982. Analysing the empirical evidence, Mishkin (2008) suggests that low pass through to import prices is not necessarily a prerequisite for low pass through to consumer prices. Even if import prices react strongly to exchange rates, an appropriate monetary policy stance that is sufficiently reactive to inflation can insulate consumer prices from the effects of any shock associated with exchange rates. Taylor (2000) also demonstrates this view in a model within a staggered price setting, arguing that the recent decline in pass through to aggregate prices is due to the success of the low inflationary environment in many countries over the last few decades. He shows the causal link between inflation and pass through in a model based on the staggered price setting and imperfect competition, where firms set their prices in a forward manner and the prices respond more to the permanent cost increase. Perceived temporary cost changes do not play any role in the pricing decisions. Regimes with higher inflation are usually associated with more persistent cost increases. Unsurprisingly, pass through would be higher in those regimes. Hence, a credible low inflationary regime will experience lower pass through.

Sustained decline in ERPT is gradually becoming a feature of small developing countries and the incidence is quite pervasive in some countries throughout the 1990s. Many of these countries also have successfully reduced inflation. Nonetheless, empirical verification is relatively scarce for these countries. Empirical studies such as Choudhri and Hakura (2006), Borensztein and De Gregorio (1999), Goldfajn and Werlang (2000), Barhoumi (2005) and Frankel *et al.* (2005) are notable in this respect. For example, empirical analysis by Choudhri and Hakura (2006) for 71 countries find strong evidence that the relationship between average inflation and pass through elasticities is robust and positive over the period 1979 to 2000. Therefore, the dependence of exchange rate pass through on the inflation regime should be considered in designing monetary policy rules.

The current study extends the existing literature on exchange rate pass in two ways. Firstly, we assess the evidence of declining exchange rate pass through for 39 countries over the period 1981 to 2010 across different monetary policy regimes. These

countries are a combination of developed and developing countries, spread across continents. We have calculated a trade-weighted exchange rates index (TWER) for each country by using the weight of import share from the trading partners of each country to the percentage change in exchange rate. We have used the TWER instead of nominal effective exchange rates (NEER) for our analysis. TWER is more appropriate as the pass through transfers from importers. The foreign inflation indices are also calculated by the weights of importer's shares and the percentage change of their producers' price index (PPI). We focus our analysis on pass through to consumer prices as it is more pertinent to monetary policy and other macroeconomic issues. There are three sub-sample periods for most of the countries. Independent break tests, along with official inflation targeting dates by central banks, have been used to find the appropriate breaks for each country over the sample period and to select each subsample period to represent different monetary policy regimes.[8] In order to address endogeneity, a vector error correction model (VECM) has been used for pass through analysis.

Secondly, we evaluate the macroeconomic factors behind the pass through elasticities using a pooled OLS regression model. We verify Taylor's (2000) proposition to find if inflation has any impact on pass through. We also observed if there is an impact of actual *de facto* monetary policy regime and central bank autonomy on pass through elasticities. The exchange rate regimes classified by Reinhart and Rogoff (2002) and inflation targeting regimes adopted by many countries are used for the monetary policy regimes. In addition to these variables, we have also examined the relative strength of the volatility of inflation and exchange rate, size and openness in explaining the variability of pass through elasticities in different countries. To the best of our knowledge, no existing empirical studies attempts to assess the impact of central bank autonomy or choice of monetary policy regime on pass through elasticities.

Findings from the pass through analysis across different countries suggest a decline in many countries over the last few decades. The findings are particularly applicable to those countries that have been successful in reducing inflation, such as Australia, New Zealand, Mexico, Brazil and some Asian and eastern European countries. Average long run pass through elasticities declined by almost 26 percentage points (50% to 24%) from the 1980s to 1990s. Average inflation and volatility of

[8] Cumulative sum of squares of recursive residual (CUSUM of squares) has been used for the independent break test.

inflation also declined substantially (by 1 and 4 percentage points respectively). However despite this, pass through seems to have increased over the last decade by around 11 percentage points. A number of countries experienced high pass through over the last decade; India, Malaysia, Pakistan, Singapore, the UK and a number of other countries saw increased pass through in recent periods.

Analysis from the second stage suggests that both average inflation and volatility of inflation are positively related to pass through elasticities. Adoption of IT has a significant negative impact on short run pass through elasticity. Exchange rate regimes with crawling pegs experience larger pass through elasticities compared to managed floats. Central bank autonomy has a positive influence. Thus, our findings are relevant to Taylor's (2000) proposition.

The remainder of this study is organised as follows. Section 2.2 provides a literature review. 2.3 provides description of the sample countries. 2.4 provides the methodology and findings. Section 2.5 concludes the study.

2.2 Literature Review

Since the collapse of the Bretton Woods system, the exchange rate has become the center of macroeconomic policy debates for open economies. Nominal exchange rates are often used as a way of bringing down inflation in an open economy. Petursson (2009) finds that exchange rate pass through is a significant variable in accounting for cross-country variations in inflation volatility. On the other hand, a relatively new stream of research suggests that low and stable inflation in many countries is one of the significant factors accounting for declining pass through elasticities (Taylor, 2000). A number of studies have attempted to verify the incidence of declining pass through observed in many countries, linking pass through elasticities with macroeconomic factors and monetary policy.

Following the demise of the Bretton Woods system, newly adopted floating exchange rate regimes in many countries were considered to be a major component of external adjustments and transmission of inflation into domestic economies (Goldberg and Knetter, 1996). The causal link between exchange rates and inflation happened to exacerbate the problem of soft money countries and reduce the burden of hard money countries. The Organisation of Economic Co-operation and Development (OECD) and the Bank of International Settlements (BIS) first recognised this 'vicious and virtuous circle'.[9] Since then, the exchange rate has become an important determining policy factor for open economies.

Much of the early research on exchange rate pass through is focused on the US and other industrialised countries (for example, Prakkan, 1978; Frankel, 1980; Woo, 1984; Hooper and Mann; 1989, Moffet; 1989, Kim; 1991; Yang, 1991). The focus has moved to industrial organisation models, where the role is played by market structures and the price discriminating opportunity by exporting firms for determining import prices (Cortinhas, 2007). An easy and comprehensive way to understand the ERPT is by Krugman's (1986) pricing to market (PTM) analysis.

[9]Bank for International Settlements, Forty-Sixth Annual Report, 1st April 1975-31st March 1976, pp. 30-32; Paul Lewis, "The Weak Get Weaker With Floating Rates," New York Times (October 10, 1976); and David King, "The Performance of Exchange Rates in the Recent Period of Floating: Exchange Rates and Relative Rates of Inflation" (Federal Reserve Bank of New York, May 1976; processed).

Krugman (1986) was one of the first to describe the phenomenon of foreign firms adjusting their export prices to specific markets as PTM and formalised the idea of the pricing behaviour of markets with exchange rate movements. PTM suggests that in an imperfect market structure, firms deliberately set different prices in different countries, according to the local competitive conditions and market structure.[10] In static form, PTM depends on the demand elasticity faced by the foreign firms, market share in the importing countries, substitutability of the imported goods and transportation, marketing and distribution costs. The dynamic effects of PTM are largely related to price stickiness in an imperfectly competitive market framework. In order to maintain their market reputation, any unexpected small rise in a firm's marginal cost of importing will not be passed on to consumers, as long as the changes are perceived to be temporary. The theory of pricing to market has since become the source of a number of empirical verifications, mostly using disaggregated industry level data.[11]

ERPT studies in the 1970s and 1980s mostly emphasized different industrial organization, the role of market segmentation and price discrimination across geographically distinct markets (Campa and Goldberg, 2002). The traditional literature on exchange rate pass through focuses on import price pass through and argues that pass through is essentially a micro-economic phenomenon, therefore emphasizing the role of market power and price discrimination in the international market (Choudhri and Hakura (2006); Richardson (1978); Woo (1984); Knetter (1989); Marston (1990); Kasa (1992); and Gagnon and Knetter (1995)). Findings from these studies suggest that there are significant and non-transitory differences in pass through elasticities due to imperfect substitution between goods or due to the presence of segmented markets.

One of the early studies by Woo (1984) on pass through from exchange rates and import price fluctuations to domestic producers and consumer prices over the period 1975 to 1983 for the US market, identifies four channels through which the exchange rate can have an impact on the price level. The first is the prices of imported consumer goods, which directly affect the consumer price index. The second is the prices of imported inputs, which directly affect costs of production. However, the degree of pass through in these two channels depends on whether the foreign price is constant and how significant the pass through is on import prices. The third is

[10] Krugman's (1986) analytical framework is based on the Haberler (1949) and Dornbusch (1985) supply-demand model of the price implications of the exchange rate.

[11] See Appendix 2.1 for a brief analysis of the Krugman (1986) model. For a detailed analysis, see Krugman (1986).

aggregate demand via the trade multiplier; exchange rate movements change the current account position, which in turn affects aggregate demand. The fourth is the prices of trading partners, which affect the prices of domestically produced competing goods. The evidence from import pricing supports the view that foreign manufacturers price their products specific to US demand and cost conditions with some adjustment (approximately 40 percent by the Federal Reserve index and 70 percent by the import-share index) for exchange rate changes.

Another study by Gagnon and Knetter (1995) of German, Japanese, and the US automobile exports to seven industrial-country destinations suggests that for most destination countries in their sample, PTM is greater in the long run than in the short run, a feature consistent with invoicing in the exporter's currency. However, the pattern is reversed for the US and Canada, which essentially suggests the presence of a segmented market. Price differentials across destination markets for the same category of automobile are often related to exchange rate movements and these differentials can persist for many years. Their finding also suggests that there is a significant and persistent markup adjustment in Japanese automobile exports in contrast to German and US exports. Japanese automobile exports tend to be in the low priced end of the auto market for most of the sample.

Since the late 1980s, declining exchange rate pass through has become a concurrent phenomenon with declining average inflation and ERPT research started to focus more on macroeconomic analysis (e.g. Kim, 1998; Dellmo, 1996; McCarthy, 1999; Cunningham and Haldane, 1999; Marazzi *et al.*, 2005; Ihrig *et al.*, 2006). Event studies by Cunningham and Haldane (1999) found that the depreciation of the UK and Sweden in 1992 and the depreciation of Brazil in 1999 experienced a small pass through of exchange rate changes to retail prices. In the case of the UK, neither the 20% depreciation in 1992, nor the 20% appreciation in 1996 caused retail price inflation to deviate significantly from its 2.5% trend. The depreciation in Brazil in 1999 generated a much smaller pass through than any other depreciation during previous periods (when the rate of inflation was also much higher). In each of these cases, the exchange rate pass through has not been immediate, nor has it been complete.

Findings from a number of studies in the late 1980s and early 1990s suggest that low and stable inflation has had a direct impact on declining pass through

elasticities in many countries over the last few decades. One explanation that has been offered is a reduction in pricing power of firms (Taylor, 2000). According to Taylor (2000), low, stable and persistent inflation observed in many countries are the main reasons behind the reduction in pricing power of firms, whereas previously it had been presumed that low pass through is one of the reasons for declining inflation rates. In support of this view, McCarthy (1999) finds that much of the decline in inflation over this period apparently comes from more permanent factors such as the success of central banks in reducing inflation and inflation expectations in these countries. Using a VAR model of the distribution chain, McCarthy (1999) examines the impacts of ERPT and import price fluctuations on domestic producer and consumer prices in nine industrialised countries over the period 1976 to 1998. The study finds evidence of a significant decline in ERPT. However, the results from impulse response and variance decomposition suggest that the effect of exchange rate and import price fluctuations on domestic producer and consumer prices are quite modest in most of the countries. Barhoumi and Jouini (2008), using a structural breaks and cointegration approach, demonstrate that changes in monetary policy regimes in these countries caused a shift towards a low inflation environment and low ERPT.

The causal link between low inflation and ERPT has been persuasively illustrated by Taylor (2000), who demonstrates that the decline in exchange rate pass through is a direct consequence of the decline in pricing power of firms. He demonstrates that the pricing power of firms is endogenous to the low inflation environment in many countries. The analysis is based on the role of price stickiness, which is explained by a simple microeconomic model of price setting.[12] Taylor argues that the observed change in pricing power is partly due to the change in expectations of inflation persistence, therefore due to the changes in costs of the firms. The extent to which a firm tries to match an increase in cost or price with other firms by increasing its own price depends on how persistent the increase of cost is expected to be. Inflation is less persistent when it is low and stable. Therefore, the role of monetary policy is significant to the extent that it is responsible for delivering low and stable inflation.

Taylor's (2000) proposition has been the subject of an extensive number of empirical verifications. For example, Campa and Goldberg (2002) seek to assess

[12] Based on the Akerlof and Yellen,1991; Bergen and Feenstra, 1998; Goodfriend and King, 1997; Gust, 1997, Kiely, 1997; King and Wolman, 1999; Rotemberg and Woodford, 1997.

whether the decline in ERPT is a macro phenomenon (as suggested by Taylor), or a micro phenomenon, with an OLS analysis of a log linear model for 25 OECD countries over the period 1975 to 1999. They assess the reasons for cross-country variations in, and the decline in, import price pass through over the period. However, their findings suggest that inflation is not of first order importance for low and declining pass through in these OECD countries. ERPT or producer currency pricing across these countries is incomplete. The average import price pass through across the OECD is 60% in the short run and 75% over the long run. Pass through is lowest in the US followed by Germany. They find that size of the country is not significant for pass through elasticities. Findings from their disaggregated industry level data on manufacturing, raw materials and food import prices also suggest the evidence of partial pass through. Most importantly, they observed that the decline in pass through in aggregate import prices is mainly due to a change in the composition of import bundles rather than inflation. A shift of import composition towards manufacturing products from raw materials has contributed significantly to the decline in pass through in these OECD countries. Therefore, Campa and Goldberg's (2002) study finds limited statistical merit in Taylor's argument. As a result, they view the 1980s and 1990s decline of ERPT, as a largely micro, rather than macro, phenomenon.

Campa and Goldberg's (2002) finding has subsequently been disputed by a number of studies. Whilst Marazzi *et al.* (2005) reaffirmed the evidence of a sustained decline of pass through in US import prices of core goods in their rolling regression analysis, they do however find that the decline in ERPT due to the compositional change in imports of the OECD countries (suggested by Campa and Goldberg, 2002) can only explain about one third of the pass through decline. Average pass through has declined by 30% over the last three decades since the 1980s. Interestingly, 1997 stands out as a moment in time throughout their robustness checks, after which the decline in pass-through gained momentum. They speculate that the Asian financial crisis of 1997 may have begun the process of decline in the US, given that a substantial portion of imports are from these Asian countries. Their empirical evidence also suggests that China's surging exports to the US has increased competitiveness and is therefore also partly responsible for reducing pass-through elasticities.

Gagnon and Ihrig (2001) also find the evidence of declining pass through into consumer prices across eleven industrialised countries over the period 1971 to 2010.

Declining pass through is more noticeable, particularly in inflation targeting countries. While they have found a statistically significant correlation between low pass through and inflation variability, the effort to link the declining pass-through evidence with changes in monetary policy behaviour remained inconclusive, largely due to the poor estimates of policy behaviour. A subsequent study by Gagnon and Ihrig (2004) also finds evidence of declining pass through in 18 out of 20 industrialised countries from 1971 to 2000. Their finding supports Taylor's (2000) proposition and suggests that monetary policy effectively reduces ERPT by emphasizing more on inflation control. They attempt to formally derive the linkage between monetary policy and exchange rate pass through to consumer prices by estimating a forward-looking Taylor-type monetary policy rule for these countries, and correlated the components of these policy rules with estimated pass-through elasticities.

Another study by Ihrig *et al.* (2006) examines the exchange rate pass through to import and consumer prices in G7 countries. Their empirical analysis used an algorithm developed by Hendry and Krolzing (2001) for selecting the appropriate specification of control and lagged dependent variables, and a rolling estimation method. The decline is significant for more than half of the countries over the period 1990-2004 compared to 1975-1989. Their rolling estimates of import-price pass-through in industrialised countries gathered more evidence that the Asian crisis may be a watershed event for declining import price pass-through in the 1990s.

If ERPT has a strong positive relationship with inflation, as suggested by a number of empirical studies, it is highly plausible that there will be a negative correlation between ERPT and the inflation targeting regime (IT). A number of studies try to verify whether or not an inflation targeting regime has a significant impact on pass through elasticity. For example, Edwards (2006) tries to verify if the adoption of inflation targeting has any significant impact on pass through in Israel and 6 other developing countries across Asia and Latin America over the period 1985 to 2005. His finding suggests a decline in import, consumer and producer price pass through for all of the countries after the adoption of IT. The decline in CPI pass through is quite significant for all of the countries except Korea. Apparently, Korea already had 2% CPI pass through, which is substantially low, even before the adoption of IT. The decline in the short-run CPI pass through is quite striking in Brazil after the adoption of IT, where it has declined by 66%. Chile, Israel and Mexico also had a substantial decline in

exchange rate pass through. The findings suggest that for these countries, adoption of IT played a significant role in reducing pass through elasticities. Furthermore, he finds that IT helps to reduce unexpected shocks by making monetary policy more transparent and predictable in these countries.

The study of ERPT is more important for developing countries for various reasons. For example, Calvo and Reinhart (2002) demonstrated that high ERPT to consumer prices is one of the main reasons for exchange rate intervention in many developing countries. Aside from exerting an impact on domestic inflation, rapid pass through to consumer prices limits the ability of exchange rates to adjust to international relative prices and therefore, reduces its potential for expenditure switching effects. The sequence of financial crisis over the 1990s forced many developing countries to officially adopt floating exchange rate regimes. Therefore, the importance of ERPT in policy making has become more relevant than ever before. The phenomenon of low and incomplete pass through is also increasingly evident in small open developing countries. Nonetheless, empirical evidence from developing countries is relatively scarce (Frankel *et al.*, 2005).

Chowdhury and Hakura (2001) study exchange rate pass through on consumer prices for 71 developed and developing countries over the period 1971 to 2000. Verification of Taylor's (2000) proposition is one of the main motivations of their study. Findings from their OLS analysis suggest that there is a significant positive relationship between ERPT and inflation. Pass through varies from 4% in the short run to 16% in the long run amongst the low inflationary countries, whilst it varies from 9% in the short run and 35% in the long run in the countries with moderate inflation. Average pass through among the high inflationary countries varies from 22% in the short run to 56% in the long run. Among the impacts of average inflation, inflation volatility, exchange rate volatility and openness on pass through elasticities, average inflation is found to be the most significant determinant of exchange rate pass through. A similar study by Cazorzi, Hahn and Sanchez (2007) on 12 emerging markets also finds a strong correlation between pass through and average inflation. Their finding, however, suggests that ERPT does not vary significantly across Asian and other developed countries.

Pass through elasticities in developing countries are important for various reasons. It plays an important role in selecting optimal exchange rate regime.

Hausmann *et al.* (2001) find that high pass through reduces the ability of a country to borrow in its own currency. Therefore, a common policy option in the developing countries is to limit the flexibility of exchange rates. Relatively high pass through in developing countries is cited as the main reason for the exchange rate management policies and 'fear of floating' stance (Frankel *et al.*, 2005). It is also an important determinant for trade balances.

Regarding the implication of optimal monetary policy on exchange rate pass through, Corsetti and Pesenti (2004) illustrate that an inward-looking policy on domestic price stabilisation is not optimal when foreign firms' mark-ups are exposed to currency fluctuations. Such a policy increases exchange rate volatility. Foreign exporters react by setting higher prices in the domestic market. The relative strength of an expenditure switching policy depends on exchange rate pass through. Pricing to market reduces the response of domestic prices to currency depreciation, thus the equilibrium exchange rate response becomes magnified (Betts and Devereux, 2000). Betts and Devereux (2000) find that PTM affects the international transmission of macroeconomic shocks. Without PTM, monetary disturbances will tend to generate high positive co-movements of consumption but large negative co-movements of output across countries. In the presence of PTM, this ordering gets reversed; PTM reduces the co-movements in consumption across borders. On the other hand, the elimination of the expenditure switching effects of the exchange rate under PTM enhances the co-movement of output across borders. They find that PTM has significant welfare implications. In the presence of PTM, Monetary policy can be a 'beggar-thy-neighbour' instrument; a domestic monetary expansion tends to increase home welfare in the case of PTM, but at the same time reduces foreign welfare.

2.2.1 The Underlying Theory

The underlying theory of our analysis is based on Taylor's (2000) explanation of how ERPT can be related to domestic anti-inflationary monetary policy. The decision making process of the management of a firm in setting the price is complex and time consuming.[13] In an imperfectly competitive market, firms usually perceive that they have some market power, therefore the price is a decision variable unlike in a perfectly competitive market where the price is given. The perceived market power of a firm depends on various factors. For example, the degree of substitutability of the product in

[13] See Levy *et al.*, 1997 for empirical evidence on the firms' decision making process.

the market, the utility function of consumers and on the reaction of other firms to a change in the cost condition.

Suppose that a firm selling a product that is differentiated from others in the market. Consumer's utility functions value this difference. Assume that the demand curve faced by a firm is linear in the difference between the firm's own price for its product and the average price for the other differentiated product in the market. Equation (2.1) shows a linear representation of the firm's demand curve.

$$y_t = \varepsilon_t - \beta(x_t - p_t) \qquad (2.1)$$

Here, y_t is production, x_t is the price of the goods, and p_t is the average price of other differentiated goods. ε_t is a random shift in demand. Let c_t be the marginal cost to produce the item. The firm sets its price once in every four periods. Thus, the average price level is a four period average of recent prices, x_t, set by the four groups of firms.

$$p_t = {(x_t + x_{t-1} + x_{t-2} + x_{t-3})}/{4} \qquad (2.2)$$

Under the assumption represented in equation (2.2), the firm's expected profit for the four periods when the price set in period *t* is given by equation (2.3).

$$\sum_{i=0}^{3} E_t \left(x_t y_{t+i} - c_{t+i} y_{t+i}\right) \qquad (2.3)$$

Here, x_t applies in period *t* through *t+3*, so that y_{t+i} depends on x_t rather than x_{t+i}, where *i* = 1, 2, and 3. The term E_t is the conditional expectations operator based on the information at period *t*. A firm maximises its profit by taking marginal cost and average price of the other firms as given. Substituting equation (2.1) and (2.3) and differentiating with respect to x_t results in the solution for the optimal price, represented in equation (2.4).

$$x_t = 0.125 \sum_{i=0}^{3} E_t\, C_{t+i} + E_t p_{t+i} + E_t \varepsilon_{t+i}\, /\beta \qquad (2.4)$$

Equation (2.4) provides the price setting equation in a standard staggered price setting model (Taylor, 1980). Several points can be made from equation (2.4). Firstly,

the amount by which a firm matches an increase in marginal cost with an increase in its own price depends on how permanent that marginal cost increase is. Similarly, the extent to which an increase in the price at other firms will lead to an increase in the firm's own price will depend on how permanent that increase in other firms' prices is expected to be. However, in neither case does the extent of this pass-through depend on the slope of the linear demand curve (which depends on β). The effect of an increase in marginal cost on the price depends on how permanent the increase in marginal cost is. Suppose, marginal cost follows a simple first order auto regressive distribution such as

$$c_t = \rho c_{t-1} + u_t \qquad (2.5)$$

In this case the matching or pass-through coefficient will be the equation (2.6).

$$0.125(1 + \rho + \rho^2 + \rho^3) \qquad (2.6)$$

Thus, lower ρ means less persistent cost, which will reduce the size of the pass-through coefficient. This smaller amount of matching to the price can be viewed as a loss of pricing power. This holds for the other firms as well. Less persistent increases in the price of firms leads to low pass-through, again a characteristic of reduced pricing power of firms.

The analysis implies that the observed market or pricing power depends to a large extent on the expectations of future cost and price movements. If an increase in cost is expected to be permanent or last for a long time, then the increase will be matched to a great extent in the price. An exchange rate depreciation will increase the cost of imports. The firm will pass through less of the depreciation in the form of a higher price if the depreciation is perceived to be temporary.

The persistence of such cost changes is likely to be related to the persistence of aggregate inflation. In a macroeconomic environment with a great deal of price stability, an increase in (nominal) marginal cost will be less persistent than in an environment with little aggregate price stability. The same will happen for price increases due to a depreciation. An economy with low inflation, close to the average of its trading partner, will be unlikely to experience a persistent nominal depreciation, otherwise the real exchange rate would be out of line for an extended period. Therefore, economies characterised by low inflation are most likely to experience low pass through. Furthermore, any depreciation is less likely to be passed on the retail price in a

low inflationary environment. Therefore, monetary policy has an active role to play in this situation as long as long it is responsible for delivering low and stable inflation.

2.3 The Sample

2.3.1 The country sample

Our analysis includes quarterly data from 39 countries over the period 1981 to 2010. The countries are selected to represent a combination of developed and developing countries. They also represent diverse sets of countries and can be divided into seven groups. Table 2.1 below lists all the countries according to country groups.

Table 2.1: Different country groups in the sample

Emerging Market Economies	Inflation Targeting countries	Euro Member	OECD Members
Brazil Chile Czech republic Hungary India Indonesia Malaysia Mexico Morocco Pakistan Philippines Poland Turkey Tunisia	Australia Brazil Canada Czech-Republic Chile Colombia Hungary Mexico Iceland Israel South Korea The Philippines New Zealand UK	France Greece Germany Finland Italy Spain Ireland Cyprus	Australia Chile Denmark France Finland Germany Greece Hungary Iceland Israel Italy Japan South Korea Mexico Poland Spain UK
Small Open Economies (SOEs)	Asian and African Countries	Latin American Countries	
Iceland Singapore Hong Kong Tunisia	Hong-Kong India Indonesia Israel Japan Malaysia Pakistan The Philippines Singapore Algeria Morocco Nigeria Tunisia	Argentina Brazil Colombia Chile Mexico Nicaragua	

14 of the 39 countries represent emerging market economies (classified according to the FTSE and S&P classification).[14] The four small open economies each have a population below 5 million. 14 of these countries have adopted inflation targeting as the formal monetary policy framework. 17 countries are OECD members; 8 have joined the Euro. In terms of continents, there are 9 Asian, 4 African, 6 Latin American, 2 Australian, and 14 European countries.

2.3.2 The data and the sample periods

Sample periods vary from country to country, depending on the availability of data. The quarterly data for 35 countries is from 1981 to 2010. For the remaining 4 countries, it starts at different points in the early 1990s. Quarterly GDP or industrial production index data are not available for these 4 countries from the earlier periods.[15] Table 2.2 provides a list of the countries according to their sample and sub-sample periods, which have been used for the estimation of ERPT and other analysis. We have also divided the sub-sample periods into 3 decades for further analysis of ERPT.

The IMF International Financial Statistics (IFS) database has been used as the main source of data. However, we have constructed the foreign price indices (FPI) and the trade weighted exchange rate indices (TWER) for each country for the analysis. The foreign price indices have been constructed using the relevant weights of importer's trading share in a country's bilateral trade and adding those weights to the percentage change in producers or consumers' price indices of the trading partners. For TWER, we have used the same weights constructed for FPI to the exchange rate changes of the trading partners. Exchange rate pass through emanates from the import's prices. Therefore, this importer's trade weighted exchange rate indices would be more appropriate to measure pass through elasticities.

[14] As of 31 December 2010, S&P classified 19 countries as emerging markets.

[15] The countries are Algeria, Argentina, Brazil and Iceland.

Table 2.2 Sample and sub-sample periods of the countries

1st Decade of the sample				2nd Decade of the sample					3rd decade of the sample		
Country	Year	Country	Year	Country	Year	Country	Year	Country	Year	Country	Year
Cyprus	1981-1988	Italy	1981-1990	Argentina	1990-2001	Ireland	1989-1999	Algeria	2003-2010	Hungary	2001-2010
Australia	1981-1992	Japan	1981-1990	Australia	1993-2002	Israel	1992-2000	Argentina	2002-2010	Iceland	2002-2010
Canada	1981-1990	Malaysia	1981-1990	Brazil	1990-1999	Italy	1991-1998	Australia	2003-2010	Iceland	2002-2010
Chile	1981-1990	Mexico	1981-1991	Canada	1991-2001	Japan	1991-1998	Brazil	2000-2010	India	2000-2010
Colombia	1982-1990	Morocco	1981-1989	Chile	1991-1999	Malaysia	1991-1998	Canada	2002-2010	Indonesia	1999-2010
Denmark	1981-1988	New Zealand	1981-1988	Colombia	1991-2000	Mexico	1992-1999	Chile	2000-2010	Ireland	2000-2010
Fiji	1981-1988	Nigeria	1982-1989	Cyprus	1989-1998	Morocco	1990-1999	Colombia	2001-2010	Israel	2001-2010
Finland	1981-1992	Pakistan	1981-1991	Czech Republic	1994-1998	New Zealand	1989-1997	Cyprus	1999-2010	Italy	1999-2010
France	1981-1989	Philippines	1981-1990	Denmark	1989-1999	Nicaragua	1994-2001	Czech Republic	1999-2010	Japan	1998-2010
Germany	1981-1990	Poland	1982-1991	Fiji	1989-1999	Nigeria	1990-1999	Denmark	2000-2010	Malaysia	1999-2010
Greece	1981-1990	Singapore	1981-1989	Finland	1993-1998	Pakistan	1992-2000	Fiji	2000-2010	Mexico	2000-2010
Hong Kong	1981-1989	Korea	1981-1990	France	1990-1999	Philippines	1990-2001	Finland	1999-2010	Morocco	2000-2010
Hungary	1981-1990	Spain	1981-1991	Germany	1991-1998	Poland	1992-1999	France	2000-2010	New Zealand	1998-2010
India	1981-1992	Tunisia	1982-1989	Greece	1991-2001	Singapore	1990-1998	Germany	1999-2010	Nicaragua	2002-2010
Indonesia	1981-1988	Turkey	1981-1991	Hong Kong	1990-1999	Korea	1991-1998	Greece	2002-2010	Nigeria	2000-2010
Ireland	1981-1988	UK	1981-1993	Hungary	1991-2001	Spain	1992-1999	Hong Kong	2000-2010	Pakistan	2001-2010
Israel	1981-1991			Iceland	1997-2001	Tunisia	1990-2000	Korea	1999-2010	Philippines	2002-2010
				India	1993-1999	Turkey	1992-1999	Spain	1999-2010	Poland	2000-2010
				Indonesia	1990-1998	UK	1994-2001	Tunisia	2001-2010	Singapore	1999-2010
								Turkey	2000-2010	UK	2002-2010

Note: Sub-sample periods are divided on the basis of CUSUM-sq and the official adoption of inflation targeting and other monetary policy regimes. These periods have been used to estimate ERPT.

2.4 Methodology and Findings

2.4.1: 1st stage regression analysis

Existing empirical studies on ERPT differ in terms of estimation techniques to calculate exchange rate pass through. Many of the studies use single equation models or system equations for each specific country, or set up single equation models for a larger set of countries (e.g. Campa and Goldberg, 2002, 2005; Chowdhury and Hakura, 2001 and Mihaljek *et al.,* 2000). Similarly, a number of empirical studies, such as McCarthy (2000 and 2003) and Ca' Zorzi *et al.* (2007), have applied the cointegration and vector autoregressive methodology for estimating ERPT.

The variables in the model are endogenous as there is feedback between pass through elasticities and inflation. To address the endogeneity issue in this study, we have adopted a vector error correction methodology (VECM). Equation 2.7 introduces the baseline Vector Autoregressive model (VAR) from which the VECM can be constructed. Equation 2.7 is a standard reduced-form VAR model representation.

$$\mathrm{Y_t} = c + \sum_{i=1}^{p} \Phi_i Y_{t-i} + \varepsilon_t \qquad (2.7)$$

Here, $\mathrm{Y_t}$ represents the vector of endogenous variables, c is a vector of constants, Φ_i denotes matrices of autoregressive coefficients and ε_t is a vector of white noise processes. We have also used the CUSUM-Squares test to test for breaks in the data. For inflation targeting countries, we have also observed the trend in inflation. Augmented Dickey Fuller (ADF) and Phillips and Perron (PP) tests have been used for unit root tests.

Cointegration tests have been done using the Johansen (1991) maximum likelihood procedure. The procedure is based on a VECM specification and represented in the form of equation (2.8).

$$\Delta Y_t = v + \prod y_{t-1} + \sum_{i=1}^{p-1} \Gamma_i \Delta y_{t-i} + \xi_t \qquad (2.8)$$

Here, Δ is the first difference lag operator, y_t is a K×1 random vector of time series variables, which is integrated of order 1 ($I(1)$), v is a k×1 vector of constants, Γ_i are (k × k) matrices of parameters, ξ_t is a sequence of zero-mean p dimensional white

noise vectors, and Π is a (k × k) matrix of parameters, the rank of which contains information about the long-run relationships of the variables. If the Π matrix has reduced rank $0<r<k$, it can be expressed as $\Pi = \alpha\beta'$; this implies that there is cointegration among the variables and β is the cointegrating vector. Π would have full rank if the variables are stationary in levels. The maximum eigenvalue and trace tests have been used for the cointegration rank test. The asymptotic critical values are provided by Johansen and Juselius (1990) and MacKinnon-Haug-Michelis (1999).

2.4.1.1 Findings from the first stage regression

We have estimated ERPT for the entire sample period, as well as for each of the sub-sample periods in each country, in order to observe the differences in ERPT in different countries. The empirical analysis of ERPT considers the way in which changes in the nominal exchange rate affect domestic prices. Most empirical studies on ERPT estimated variants of the generic equation of an open economy Phillips curve represented by equation (2.9). [16] We have also utilised equation (2.9) for our estimation of pass through elasticities.

$$\ln cpi_t = \beta_0 + \sum_{i=0}^{4} \beta_1 \ln twer_{t-i} + \sum_{i=0}^{4} \beta_2 \ln gdp_{t-i} + \sum_{i=0}^{4} \beta_3 \ln fpi_{t-i} + \sum_{i=0}^{4} \beta_4 \ln cpi_{t-i} + \beta_5 ect_{-1} + e_t \quad (2.9)$$

Here, *cpi* is the consumer price index, *twer* is trade weighted exchange rate index which we have constructed specifically for this study, *gdp* is gross domestic product, *fpi* is trade weighted foreign producers price index constructed for the study and ect_{-1} is the error correction term. All of the variables are in natural logarithm form. Here, *cpi* is used to proxy the domestic price level; *twer* has been used instead of the nominal effective exchange rate, lag of *gdp* is used to measure the output gap as well as inflationary pressure in the economy and *fpi* is used to measure domestic inflation of trading partners. Short run ERPT is measured by the pass through coefficients over the first quarter and long run ERPT is measured by the pass through coefficients over a year (by adding the short run pass through of each quarter).

[16] See for example, Campa Goldberg, 2002, 2006; Chowdhury and Hakura, 2006; Gagnon and Ihrig, 2001, 2004).

As mentioned previously, breaks in the data have been primarily selected by CUSUM-squares. For IT countries, the year of IT adoption is used for selecting the breaks. The first break dates for most of the countries start from 1981 and last until the late 1980s or early 1990s. A number of countries experienced economic downfalls during the Mexican Peso crisis, Asian financial crisis, Russian Ruble crisis and dot-com bubble over the 1990s. Quite naturally, structural breaks have been found over these periods for many countries. The final break dates for most of the countries fall between the late 1990s or early 2000s and lasted up until 2010.[17] Table 2.2 shows all the subsample periods of the 39 countries.

All the variables are found to be I (1) in the DF, ADF and PP tests. The cointegration tests suggest one or more cointegrating relationship for all of the countries, across the sub-sample periods. Therefore, VECM has been deemed appropriate for the analysis. Lag length for the VECM is selected by LR, AIC and SBIC.[18]

2.4.1.2: Cross country analysis of pass through elasticities

A large variation in pass through elasticities has been observed across different countries over the period 1981 to 2010. As expected, long run ERPT is usually higher than short run ERPT for most of the periods. Average short run ERPT for the whole sample period is 17% and average long run ERPT is almost 52%. Average inflation is 10%, whilst volatility of inflation is 8% amongst all the countries over this period. However, ERPT is significantly different across countries and also over the different subsample periods. Table 2.3 provides a synopsis of average and volatility of inflation and short and long run pass through elasticities across the groups of countries.[19]

[17] Table 2.1A in appendix 2.1 listed the pass through elasticities of all the countries across different regimes.

[18] Unit root test results and VECM analyses for 39 countries across 100 subsample periods are available upon request.

[19] Average quarterly inflation is measured by annualised change in CPI inflation rates. Inflation volatility is measured by the standard deviation of inflation rates.

Table 2.3: Inflation and pass through elasticities across the country groups

Category		Average Inflation	Inflation Volatility	Short Run Pass Through	Long Run Pass Through
All Countries	1980s	18%	17%	6.6%	50%
	1990s	8%	4%	20%	24%
	2000s	5.2%	3.35%	22%	35%
OECD (1981-2010)		7%	10%	15%	20%
EMEs(1981-2010)		15%	21%	23.95%	35%
SOEs(1981-2010)		4%	3%	4.9%	26%
Latin America Countries		16%	14.51%	10%	60%
African Countries		4%	4%	6%	65%
Euro Members	Before Euro	3.27%	3%	63%	28%
	After Euro	2.5%	1.25%	3.4%	27%
Asian Countries (1981-2010)		9%	12%	14%	63.50%
IT Countries	Before IT	21%	14%	28%	55%
	After IT	6%	3%	6.6%	20%

Note: The table reports quarterly average inflation and ERPT for different country groups. Inflation is defined as quarterly changes in CPI and inflation volatility as the standard deviation of inflation. Both expressed as % changes. Long and short run ERPTs are calculated using equation (2.9).

The highest long run ERPT, observed over the 1980s, is almost 50%, which also corresponds to the period of highest average inflation (18%) and inflation volatility (17%). Average inflation and inflation volatility is highest in the 1980s. However, both average inflation and inflation volatility dropped quite significantly over the 1990s compared to the 1980s (10 percentage points and 13 percentage points respectively). Long run ERPT has declined by 26% percentage points during this period. However, pass through elasticities have increased over the late 2000s. Average long run ERPT has increased by 11 percentage points over the last decade. This is likely due to the recent financial crisis.

Average inflation and inflation volatilities are quite high across Latin American countries (almost 16% and 15% respectively). However, emerging countries have the highest average inflation volatility, which is almost 21%. Among the 14 EMEs, Mexico, Poland, and Turkey have the highest inflation rates over the whole sample periods. Average short and long run ERPT for these countries are also higher, 24% and 35% respectively. These countries have been through a number of transition periods

and economic upheavals over the 1980s and 1990s, therefore high inflation volatility is not very surprising.

The OECD, Asian and Euro member countries have relatively low average and volatile inflation rates. Among OECD countries, Israel has one of the highest average and volatile inflation, 41% and 93% respectively. This average estimation is dominated over the period 1981-1991, when Israel experienced excessively high inflation and average and volatility of inflation were more than 100%. Average long run pass through elasticity is the highest in the African countries followed by the Asian and Latin American countries.

There are 14 IT countries and 8 Euro members in the sample.[20] Aside from Mexico and Indonesia, most of the break dates for the rest of the countries are in accordance with the year of IT adoption. Both ERPT and inflation declined significantly amongst the IT countries and members of the Euro after adopting IT and the Euro. After the adoption of IT, the average inflation rate for IT countries has declined by 15% and the volatility of inflation by 11%. Both the long and the short run ERPT has also declined, by 35% and 21% respectively. Average inflation, inflation volatility, and ERPT have declined for Euro members as well. However, the changes are less dramatic compared to IT countries.

For the Euro countries, average short run pass through elasticity is higher than the average long run pass through elasticity. In the short run, when prices are rigid, import price pass-through into the producer's currency can be higher. However when prices adjust over the long run, pass-through elasticities can drop significantly. This is probably one of the main reasons why average short run elasticities are higher in some Euro countries.

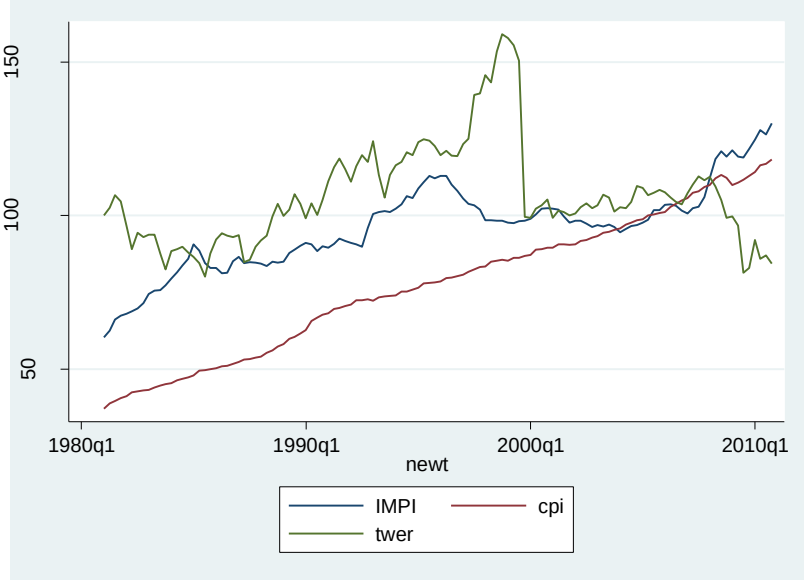
As mentioned previously, average short and long run ERPT have been increased during the 2000s, compared to the previous decade (almost 2% and 11%, respectively), despite a drop in inflation. A number of countries over this sample period experienced significantly higher pass through compare to previous periods. Pass through elasticities over this period have increased significantly in India, Pakistan, Czech Republic, Singapore, Israel, Ireland and the UK. Inflation volatilities are found

[20] Table 2.1 provides the names of the 14 IT countries and the dates when they have adopted IT.

to have increased for most of these countries. The recent financial crisis might have a significant impact for this increase in ERPT.

For the UK, long run pass through has increased over the recent decades. Figure 2.1 is a linear plot of the import price index (IMI), TWER and CPI for the UK over the period 1981 to 2010. Both IMI and CPI are on an increasing trend, whilst TWER (which is a proxy of NEER estimated for this study) dropped quite sharply over the period 2007 to 2010. This might be a plausible explanation as to why some countries have experienced higher pass through during the recent financial turmoil.

Figure: 2.1 CPI, IMI and TWER for the UK from 1981-2010



2.4.2 The macroeconomic determinants of ERPT

The estimated ERPT coefficients have been used for the second stage analysis to evaluate if there is a significant relationship between ERPT and other macroeconomic variables. The variables used for the second stage regressions are average inflation, inflation volatilities, exchange rate volatilities, central bank autonomy indices, country sizes, openness, monetary policy regimes and dummies for the three decades over the sample period. The following sub-sections contain the descriptions of the macroeconomic variables for our 2nd stage analysis.

Average inflation and Inflation volatility: Average inflation and inflation volatility has been measured by the mean and the standard deviation of inflation over the period 1981 to 2010. Taylor (2000) illustrates that higher average inflation induces higher inflation persistence, which increases the expected cost perceived by firms. Hence,

countries with high inflation should experience high pass through elasticities. However, the effect of inflation volatility is ambiguous. Inflation volatility will not have any significant impact on exchange rate pass through if the market reputation is important. This is particularly relevant for large and competitive markets.

Exchange rate volatility: Baxter and Stockman (1988) and Flood and Rose (1995) show that high exchange rate volatility under floating exchange rates is not necessarily reflected in high volatility of other macroeconomic variables. Krugman (1989), Froot and Klemperer (1989) and Taylor (2000) demonstrate that a given change in the exchange rate is likely to be absorbed in import prices, in an environment where such fluctuations are common and transitory. If a change in the exchange rate is perceived to be temporary, it is more likely that firms will not consider it in their pricing decision. Thus, the expected volatility should have a negative effect on pass through elasticities. Devereux and Engel (2002) show that a combination of local currency pricing, heterogeneity in international price-settings and goods distribution, and expectation biases in international financial markets may combine to produce very high exchange rate volatility, without the implications of this volatility on other macroeconomic aggregates.

Central bank autonomy: Central banks autonomies have been measured by the central bank autonomy index (CBI) of Cukeirman-Webb-Neyapti (1992). The original paper of Cukierman *et al.* (1992) calculates the CBI index up to 1989. However, Polillo and Guillen (2005) updated the CBI index further until 2004. We have approximated the CBI index up to 2010, assuming that it remains unchanged for a number of years; hence will be misleading for our analysis. Central bank's autonomy is an important indicator for inflation performance and monetary independence of a country. Theoretical work in the early 1980s, notably Barro and Gordon (1983) demonstrate that inflation would be sub-optimally high when unanticipated monetary policy reduces the rate of unemployment at the expense of high inflation. Rogoff (1985) suggests that dynamic inconsistency theories of inflation, of the type described by Kydland and Prescott (1977) and Barro and Gordon (1983), makes it apparent that the independent central banks are much more likely to reduce inflation. While the theoretical benefit of CBI appears to be well accepted, the findings from empirical studies are inconclusive (Crowe and Meade, 2007). Acemoglu *et al.* (2008) find that these indices are not a

good representation of the central bank independence for the countries with weak political constraint.[21]

Trade openness: Trade openness is measured by the ratio of exports and imports to GDP of a country, more specifically, $\frac{X+M}{Y}$. A number of empirical studies suggest that more active and open economies should experience less inflation, therefore, less pass through. Romer (1993) demonstrates that greater trade openness enhances negative terms of trade shocks resulting from domestic output expansions, in turn reducing the central bank's incentive to engage in inflationary policymaking.[22] Thus, the relationship between openness and ERPT can be negative since the countries with low inflation tend to have low pass through. Lane (1997) suggests that greater trade openness reduces potential output gains from unexpected inflation in non-tradable sectors characterized by imperfect competition and sticky prices. Thus, it reduces the incentives of central banks to pursue expansionary policy. On the contrary, Daniels and Van Hoose (2005) find that higher pass through increases the sacrifice ratio. Their theoretical model predicts that higher ERPT either enhances the positive impact or reduces the negative impacts from greater openness on the sacrifice ratio. However, the overall impact is ambiguous, considering the competing effects of the main characteristics of an economy, particularly ERPT. Ball (2006) argues that there is no clear evidence that globalisation has any impact in the process of inflation determination in the US.

Size of the economy: A larger economy has a larger market share of domestic import substituting goods and a higher ratio of domestic to foreign firms. Thus, demand is more elastic for foreign producers, which implies that local currency pricing should be more prevalent in a large country (Krugman, 1986; Dornbusch, 1986). Therefore, the larger the size of a country, the lower should be the pass through.

[21] Their political economic model of policy distortions suggests that the policy reform may not be effective when constraints are so weak that reform can be undermined. The second important lesson from the model is that with multiple policy instruments, reform may lead to a *seesaw effect*, whereby effective or partially effective reform in one dimension leads to more-intensive use of other distortionary instruments.

[22] Using a Barro-Gordon type model, Romer (1993) argues that openness restricts a government's incentive to engage in an unanticipated inflation driven by depreciation. Following Rogoff (1985), he argues that since the negative effects of real depreciation are larger in more open economies, the benefits from unanticipated monetary expansion decreases in relation to the degree of openness. More open economies, in the absence of an induced pre-commitment of monetary policy, tend to have lower inflation rates. His cross country analysis finds a robust negative link between openness and inflation.

Exchange rate regime: Reinhart and Rogoff's (2002) classification of exchange rate regime has been used to assess the impact of the pass through elasticities across different exchange rate regimes. The radical classification exercise by Reinhart and Rogoff (2002) is conducted on 153 countries over the period 1946 to 2001. Their coarse classification includes six categories and fine classification includes fifteen categories of exchange rate regimes. We have used the coarse classification for our analysis, which has six categories of exchange rate regimes.

Romer (1993) argues that the choice of exchange rate regime is not an important determinant of inflation. However, Frankel (1999) finds that fixing the exchange rate has the advantage of providing an observable commitment by the monetary policy authority. Ghosh *et al.* (1997) find that a pegged exchange rate is associated with low inflation. Using a panel data set of a number of developed and developing countries over the period 1973 to 1998 and Reinhart and Rogoff's (2002) classification, Alfaro (2002) finds a significant negative relationship between fixed exchange rate regimes and inflation, which is also robust to the inclusion of other control variables. Thus, in the short run, a fixed exchange rate can work as a commitment mechanism, therefore can reduce inflation. However, Hussein *et al.* (2004) find that countries appear to have benefits from flexible exchange rate regimes as they become richer and more financially developed. For relatively poor countries, with little access to international capital markets, pegged exchange rate regimes work better by delivering low inflation and high exchange rate regime durability. However, for emerging countries, their finding suggests no systematic effects of exchange rate regimes on inflation or growth. The basic argument is that as the fixed exchange rate acts as a nominal anchor, the monetary authority ties down the price of traded goods, which eventually creates downward pressure on other prices. More open economies are more efficient with the mechanism of pegging exchange rates, as this could tie down more prices. Another major advantage of fixed exchange rate is that it reduces the transaction costs and exchange rate risk, which to a large extent restricts trade in the developing countries. However, the stated benefits from any fixed exchange rate arrangement, largely, depend on the credibility of the regime.[23]

[23] The regime needs to be supported by sound macroeconomic policies to reduce the threats of speculative attacks on the currency.

2.4.2.1: Descriptive statistics and findings from the cross-country variables

Table 2.4 lists the pair-wise correlation between the variables used for the second stage regression analysis. The correlation between average inflation and long run pass through is almost 26%, showing the highest correlation amongst all the variables. On the other hand, Central Bank (CB) autonomy is negatively correlated with both short and long run ERPT. As expected, IT is also negatively correlated with both the short and long run ERPT, as well as with inflation and exchange rate volatility. Openness is negatively correlated with both of the pass through elasticities and also with average and volatility of inflation. However, size (measured by GDP of a country compare to the world GDP) shows a positive correlation with both the short and long run ERPT.

Table 2.4: Correlation between the explanatory variables and exchange rate pass through

	Inf avg	*Inf var*	*Exvol*	*Cbauto*	*Size*	*openness*	*ERPT_s*	*ERPT_l*
Inf avg	1	0.853	0.045	-0.007	-0.094	-0.125	0.07	0.2580
Inf var	0.853	1	0.038	-0.014	-0.062	-0.069	0.019	0.164
Exvol	-0.045	-0.038	1	-0.013	0.058	-0.038	0.103	-0.016
Cbauto	-0.007	-.0133	-.0132	1	-0.081	0.009	-0.007	-0.042
Size	-0.094	-.062	.058	-0.081	1	-0.248	0.094	0.1288
openness	-0.115	-0.069	-0.038	0.009	-0.249	1	-0.0551	-0.179
IT	-0.123	-0.082	-0.091	-0.045	-0.056	0.059	-0.0236	-0.087

Note: Here *Inf avg* is average inflation, *inf var* is inflation volatility, *exvol* is the volatility of exchange rates after de trending the rates, *Cbauto* is the central bank autonomy, *Size* is the GDP size of a country compare to the world GDP, openness is the ratio of export-import to GDP, *IT* is inflation targeting countries, *Erpt_s* is the short run pass through and *Erpt_l* is the long run pass through coefficients estimated by equation (2.3) for the subsample periods of table 2.2 across 39 countries.

2.4.2.2 Findings from the second stage regression analysis

We have regressed the estimated short and long run ERPT on a number of variables such as average inflation, inflation volatility, exchange rate volatility, central bank autonomy, size and openness. Dummies have been used for the different exchange rate and inflation targeting regimes, in order to observe the impact of these regimes on ERPT. Time dummies for each decade since the 1980s have been used to observe if the ERPT elasticities varies over the three decades covering our sample periods. The estimated regressions are in the form of equation (2.10).

$$ERPT_{is} = b_0 + b_1\ Inf\ avg_{\ is} + b_2\ Inf\ var_{\ is} + b_3\ Exvol_{\ is} + b_4 openness_{is} + b_5 Size_{is} + b_6 Cbauto_{is} + b_8 \sum_{i=1}^{3} TD_{is} + b_9 \sum_{i=1}^{5} ER_{is} + b_9\ IT_{\ is} + e_{is} \quad (2.10)$$

where, i is the country and s is the sub-sample period. $ERPT$ is the estimated exchange rate pass through coefficient from the previous analysis, $Inf\ avg$ is average inflation, $Inf\ var$ is the volatility of inflation measured by its standard deviation, $Exvol$ is the volatility of exchange rates (which is measured by the standard deviation of de-trended exchange rates), $openness$ is defined as $\frac{(X+M)}{Y}$, which is the ratio of exports and imports to GDP , $Size$ is measured by the ratio of GDP of each country to the world GDP, $Cbauto$ is CBI index to measure central bank independence and IT is dummy for inflation targeting countries.[24]

The exchange rate has been classified according to the Reinhart and Rogoff (2000) classification. Here:

ER_1= 1 if pegged exchange rate regime, 0 otherwise

ER_2= 1 if crawling peg exchange rate regime, 0 otherwise

ER_3= 1 if managed floating exchange rate regime, 0 otherwise

ER_4= 1 if freely floating exchange rate regime, 0 otherwise

ER_5= 1 if freely falling exchange rate regime, 0 otherwise

Time dummies are formulated to represents the 3 decades covering the sample period 1981 to 2010 where:

TD_1= 1 if 1980s, 0 otherwise , TD_2= 1 if 1990s, 0 otherwise

TD_3= 1 if 2000s, 0 otherwise

[24] Cukierman Webb-Neyapati (CBI) index has been measured by the index developed by Cukierman *et al.* (1992). However, the index is constructed up to 1989. Polillo and Guillen (2005) updated the CBI index further until 2000. We approximated the updated CBI index up to 2010 assuming that CBI index for a country remains unchanged for a number of years, hence does not get updated very frequently.

Estimation results for long run ERPT

We have used pooled OLS regression analysis, with and without dummies, to observe if there are any significant variations in our findings. We have started our analysis with the long run ERPT. Table 2.5 displays the estimation results of long run pass through with and without dummies. Estimation result with dummies using long-run ERPT shows a significant positive relationship with average inflation. An 1% increase in average inflation increases ERPT by 1.7%. Inflation volatility has a significant negative association with long run ERPT. However, exchange rate volatility does not have any impact on the long run ERPT.

Size has a significant positive relationship with long run ERPT. Openness has a negative relationship (somehow consistent with Romer (1993) prediction) which is, however, not found to be statistically significant. Studies like Chowdhury and Hakura (2001) and Campa and Goldberg (2002) also find an insignificant relationship between openness and ERPT. Central bank autonomy has a highly significant negative relationship with long run ERPT. A 1% increase in central bank autonomy reduces the pass through elasticity by 1%. On the other hand, IT regimes are not significantly associated with long run ERPT. A crawling pegged exchange rate regime is found to be positively related to long run pass through elasticities. The remainders of the exchange rate regimes do not exhibit any significant relationship with the estimated long run ERPT. The relationship between long run ERPT and the dummies for decades is not significant.

Table 2.5 also presents the analysis without the dummies. The findings without the dummies are fairly comparable to the findings with the dummies. While average inflation is positively related to pass through, inflation volatility is negatively related. CB autonomy also exhibits a significant negative relationship with long run ERPT. However, like the previous findings, the IT regime does not have any significant relationship with long run ERPT.

Estimation results for short run ERPT

Table 2.6 provides the results from regression analysis with and without the dummies for short run pass through. The findings are comparable to the previous analysis of the long run elasticities. However, there are some contrasts between the long and short run

ERPT analysis. Average inflation does not exhibit any significant association to the short run ERPT. However, there is a significant positive association between inflation volatility and short run ERPT. Contrary to the long run results, the IT regime is found to be negatively related to short run ERPT while CB autonomy does not exhibit a significant relationship. Pass through elasticities are higher over the TD_3 periods compare to TD_2, indicating that short run elasticities have increased over the recent decade. Crawling pegged and managed float exchange rate regimes are found to be positively associated with the pass through elasticities.

Table 2.5: Long run ERPT results

Long run ERPT with the dummies		Long run ERPT without the dummies
Regressors	Coefficient	Coefficient
$Inf\ avg$	0.015***	0.0139***
	(0.000)	(0.000)
$Inf\ var$	-0.005***	-0.005***
	(0.000)	(0.000)
$Exvol$	-0.003	-0.0004
	(0.690)	(0.473)
$Openness$	-0.057	-0.072*
	(-0.390)	(0.315)
$Size$	5.096*	3.489
	(0.100)	(0.400)
$Cbauto$	-0.011***	-0.005***
	(0.000)	(0.000)
It	-0.266	-0.201
	(0.191)	(0.280)
ER_2	0.413*	
	(0.074)	
ER_3	0.138	
	(0.558)	
ER_4	0.032	
	(0.901)	
ER_5	0.226	
	(0.384)	
TD_2	-0.079	
	(0.571)	
TD_3	0.250	
	(0.139)	
Constant	0.068*	0.367***
	(0.058)	(0.001)
R^2	0.221	0.136

Note: *p* values are in the parenthesis. *** indicates significant at 1% level, **indicates significant at 5% level and * indicates significant at 10% level. Robust standard errors have been used for the analysis

Table: 2.6 Short run ERPT results

Short run ERPT with the dummies		Short run ERPT without the dummies
Regressors	Coefficient	Coefficient
$Inf\ avg$	-0.010	-0.002
	(0.341)	(0.274)
$Inf\ var$	0.005*	0.002**
	(0.094)	(0.027)
$Exvol$	-0.002**	-0.001**
	(0.027)	(0.041)
$Openness$	-0.028	-0.042
	(0.651)	(0.558)
$Size$	2.600	1.058
	(0.452)	(0.736)
$Cbauto$	-0.005	-0.003
	(0.226)	(0.276)
It	-0.484***	-0.363**
	(0.010)	(0.029)
ER_2	0.476*	
	(0.065)	
ER_3	0.428**	
	(0.030)	
ER_4	0.143	
	(0.518)	
ER_5	0.812	
	(0.280)	
TD_2	0.312*	0.276*
	(0.067)	(0.095)
TD_3	0.454*	0.316
	(0.087)	(1.43)
Constant	-0.328	0.243*
	(0.140)	(0.138)
R^2	0.137	0.101

Note: *p* values are in the parenthesis. *** indicates significant at 1% level, **indicates significant at 5% level and * indicates significant at 10% level. Robust standard errors have been used for the analysis

Overall, the findings from the 2nd stage ERPT analysis present some contrasts between the findings from short and long run ERPT analysis. The short run ERPT analysis only represents an impact over a quarter, therefore it possesses a little less merit compared to the long run ERPT, which captures the impact over a year. Average inflation has a significant impact on long run ERPT, whilst inflation volatility plays a significant role in the short run ERPT. The volatility of the exchange rate is also found to be significant for short run ERPT. The findings indicate that if average inflation is sufficiently low in the long run, inflation volatility or exchange rate volatility will not have any impact on long run pass through ERPT. The dummy variables representing the decades were also significant only for the short run ERPT analysis, indicating that the increase of ERPT by the end of the last decade might be a temporary phenomenon.

CB autonomy plays a significant role in reducing long-run ERPT, but the adoption of an IT regime plays a significant role in reducing short-run pass through elasticities. Inflation targeting is a short to medium term policy strategy with the mandate for reducing inflation. Central bank autonomy is a vital prerequisite for an effective inflation targeting regime. The main reason for the negative association between CB autonomy and long run ERPT is that greater CB autonomy reduces inflation significantly. For example, Alesina and Summers (1993) finds that monetary discipline associated with central bank independence reduces the level and variability of inflation. According to Cukierman *et al.* (1992) "making the central bank an agency with the mandate and reputation for maintaining price stability is a means by which a government can choose the strength of commitment to price stability".[25] There is a significant correlation between high inflation and the lack of central bank independence.[26]

[25] Cukierman, A., S, Webb., and Neyapti, B .(1992). 'Measuring the Independence of Central Banks and its Effect on Policy Outcomes,' *World Bank Economic Review*,Vol.(6), pp. 353–98.

[26] The CBI index we have used for our analysis is a *de facto* central bank independence index which combines a number of indicators such as legal independence, turnover ratios of the central bank governors etc.

2.5 Conclusions

In this study we have estimated exchange rate pass through elasticities and assessed the impacts of several macroeconomic variables on pass through for 39 countries over the period 1981 to 2010. In the first step, we try to estimate pass through elasticities for each of the 39 countries over the sample period as well as for 2 to 5 subsample periods, depending on data availability and regime shifts of the countries. The subsample periods are selected on the basis of inflation and represent different monetary policy regimes. CUSUM-squares tests and dates of the formal adoption of monetary policy regimes have been used for the selection of breaks. We have constructed trade weighted exchange rate indices, which we have called TWER, and foreign inflation price indices, which we have called FPI, for the analysis. TWER has been used to proxy nominal effective exchange rates (NEER) and FPI has been used to proxy the inflation of the trading partners from which a country imports.

In the second step, we have used the estimated pass through elasticities for a panel estimation to evaluate the impact of various macroeconomic factors on the elasticities. The macroeconomic factors are average inflation, inflation volatility, openness, size of the economy, different monetary policy regimes represented by various exchange rates and inflation targeting regime. Reinhart and Rogoff's (2002) classification of exchange rate regimes has been used for the analysis.

Declining ERPT has become a feature in many countries since the late 1980s. A number of empirical studies find evidence supporting the declining pass through in a number of countries over the recent decades. Taylor (2000) demonstrates that maintaining low and stable inflation has induced the process of low ERPT. Therefore, the success of declining pass thorough has been attributed to the conducting of credible monetary policy. However, the issue remains, to some extent, unresolved. A few studies claim the decline in pass through as a micro rather than macroeconomic phenomenon. For example, Campa and Goldberg (2005) find that shifting imports from homogenous raw materials towards differentiated manufactured goods and services is the main reason for the declining ERPT in OECD countries, rather than macroeconomic factors. Marazzi and Sheets (2007) find that soaring Chinese imports reduced ERPT in the US. Nevertheless, evidence from an increasing number of empirical studies suggest that macroeconomic factors are the main reasons behind the declining pass through observed in many countries and find that a transparent and

stable monetary policy regime is the main driving force as long as it is conducive to a low inflationary regime. Our study, therefore, tries to have a fresh look on this issue.

We have also found evidence of declining pass through in many countries. There is a strong relationship between ERPT and average inflation. However, the decline in pass through is not entirely common for all the subsample periods. Pass through elasticities in some of the countries, including OECD countries, has increased significantly during the late 2000s. Countries like, India, Malaysia, New Zealand, Pakistan, Singapore, the UK experienced an increase in pass through elasticities over the recent financial crisis.

The evidence of declining pass through is quite strong, particularly for Latin American countries. In many countries pass through elasticities have been declining. The decline is more pronounced, particularly, after the Asian financial crisis. OECD countries have the lowest pass through among all country groups. The adoption of an IT regime (by fourteen countries in the sample) has shown a remarkable decline in ERPT. Long run ERPT reduced by almost 35% in these countries. Eight other Euro member countries also experienced a decline in ERPT and average inflation.

Higher average inflation induces higher long and short run ERPT. Volatility of inflation is negatively related to long run pass through but positively related to the short run pass through elasticities. Adoption of inflation targeting is found to be effective in reducing short run pass through, whilst central bank autonomy is effective in reducing long run pass through. Crawling peg and managed floats, two of the intermediate regimes, are found to have a significant positive association with short run pass through. Overall, the evidence from our study is consistent with Taylor's (2000) proposition that lower pass through is associated with lower inflation. Therefore, credibility of the monetary policy and the role of Central Banks are crucial. An important corollary of this proposition is that low pass through will persist as long as monetary authorities continue to successfully anchor inflation expectations and affirm that their response will be aggressive to any adverse inflationary shocks.

Appendix 2.1

Static framework of Krugman's (1986) model:

This is static in the sense that neither the actual nor the expected duration of the exchange rate change affects the extent of pricing to market. Krugman's framework sets out a supply and demand model of the price implications of exchange rates. Let us imagine the world comprises two countries, namely the US and European Union (EU); and two currencies, the dollar and the euro. The equilibrium condition can be described by two conditions. Let p be the dollar price of some importable and p^* is the EU price, e is the exchange rate of the euro per US dollar. Let $s(p)$ and $s^*(p^*)$ be the supply from the US and EU respectively and $D(p)$ and $D^*(p^*)$ are the demands. The equilibrium can be described by two equations. First the world market clearing implies that:

$$s(p) + s^*(p^*) - D(p) - D^*(p^*) = 0 \qquad (2A.1)$$

Second, the law of one price implies that $p^* = ep$. The elasticity of the EU price with respect to exchange rate is

$$d(s - D)/dp \Big/ d(s - D + s^* - D^*)/dp \qquad (2A.2)$$

Therefore, the extent to which the import price will fall 'too little' depends on the US share in the response of the world excess demand to price. However, to explain the divergence of the prices between the US and the EC, transaction costs can be used, even though there is the substantial restriction of assuming an upward sloping transaction cost function.

$$p^* = ep - t \qquad (2A.3)$$

Here, t is the marginal transportation cost, and is increasing in the volume of the US imports.

$$t = t(D - S) \qquad (2A.4)$$

Equation (2A.2) and (2A.4) implies that a rise in the dollar would be accompanied by a fall in the US price, and thus a rise in the US imports. However, the rise in imports will be associated with a rise in the marginal transportation costs, therefore this will widen the price gap between the two regions. Apart from transportation costs, marketing and distribution costs are also relevant.

The effects of demand elasticity and market share can be explained in a Cournot market structure which can be represented in the following equations. The basic rule of Cournot competition is that a firm will face a constant perceived elasticity of demand equal to E/s. Here, E is the market elasticity and s is the market share. There are two suppliers in the market, the US based firm and other is a foreign firm based in the EU. Let s be the market share of the US firm in the domestic market and s^* is the market share of the EU firm which is basically $(1 - s)$. The pricing rules of the US and the EU firm are represented by equations (2A.5) and (2A.6) respectively.

$$P = \frac{cE}{E - s} \qquad (2A.5)$$

$$P^* = \frac{c^*E}{e(E - s^*)} \qquad (2A.6)$$

In equilibrium, market shares will be such that these two pricing rules coincide. The equations imply that the higher is the import market share in the US, the lower would be the elasticity of demand perceived by the EU firm, thus the higher would be the price for any given marginal cost. Similarly, elasticity of demand for the domestic firm will be higher. Now, if the exchange rate 'e' appreciates, the EU firm's pricing schedule will shift down proportionately to this change. However, its actual price will not fall as the market shares will rise and the perceived elasticity of demand will fall. Algebraically, this can be explained by taking the logs of both (2A.5) and (2A.6).

$$\ln(P) = \ln(cE) - \ln(E - S) \qquad (2A.7)$$

or $$\ln(P) = \ln(c^*E) - \ln(e) - \ln(E - s^*) \qquad (2A.8)$$

Differentiating and substituting we get for the change in the US share of output and for the change in the price respectively in equation (2A.9) and (2A.10):

$$ds = -\frac{dln(e)[(E - s^*)(E - s)]}{[(E - s^*) + (E - s)]} \qquad (2A.9)$$

$$dln(p) = -\frac{dln(e)(E - s^*)}{[(E - s) - (E - s^*)]} \qquad (2A.10)$$

The equation implies that the elasticity of the price with respect to the exchange rate will be less than one. However, this result is based on two unrealistic assumptions. The first assumption is the perfect substitutability of the domestic and the foreign firm's production. The second assumption is that the competition is assumed to be Cournot, as Bertrand competition will lead to a collapse of either imports or domestic production in the case of perfect substitutability. The dynamic form overcomes both of these shortcomings. In the dynamic form of the same model, import prices will fall less than proportionately to the exchange rate change if the change is either unanticipated or expected to reverse.

Appendix 2.2

Table 2.2A: Pass Through Elasticities

Country	Year	Short run pass through elasticities	Long run pass through elasticities
Algeria	1995-2002	0.0109	-0.2725*
Algeria	1995-2010	-0.0042	-0.356*
Algeria	2003-2010	-0.0325*	-2.815*
Argentina	1990-2001	-0.6216*	-0.1229*
Argentina	1990-2010	-0.0612*	-0.6089
Argentina	2002-2010	-3.5879*	-0.5609*
Australia	1981-1992	0.4271	-0.5150*
Australia	1981-2010	0.1132*	-0.5545*
Australia	1993-2002	0.5786*	0.6242*
Australia	2003-2010	-0.43	0.203*
Brazil	1990-1999	-2.611**	-0.7888*
Brazil	1990-2010	-0.378*	0.03076
Brazil	2000-2010	-0.376*	-0.2753*
Canada	1981-1990	-0.0324	-0.0642*
Canada	1981-2010	0.1212	0.2476*
Canada	1991-2001	0.0493	-0.1135*
Canada	2002-2010	-0.1607	-0.0505*
Chilli	1981-1990	-0.32966	-0.396*
Chilli	1981-2010	0.10082**	-0.3372*
Chilli	1991-1999	0.3992	-0.5070*
Chilli	2000-2010	-1.4849*	-0.2853*
Colombia	1982-1990	-0.3822*	-0.1654
Colombia	1982-2010	0.0065	-0.996*
Colombia	1991-2000	0.2852	0.4791*

Table 2.2A: Pass Through Elasticities (Continued)

Country	Year	Short run pass through elasticities	Long run pass through elasticities
Colombia	2001-2010	0.27383*	0.984*
Cyprus	1981-1988	0.3586915	-0.1997*
Cyprus	1981-2010	-0.261539*	-0.29119*
Cyprus	1989-1998	0.3586	-0.1997*
Cyprus	1999-2010	-0.265477*	-0.26905*
Czech Republic	1994-1998	-1.70336*	-0.57167*
Czech Republic	1994-2010	-2.5006*	-0.1581829*
Czech Republic	1999-2010	-0.3138*	-2.338254*
Denmark	1981-1988	0.3178	-0.35981*
Denmark	1981-2010	0.01586	0.034221
Denmark	1989-1999	0.0726	-0.14037*
Denmark	2000-2010	0.3148*	0.2546*
Fiji	1981-1988	-0.093	-0.6354*
Fiji	1981-2010	-0.1416	-0.14158
Fiji	1989-1999	-0.0715	-0.67799*
Fiji	2000-2010	-0.2386	-0.7224*
Finland	1981-1992	0.11784	0.43555*
Finland	1981-2010	-0.2232	-0.03754
Finland	1993-1998	-0.18961	-0.40634*
Singapore	1981-1989	-1.0792*	0.36157*
Singapore	1981-2010	0.073	0.17435*
Singapore	1990-1998	0.278	0.182198*
Singapore	1999-2010	-0.039*	-0.7974*

Table 2.2A: Pass Through Elasticities (Continued)

Country	Year	Short run pass through elasticities	Long run pass through elasticities
Korea	1981-1990	1.17*	0.3188*
Korea	1981-2010	-0.0441	-1.1134*
Korea	1991-1998	0.479	-0.349076*
Korea	1999-2010	0.339	-0.13471*
Spain	1981-1991	-0.2448*	-0.8019*
Spain	1981-2010	-0.5929*	0.00252
Spain	1992-1999	-0.849	-0.001
Spain	1999-2010	-0.257	-0.003
Tunisia	1982-1989	1.207	0.380*
Tunisia	1982-2010	-0.047	0.0519*
Tunisia	1990-2000	0.947	0.01426
Tunisia	2001-2010	-0.018	-0.11274
Turkey	1981-1991	0.070	-0.911*
Turkey	1981-2010	0.01	-0.696*
Turkey	1992-1999	-0.0237*	-1.460*
Turkey	2000-2010	-0.254	-0.85*
UK	1981-1993	0.240	-0.0030*
UK	1981-2010	-0.0017	0.266*
UK	1994-2001	-0.0217	0.031*
UK	2002-2010	-0.9764*	-0.701*

Note: *** indicates significant at 1% level, ** indicates significant at 5% level and ***indicates significant at 10% level

Chapter Three: A Classification of Monetary Policy Regimes and the Implications on Growth and Inflation

3.1. Introduction

The choice of appropriate monetary policy regime, particularly for developing countries, has long been at the center of the debate in international economics. The steady increase in both magnitude and variability of international capital flows has intensified the debate over the past few decades, as each of the major currency crises in the 1990s in some way involved a fixed exchange rate and sudden reversal of capital inflows. As a consequence, a large number of empirical studies have attempted to evaluate the performance of alternative exchange rate policies in terms of growth, trade, inflation, business cycle and commodity price behaviour (Reinhart and Rogoff, 2004).[27]

Official classification of exchange rate regime however, often fails to describe the actual practice by the monetary authorities, which implies a significant gap between *de facto* and *de jure* regimes.[28] As a result, Ghosh *et al.* (1997), Levy Yeyati and Sturzenegger (2005) and Reinhart and Rogoff (2004) amongst others, attempted to rectify the deficiencies of *de jure* classifications. There are also drawbacks with evaluating economic performance on the basis of *de facto* regimes. Exchange rate regimes are at the same time characterised by both weak and strong monetary policy frameworks. A free or managed float regime may have an inflation targeting or monetary targeting framework. Therefore, evaluating performance solely on the basis of exchange rate regime would be misleading, as the performance is not only the contribution of the exchange rate regime but also the contribution of the underlying monetary policy framework.

A distinctive study by Bailliu *et al.* (2003) focused on the monetary policy framework applied along with the exchange rate regimes. They argue that an exchange rate anchor is simultaneously a monetary anchor and also that intermediate and floating

[27] See also Husain, Mody and Rogoff (2005), Mishkin and Schmidt-Hebbel (2007).

[28] The *de jure* classification is defined as the official classification of the regime by the country. In contrast, the *de facto* classification is defined with reference to a range of economic and institutional variables and outcomes.

regimes might be associated with either weak or strong monetary policy frameworks. Therefore, the impact of these weak and strong monetary policy frameworks will reflect upon the relationship between the regimes and growth.

While a number of studies have tried to improve the *de jure* classification of exchange rate regimes, this has not been the case for alternative monetary policy regimes. *De facto* classifications for inflation targeting (IT) or monetary targeting (MT) regimes are just as important as *de facto* classifications of exchange rate regimes. Even though Bailliu *et al.'s* classification (2003) attempts to incorporate the underlying monetary policy framework by classifying exchange rate regimes on the basis of monetary policy anchors, their classification has not explicitly considered other monetary policy regimes. The present study refines the classification scheme by taking into account different monetary policy frameworks and tries to evaluate regime performance in terms of growth and inflation.

The literature on *de jure* and *de facto* classification of exchange rate regimes is quite substantial. For example, Calvo and Reinhart (2001,2002), Eichengreen and Leblang (2003), Frankel (1999), Hausmann (1999) and Mackinnon (2001) demonstrate that many countries officially have a flexible rate, but they intervene in the exchange rate markets so persistently that in practice the exchange rate is effectively fixed. Conversely, the frequent and periodic devaluation of fixed exchange rates in inflation prone countries due to poor monetary policy often renders the exchange rate more flexible than fixed. Calvo and Reinhart (2002) showed that emerging economies often actively intervene in the exchange rate market so as to reduce the volatility of their exchange rate. This is popularly referred to as the 'fear of floating' and a number of explanations have attempted to clarify the phenomenon. One is the lack of credible monetary policy (Calvo and Reinhart, 2002). In such countries, stabilising the exchange rate provides a clear nominal anchor for prices. Other explanations include that (i) exchange rate volatility is thought to be detrimental for international trade as most of the trade is invoiced in a foreign currency, (ii) the pass through from exchange rate movements to inflation is higher in emerging countries than in developed countries, and (iii) the inability of emerging countries to borrow in their own currency leads to the liability being denominated in foreign currencies and the subsequent exchange rate risks borne by the country issuing the debt (Hausmann *et al.,* 1999).

As a result, it is misleading to classify the exchange rate regime by its 'official' *de jure* status and the literature reports efforts to classify exchange rate regimes on a *de facto* basis.[29] Such *de facto* classifications attempt to correct the deficiencies in the *de jure* classifications (Tavlas *et al.*, 2008). In recognition, IMF official classifications have, since 1999, started to take into account these deficiencies. Studies vary on the basis of the variables and methods used to classify the exchange rate regime in the sense that they compare their classifications with IMF *de jure* classifications, some incorporate a mixture of *de jure* and *de facto* classifications. For example, Ghosh *et al.* (1997), and Reinhart and Rogoff (2002, 2004) are examples of the mixed *de jure - de facto* approach to classifying exchange rate regimes. Pure *de facto* classifications of exchange rate regimes can be compared with *de jure* classifications, but the former mostly use a tripartite system where the regime is classified as either pegged, intermediate or freely floating (for example, see Levy Yeyati *et al*. (2005), Shambaugh (2004) or De Grauwe and Schneble (2005)).

There is also a range of methodologies used in *de facto* classification approaches. For example, Reinhart and Rogoff (2002, 2004); Bailliu *et al.* (2003) and Ghosh *et al.* (2002) applied statistical algorithms to the changes and variances in nominal exchange rates. In some ways, the Reinhart and Rogoff (2004) approach, which studies 156 countries over the period 1946 to 2001, is considered as one of the more radical revisions to the *de jure* classification of exchange rate regimes. Using data from the parallel exchange rate markets alongside official exchange rates, they categorise a regime as freely floating if annual inflation exceeds 40%. To avoid the impact of short run fluctuations of the exchange rate, they compute the probability of the monthly change in the nominal exchange rate within a specified band over a rolling five-year period. If the probability that the exchange rate will stay within a specified band is 80% or more, the regime is classified as either of the suitable categories of their classification. Their 'coarse' classification of regimes has as many as 7 categories and their 'fine' classification has 15 categories.

Algorithms used by most of the other *de facto* approaches to classifying exchange rate regimes make use of a range of statistical algorithms and measures of

[29] For detailed analysis, see Ghosh, Gulde and Wolf (1997, 2002), Reinhart and Rogoff (2002, 2004), Levy Yeyati and Sturzenegger (2005), Bailliu, Lafrance and Perrault (2001, 2003), Eichengreen and Leblang (2003), Dubas, Lee and Mark (2005).

exchange rate variance (for example: Reinhart and Rogoff, 2004; Levy Yeyati, 2005; Bailliu *et al*., 2001, 2003). Additionally, Levy Yeyati *et al.* (2005) also incorporate the volatility of international reserves as a classification variable. One of the shortcomings of using the volatility of exchange rates, or volatility of changes in exchange rates or reserves is that taking the volatility will only give a partial representation. As argued by Hausmann *et al.* (2001), the exchange rate in one country may be more volatile, because of the fact that it is subjected to larger external shocks, despite significant intervention by the authorities to keep it stable. The variance of reserves might also not be a good indicator, as reserves can be very stable due to the absence of shocks, even in a country that would intervene heavily if a shock warrants it. Besides that, there are many other factors that affect the reserves in a developing country. Therefore, Haussmann *et al.* (2001) argue that the relative volatility of the change in exchange rates to the change in reserves (RVER) is a better variable to use for classifying exchange rate regimes. The measure of volatility itself is another issue. Using the standard deviation to measure the volatility of exchange rates is vulnerable to any large depreciation or appreciation of the exchange rate. To address this problem, Reinhart and Rogoff (2004) and Levy Yeyati (2005) used mean absolute deviations of exchange rates to measure the volatility.

The current study extends the literature by classifying alternative yearly *de facto* monetary policy regimes based on some classification criteria for 124 countries over the period 1970 to 2012. Unlike other *de facto* classification studies, we have explicitly classified all the monetary policy regimes along with the exchange rate regimes. The classification exercise covers seven exchange rate regimes and four inflation targeting and monetary targeting regimes, which have also included converging episodes of the both regimes. For the classification of exchange rate regimes, we used volatility of exchange rates, volatility of changes in exchange rates, volatility of reserves and also the relative volatility of exchange rate to reserves (RVER). To reduce the influence of outliers in the exchange rate regime classifications, we used the standard deviation and eliminated the largest 10% of deviations from the mean. Inflation targeting and monetary targeting regimes are classified on the basis of changes in inflation rates and policy rates, and changes in both broad and narrow money and the policy rates, respectively. If a regime satisfies multiple categories, we attempt to classify the regime on the basis of the policy which is more obvious and likely to be pursued by the monetary authority during that particular period or periods. For example, if an

intermediate exchange rate regime is classified as an inflation targeting or monetary targeting regime, the regime is classified as an inflation targeting regime, otherwise it is classified on the basis of its exchange rate policy. Secondly, we try to assess the impact of the monetary policy regimes on growth and inflation using Pooled Mean Group (PMG) estimation developed by Pesaran, Shin and Smith (1997) rather than widely used Generalised Method of Moments (GMM) approach used in the previous studies. PMG is more appropriate than GMM for panel data sets with both large number of countries and time periods as the asymptotic properties of the long run panel is different. Unlike GMM, it is an intermediate estimator which involves both pooling and averaging and allows the intercepts, short run coefficients and error variance to differ across countries. There are also other advantages for the choice of the PMG procedure. It allows for short-run heterogeneous dynamics but imposes a long-run homogeneous relationship for countries in the sample.

More than 10% of the regimes are classified as either some sort of inflation or monetary targeting regime, which previous studies classified as some kind of exchange rate regime. 45% of the time our classification compared to the Reinhart and Rogoff's (2004) classification and 33% of the time with the IMF *de facto* classification. Our findings suggest a less pronounced move away from intermediate exchange rate regimes. Results from the panel estimation suggest that monetary policy regimes with nominal anchors are better for both economic growth and inflation. Among the exchange rate regimes, our findings suggest that fixed regimes are better compared to other exchange rate regimes for both industrialised and non-industrialised countries. Inflation targeting regimes have a more positive impact on non-industrialised countries compared to industrialised countries. Overall, our findings suggest that monetary policy regimes with nominal anchors exert a positive influence for both groups of countries.[30] We find that inflation is significantly lower and growth is significantly higher for regimes with some form of nominal anchors. Inflation is modest for industrialised and non-industrialised countries under inflation targeting, monetary targeting and fixed exchange rate regimes. Therefore, the findings suggest that the presence of some form of monetary policy anchor is beneficial for economic growth and inflation.

[30] A nominal anchor for monetary policy is a single variable or device which the central bank uses to pin down expectations of private agents about the nominal price level or its path or about what the Bank might do with respect to achieving that path (Krugman, 2003)

The remainder of this study is organised as follows. Section 3.2 provides an extensive literature review on the classification and performance of all the monetary policy regimes. Section 3.3 provides the methodology for classifying the regimes and the justifications. Section 3.4 describes the findings from the regime classifications. The classifications have been utilised further to evaluate the impact of the regime on growth and inflation. Section 3.5 provides the methodology for this 2nd stage analysis of regime performance, while section 3.6 discusses the findings from the 2nd stage regression analysis. Section 3.7 concludes the chapter.

3.2: Literature Review

The appropriate choice of monetary policy regime is a recurrent issue. The wave of financial crises in developing countries over the 1990s made this issue more relevant than ever before. Early empirical studies of alternative exchange rate regime performance focused on the comparison of unconditional variances of nominal and real exchange rates under the Bretton Woods system and the aftermath (Tavlas *et al.*, 2008). Studies like Stockman and Mussa (1986), Baxter and Stockman (1989), or Flood and Rose (1995) find that the demise of Bretton Woods was characterised by increased volatility of real exchange rates. However, they failed to detect any significant difference in macroeconomic performance between fixed and floating exchange rates. While trying to assess the volatility of macroeconomic variables under the two regimes, Baxter and Stockman (1989) find little evidence of systematic differences in the behaviour of macroeconomic aggregates such as consumption or international production. Flood and Rose (1995) find that the unconditional volatilities of macroeconomic variables such as industrial production, money, consumer prices and interest rates did not change much across regime. There is, however, one thing common among the studies mentioned above: their analysis is based on official classifications of the exchange rate regime.

The findings from above studies generated inconsistency by suggesting that key macroeconomic variables, rather than real exchange rates, are invariant to the choice of exchange rate regime (Reinhart and Rogoff, 2004; Levy Yeyati and Sturzenegger, 2005). Furthermore, currency and financial crises during the 1990s renewed interest in the debate surrounding the choice of appropriate monetary policy and exchange rate regime for small open economies and, in particular, emerging countries. Many blamed soft pegs for the currency and banking crisis during the 1990s (Goldstein and Peterson, 1999). Unsurprisingly, supporters of this view advocated that emerging markets should allow their currency to float in order to avoid future crisis. Following this advocacy, policymakers of many countries officially indicated their preferences for flexible exchange rates.

A dramatic change in the IMF official report of 1999 reflects these changes, suggesting only 5 countries adopted exchange rates with an 18% horizontal band, whereas 49 countries adopted independently floating exchange rates and 25 countries adopted managed floating with no intervention. However, findings by many studies

later suggest that there are discrepancies between the actual and official exchange rate regimes. Theoretical studies such as Frankel (1999), Calvo and Reinhart (2000) and Hausmann *et al.* (2001) had already substantiated the reasons for a country to deviate from the official exchange rate. A number of empirical studies attempted to verify that countries with different exchange rate regimes show remarkable differences regarding the way they intervene in the foreign exchange markets. Empirical studies like Haussmann *et al*. (1999), Calvo and Reinhart (2000, 2002), or Reinhart and Rogoff (2004) find that many emerging countries tend to hold large amount of international reserves. Consequently, intervention in the foreign exchange market is also very frequent in these countries.

3.2.1 Fear of floating phenomena

Why might a country prefer to smooth exchange rate flexibility? The fear of floating phenomenon, pioneered by the analysis of Calvo (1999), Calvo and Reinhart (2000, 2002), delves deeper into this issue. Calvo and Reinhart (2000, 2002) studied 39 countries between 1970 and 1999 and found that many countries, irrespective of economic status, are very reluctant to allow large swings in their exchange rates. On an average, the probability that an exchange rate change is within the moderate ± 2.50% band is over 79% for free floaters.[31] Moderate to large monthly fluctuations are found to be rare for managed floaters. On average, there is an 88% probability that monthly changes of exchange rates for managed floaters are confined within the narrow band of 2.50%. Low exchange rate flexibility is the result of deliberate policy interventions. Furthermore, international reserves and interest rates are more volatile for these countries. Technically, interest rate movements are a by-product of a combination of exchange rate stabilisation through domestic open market operations and a lack of credibility. They demonstrate why a lack of credibility of the monetary authority leads to fear of floating with high international reserves and interest rate volatility, within the framework of a pro cyclical monetary policy. These countries have a high risk premium. Therefore, smoothing exchange rate fluctuations is an attractive alternative to reduce the variance of real outcomes. In a stylised model, the authors demonstrate how offsetting the risk premium shocks and reducing exchange rate fluctuations can limit unnecessary variations in inflation.

[31] Significantly above the benchmark countries of Australia, Japan and US.

In the context of an inflation targeting country, Calvo and Reinhart (2000, 2002) demonstrated that a larger variance of nominal interest rates lowers the credibility of the monetary authority and increases risk premium shocks. Therefore, a greater commitment to inflation targeting by the authority will lead to the choice of a reduction in the variance of exchange rates changes. As a result, inflation targeting by many emerging countries can also explain the fear of floating phenomenon.

In order to provide an explanation for exchange rate interventions, Hausmann *et al.* (2001) find that many countries which classified their regime as floating show strikingly different volatilities in the movement of exchange rates relative to that of reserves or interest rates. They developed a model which explains that exchange rate intervention is the optimal choice of a central bank that attempts to minimise a standard loss function where domestic firms are credit-constrained and incomplete market structure limits the ability to avoid currency mismatch. [32] Thus, the model suggests that the difference in the way countries' floats are related to their different levels of exchange rate pass through and their ability to avoid any currency mismatches. They find a very strong robust relationship between the pattern of exchange rate flexibility and the ability for international borrowing in own currency.[33] The finding suggests exchange rate flexibility will be lower if the ability to borrow in own currency is low.[34]

3.2.2 Classification of *de facto* exchange rate regimes

As a consequence of the dubious nature of official exchange rate regimes, classification of *de facto* exchange rate regimes has rapidly become one of the new standards of research (Genberg and Swoboda, 2004). *De facto* regime classification attempts to rectify the deficiencies of *de jure* classification. Studies differ in terms of their methodologies and the variables used to classify the regimes. These classifications depend on a number of judgmental issues on variables such as the choice of the reference currency, changes in reserves and interest rates in the decision making

[32] Aghion *et al.* (1999, 2000) and Bacchetta (2001) suggest that monetary policy becomes complicated when firms hold a large fraction of their debt in foreign currency. This is due to the fact that while a reduction in interest rates can have expansionary effects through credit channels, the depreciation brought by the interest rate reduction can be contractionary through a balance sheet channel. Hence, the central bank will prefer less exchange rate flexibility with the increase in the importance of foreign currency debt.

[33] The relationship between ERPT and exchange rate flexibility was not statistically significant. They suspect that this might be due to measurement errors in calculating the pass through index.

[34] Which is likely to be the case with most developing countries.

process. In their survey, Tavlas *et al.* (2008) categorised these exchange rate classifications into two different groups:

A) Mixed *de jure* - *de facto* classification approach: in this category, self-declared regimes are adjusted by the devisers of anomalies on the basis of factors like judgments, statistical algorithms, and developments in parallel markets. IMF classifications are used as a reference in order to compare the findings of the new *de facto* regimes.

B) Pure *de facto* approach: assignment of these regimes are purely independent from the IMF classification.

Maintaining the same line of analysis as Tavlas *et al*. (2008), we present a brief literature review below.

A) Mixed *de jure* - *de facto* classification approach

While trying to assess the impact of exchange rate flexibility on inflation and growth, Ghosh, Gulde and Wolf (1997) rearranged the *de jure* pegged grouping between the frequent and infrequent adjusters in 136 countries over the period 1960 to1990. A regime is classified as pegged if the authority changes the value of the pegged currency within a particular year. However, they placed *de jure* intermediate and floating regimes in a single *de jure* group, therefore this is a partial classification. IMF official reports also started to include the *de facto* classification after recognising the deficiencies of the *de jure* classification. Based on exchange rate and reserve movements, studies by IMF (1999, 2003) and Bubula (2002) amended the self-declared regimes for 190 countries between 1990 and 2001. When the *de jure* regime was a peg, but the currency underwent frequent devaluations within a very short period of time, the regime has been classified as managed float. Evidence of intervention, for alternating the long-term trend in the exchange rate movements, is used to distinguish between managed floating and independently floating regimes. From 1999, this *de facto* classification replaced the IMF reports on *de jure* classifications.

Statistical algorithms have been used quite extensively in *de facto* classifications. The algorithms varied from simple probability estimations in Reinhart and Rogoff's (2002) study to cluster analysis in the study of Levy Yeyati and Sturzenegger (2005) and multinomial logit or probit models by some other studies. The

natural classification of Reinhart and Rogoff (2002, revised in 2004) is probably one of the most cited revisions of *de jure* classifications. They performed this exercise on monthly data for 153 countries over the period 1946 to 2001. Their classification also takes into account dual or parallel market rates and divides the classification between fine and coarse.[35] Their fine classification covers as many as 15 categories of exchange rate arrangement and coarse classification covers 7 categories. They treated the countries with official dual or multiple rates and active parallel markets separately. The authors then calculated the probabilities of monthly exchange rates in order to assess the flexibility of the regimes. If the probability of monthly exchange rate changes for a regime to stay within ± 1% is 80% or more, the regime is classified as a *de facto* peg or *de-facto* crawling peg. The same procedure has been followed in order to classify the regimes with different horizontal bands. Those regimes with a greater than 5% horizontal band are categorised as a managed or free float. To distinguish between the two regimes, a statistical test is used to gauge the degree of exchange rate flexibility. They defined a freely falling regime if the 12-month rate of inflation exceeded 40%.[36] A regime is classified as hyperfloat, a sub-species of freely falling, if the inflation rate is 50% or more.

Bailliu *et al.* (2003), adopting Ghosh *et al.*'s (1997) tripartite scheme as the official classification, classified de *facto* exchange rate regimes for 60 countries over the period 1973 to 1998. They developed a two-step hybrid mechanical rule which classifies exchange rate regimes in terms of their observed flexibility and takes into account external shocks and revaluations. In the first step, they classified countries as having a pegged regime based on the *de jure* classification.[37] They also classified regimes as pegged where exchange rate volatility is less than 0.45 percentage points over a given year. This threshold is broadly consistent with the IMF official

[35] They find that post World War II every country relied at least once on capital controls or multiple exchange rate systems. Therefore, failing to look at the market-determined exchange rates often gives the false picture of underlying monetary policy and the ability of the economy to adjust imbalances.

[36]Six months if an exchange rate crisis was accompanied by a transition from a fixed or quasi fixed regime to a managed or independently floating regime.

[37] The literature has identified a bias for declaring exchange rate arrangements as being more flexible than they actually are and not vice versa. The bias is thought to result from the fact that it is difficult for a country that publicly declares it is pegging the exchange rate to cheat on the exchange rate commitment, given the fixity of the nominal target.

classification.[38] In contrast to Levy Yeyati *et al.* (2005) and Calvo and Reinhart (2000), their method identifies intermediate and flexible regimes on the the basis of observed exchange rate volatility, without taking any account of international reserves. In order to control for external shocks, which they have assumed occur mainly due to the terms of trade or capital account shocks, they regrouped countries into industrialised and several groups of emerging countries based on geographic location. The rationale behind this is to create groups of countries that are more likely to share common characteristics and be influenced by the same common shocks. They developed exchange rate flexibility indices for each country based on the degree of exchange rate volatility relative to the group average for each year. Countries with a flexibility index greater than one are considered to be flexible and the rest are considered to be intermediate regimes.

B) Pure *de facto* classifications of the exchange rate regimes:

Shambaugh (2004) divided the regimes into pegged and non-pegged, based on the movements of exchange rate regimes within a pre-specified band. Using data from 155 countries over the period 1973-2000, a currency is classified as pegged in a particular year if the volatility of the exchange rate is within ±2% against the base currency. Levy Yeyati and Sturzenegger (2005) used cluster analysis to construct a three-way classification of pegs, intermediates and float regimes over the period 1947 to 2000 for 185 countries.[39] They used the volatility of exchange rates, volatility of the change in exchange rates and the volatility of reserves for the specification of the exchange rate regimes.

There are disagreements between the *de facto* regime classifications. The disagreements are broadly based on three components: (1) data series (the reference currency or currencies and parallel markets rate), (2) statistical methodologies and (3), the thresholds for categorising exchange rate regimes. Table 3.1 below presents the correlation between the four *de facto* classifications. Ghosh *et al*. (1997) has the highest correlation with the IMF classification.

[38]Most of the *de jure* fixed arrangements of the IMF exhibit less than 0.45 percentage points exchange rate volatility.

[39] Cluster analysis is a class of statistical techniques that can be applied to data that exhibits natural groupings.

Table 3.1: Pair wise correlations among *de facto* coding schemes (1990-99)

Classification	IMF	GGW	LY-S	R-R
IMF	1.00			
	(100)			
GGW	0.60	1.00		
	(55)	(100)		
LY-S	0.28	0.13	1.00	
	(41)	(35)	(100)	
R-R	0.33	0.34	0.41	1.00
	(55)	(35)	(45)	(100)

Source: Frankel (2004); frequency of outright coincidence (%) in parenthesis. GGW= Ghosh, Gulde and Wolf. LY-S= Levy-Yeyati and Sturzenegger. R-R= Reinhart and Rogoff

3.2.3 Reliability of the regime classifications

There are some drawbacks of *de facto* classifications. A fundamental problem is the use of backward information. Whilst the stated regime, in principle, conveys information about future policy intentions, observed actions necessarily pertain to the past (Ghosh *et al.*, 2002). Most of this *de facto* coding is based on the assessments of exchange rate movements and volatility of reserves. However, the exchange rate or reserve volatilities alone will often not be good indicators of exchange rate flexibility. Stability of the nominal exchange rate could either reflect the absence of any shock or active intervention for smoothing out these shocks from exchange rate fluctuations. Only the latter criterion is relevant for the classification of *de facto* exchange rate regimes. More generally, countries have different structures and are subject to different shocks. Hence, it is difficult to infer the underlying practice purely from the observed exchange rate movement.

Coding which uses short frequencies may also be susceptible to the problem of a large one-time swings in exchange rates. Classifications like Levy Yeyati *et al.* (2005) and Bailliu *et al.* (2003) are particularly susceptible to this problem; Reinhart and Rogoff (2004) used a five-year rolling window and mean absolute deviations as a measure of exchange rate volatility to overcome the problem of outliers.

Some studies have used other policy variables, such as the change in gross reserves, in order to measure intervention. However, these variables also have some

serious drawbacks. There are many reasons why the international reserves of a country might show unintentional volatility. The movements of international reserves are influenced by a number of factors, particularly in emerging markets. Such movements might be due to the servicing of foreign debt or payments for bulky purchases such as oil imports or aircraft, which have little to do with intentional foreign exchange intervention but do result in large movements of reserves. As the use of forward markets, swaps, non-deliverable forwards and a variety of other off-balance sheet instruments by central banks have become more common, gross reserves, even if reported accurately, become ever less revealing. The objective of building classifications purely on the basis of policy instruments is another drawback of *de facto* classifications. As Levy Yeyatti *et al.* (2005) pointed out, this introduces the problem of endogeneity. For example, countries with high exchange rate pass through and with an inflation targeting objective are likely to prefer a stable exchange rate, even though the primary goal is not to intervene in the exchange rate markets. Thus, they reassessed the suspicion of Calvo and Reinhart (2000) regarding fear of floating by many inflation-targeting countries. For the aforementioned reasons, studies like Hausmann *et al*. (2001) used the relative volatility of exchange rates and reserves to verify the extent of intervention in foreign exchange markets by the floaters.

3.2.4 Performance of exchange rate regimes in terms of growth and inflation

There is no clear evidence for any particular regime to be growth enhancing. On the contrary, there is a consensus that fixed exchange rate regimes show better performance with regard to inflation control. Where growth is concerned, it has been argued that a more flexible exchange rate policy can enhance economic growth, as a flexible exchange rate acts as a shock absorber and will enable economies with nominal rigidities to absorb and adapt to economic shocks more easily (Bailliu *et al.*, 2003). Studies such as Bailliu *et al.* (2001) and Levy Yeyati and Sturzenegger (2001) find a significant relationship between economic growth and the exchange rate regime.

Bailliu *et al.* (2001), in their study of 25 emerging countries from 1973 to 1998, find that flexible exchange rate arrangements are associated with higher growth. Similar findings have been confirmed by Levy Yeyati *et al.* (2001) for developing countries. However, their findings suggest that the exchange rate regime does not have any significant impact on growth in industralised countries. The subsequent study by Bailliu *et al.* (2003) is critical of the previous studies for not considering the underlying

monetary policy framework for the corresponding exchange rate regimes. They argue that both the intermediate and flexible regimes may include some form of weak or strong monetary policy frameworks. Therefore, failure to account for this discrepancy may result in an inaccurate assessment of the impacts of alternative exchange rate regimes on growth. Using a GMM framework on a panel of 60 countries over the period 1973 to 1998, they find that exchange rate regimes characterised by monetary policy anchors exert a positive influence on growth. Their findings also suggest that intermediate and flexible regimes without any nominal anchors are detrimental for growth. On the contrary, Ghosh *et al.* (1997) find no systematic differences in growth rates across exchange rate regimes in a sample of 136 countries during the period 1960 to 1989.

Unlike growth, there is a widespread consensus that pegged regimes more or less act as an anti-inflationary device in the short run. The findings of Ghosh *et al*. (1997), for 136 countries over the period 1960 to 1990, suggest that by imposing greater central bank discipline and a lower growth rate of residual velocity, fixed exchange rate regimes experience low and less volatile inflation compared to the other regimes. The study by Levy Yeyati and Sturzenegger (2005) supports similar findings. A subsequent study by Ghosh *et al.* (2002), using three *de jure* and a detailed 6 ways classification supports the earlier findings that inflation is lower under pegged exchange rates, reflecting both lower money growth and greater confidence in the currency.

Using the natural classification of exchange rate regimes by Reinhart and Rogoff (2004), Husain *et al.* (2005) find that the macroeconomic performance of alternative exchange rate regimes mainly depends on the maturity of the economy and institutions of a country. Developing countries, which have less exposure to international markets, appear to benefit from regimes with a strong exchange rate and monetary policy commitment. For these countries, the harder the commitment to a stable exchange rate, the lower the inflation rate without any sacrifice to economic growth. In the same way, more flexible regimes are associated with higher inflation without any concomitant reward to economic growth. On the contrary, their findings for advanced economies suggest that flexible regimes are correlated with low inflation and high growth.

An issue yet to be addressed, pointed out by Tavlas *et al.* (2008), is that the major research agenda for the future in this area involves the need for a more thorough investigation of the degree of monetary policy independence without relying on the movements in exchange rates. A natural objective of these *de facto* classification exercises is to evaluate macroeconomic performance of the regimes. However, the evaluation will not be complete if the study does not consider the underlying monetary policy framework of any particular regime i.e. consideration of inflation targeting or monetary targeting should be of equal importance for the performance evaluation. Sections 3.2.5 and 3.2.6 provide a brief overview of these two regimes.

3.2.5 Monetary targeting regimes

Monetary targeting was a popular policy choice over the late 1970s and 1980s. Influenced by the monetarist school of thought, most OECD countries began adopting, with varying degrees of conviction, some form of intermediate money and credit targets over this period. The idea was mainly to control the intermediate targets rather than an ultimate policy goal like inflation.[40] Estrella and Mishkin (1996) suggest that there are three possible roles for monetary aggregates in monetary policy: it can act as 1) an information variable, 2) an indicator of policy actions and 3) an instrument in a policy rule. This policy allows the central bank to independently choose the appropriate inflation rate (Mishkin, 1999). Monetary targeting can also act as a nominal anchor. It can increase accountability and remove the time inconsistency trap.

Monetary targeting regimes were not a success story for the U.S, U.K and Canada, and a major disadvantage was the lack of stable relationship between monetary aggregates and the price level. According to Bernanke and Mishkin (1992), the central banks of these countries never adhered to strict, ironclad rules for monetary growth and in some cases monetary targeting was not pursued in a serious manner. However, there were various discrepancies. Mishkin (1999) finds that the US, Canada and the UK engaged in substantial game playing in which they targeted multiple aggregates, allowed the base to drift, did not announce targets on the basis of the schedule, and often overshot their targets without reversing, the reasons of which remained obscure.

[40] It was widely believed that intermediate targets are easy to control, as the lag between policy actions and inflation is larger than the lag between policy actions and monetary growth. Moreover, monetary target is perceived by policy makers to be more directly manageable.

As a result, monetary targeting in these three countries never proved to be successful in controlling inflation. According to Mishkin (1999), there are two interpretations for this. Firstly, that monetary policy was never pursued in a serious manner in these countries and secondly, the growing instability of the relationship between monetary aggregates and the goal variables such as inflation. Estrella and Mishkin (1996) find that for the US, the problem with monetary aggregates as a guide to monetary policy is the frequent shift in velocity, which altered the relationship between money growth and nominal income. As a consequence, all three countries formally abandoned monetary targeting regimes by the early 1980s.

However, the success of this regime in controlling inflation in Switzerland and Germany is one of the main reasons why monetary targeting still has some strong advocates today and is apparently the official policy regime of the European Central Bank (ECB). The targeting regimes for these countries are very far from a Friedman-type monetary targeting rule where monetary aggregates are kept on a constant growth path, which is the primary focus of monetary policy. One of the secrets of the success of German monetary policy is that the authority often did not feel bound by the monetarist orthodoxy as far as its technical details were concerned (Issing, 1997). In fact, monetary targeting in both countries should have been viewed as a method of communicating a strategy of monetary policy that focuses on long run considerations and the control of inflation (Mishkin, 1999; Bernanke and Mishkin, 1992). There are certain factors behind the success of the regimes in both of these countries. According to Bernanke and Mishkin (1992), Mishkin and Posen (1997) and Mishkin (1999), the main reason is a featured numerical inflation goal to set the target ranges. At the same time, far from being rigid, monetary policy was in fact quite flexible in practice. 50% of the time, the target ranges were missed, often because the monetary authorities were concerned with other objectives such as output or exchange rates. The Bundesbank had demonstrated its flexibility by allowing the short-term inflation goal to vary and converge slowly to the long run goal. Transparency was another important reason. Through publications and frequent speeches by officials, monetary authorities successfully demonstrated a strong commitment to public communication.

According to Mishkin (1999), there are two key lessons from the experiences of these two countries. First, targeting regimes can withhold inflation in the long run without adherence to a rigid policy rule. Second, the key reason for the success of

monetary targeting, despite frequent target misses, is that the objectives of monetary policy were stated clearly and both authorities were actively engaged in communicating the strategy of monetary policy to the public, which in turn enhanced the transparency and accountability of the central banks.

3.2.6 Inflation targeting regimes

Form the late 1980s, many countries started to adopt inflation targeting to overcome the shortcomings of intermediate targets such as exchange rate or monetary targets. Starting with the reserve bank of New Zealand, so far 30 countries have adopted inflation targeting as their official monetary policy framework over the past two decades. In many countries, the spread of inflation targeting has been prompted by exchange rate crises. The main idea is to anchor inflationary expectations by committing to a particular inflation target. The key aspect that separates inflation targeting from other monetary policies is the public announcement of a numerical target. By making the target explicit, inflation targeting provides a nominal anchor. The three main features of inflation targeting that distinguishes this strategy from other monetary policy strategies are 1) the central bank's commitment to a unique numerical target (either level or range) of annual inflation, 2) the inflation forecast over some horizon: the *de facto* intermediate target and 3) the emphasis on public communication, transparency and accountability. An inflation targeting central bank publishes regular monetary policy reports that incorporate the bank's forecast of inflation and other variables, analysis behind the forecast and motivation for the decision. The emphasis on transparency is based on the insight that the monetary policy's action and announcement has significant consequences on private sector expectations.

Undertaking inflation targeting involves a gradual disinflationary period towards a low stable rate before the official adoption of the regime. Even though, there are some basic general frameworks, the policy framework and implementation of inflation targeting can differ substantially. There are also several economic trade-offs, such as output volatility and unemployment. Therefore, inflation targeting countries are flexible in terms of pursuing the targeted rates (Roger, 2010). Also, there are some important differences between inflation targeting countries regarding the role of exchange rate in the policy framework (Shimizu *et al.,* 2009). The exchange rate has a more prominent place in the inflation targeting framework, particularly for emerging countries. Even though the interest rate is the primary policy tool, reserve requirements

or foreign exchange market intervention are also used by some countries as supplementary instruments.

3.2.7 Performance of inflation targeting regime in terms of growth and inflation

Advocates of inflation targeting monetary policy, such as Bernanke *et al.* (1999), suggest that the policy promotes price stability and reduces inflation persistence. However, experiences differ from country to country (Ball, 2006). Evidently, inflation targeting regimes are more successful in developing countries than their developed counterparts (Ball and Sheridan, 2003; Goncalvez and Salles, 2008). A study by Roger and Stone (2005) suggests that inflation targeting is associated with an overall improvement of economic performance. On the contrary, experiences with developed countries are mixed. The preferences of policy makers are shifted more towards the aversion of inflation rather than output volatility. Therefore, many expect that the outcome would result in higher output volatility (Cecchetti and Ehrman, 1999).

Studies like Cecchetti and Ehrman (1999), Neuman and Von Hagan (2002) and Hu (2003) used a pure difference in difference approach to measure the effects of IT. The findings of these studies generally suggest that IT reduces the mean and variance of inflation. However, the results regarding the variance of output are mixed. Cecchetti and Ehrman (1999), studying a sample of 24 non inflation targeting and 9 inflation targeting countries over the period 1985 to 1997, find that aversion to inflation variability has increased since the 1990s, irrespective of monetary policy regime. However, the reduction in inflation volatility is modest among inflation targeting countries compared to non inflation targeting countries. Using a similar approach, Ball and Sheridan (2003) compared the performance of all the OECD inflation targeting countries with 13 non-inflation targeting countries over the 1990s. They find an insignificant and weak effect on average inflation of inflation targeting countries. The apparent success of the inflation targeting countries simply reflects a reversion to mean inflation. That means, inflation falls faster in countries with a high initial level of inflation. Since most of the inflation targeting countries usually started from a relatively high level of inflation, the greater declining rate actually reflects the general declining trend of the rest of the world.

A subsequent study by Goncalvez and Salles (2008) used a similar approach and found that inflation targeting had a substantial effect on the reduction of inflation in

36 emerging economies. Inflation had been reduced by 2.5 percentage points and volatility of the annual growth rate was reduced by 1.4 percentage points in these countries. The study suggests that monetary policy targeting inflation has a much stronger impact in developing countries compared to developed countries. However, Ball (2010) argues that in Goncalvez and Salles's (2008) study, 5 of the non inflation targeting countries including Argentina and Bulgaria, had pegged exchange rate regimes and hard pegs increase output volatility. Therefore, the finding that inflation targeting reduces output volatility compared to hard pegged regimes is ambiguous.

The study of Ball and Sheridan (2003) has also been criticised by Vega and Winkelried (2005), who argue that the former study might have suffered from sample selection bias. Any inflation targeting countries with poor performance before the adoption of an inflation targeting policy should be compared with equally poor performing non-inflation targeting countries, otherwise the comparison would be biased and misleading. Using a propensity score matching technique for cross country data of a treatment sample of 23 inflation targeting and 86 non inflation targeting countries, their central finding supports the idea that the adoption of inflation targeting, either in soft or explicit form, delivers the theoretically promised outcome of low inflation (around a fixed target or within a target range) as well as low inflation volatility. Inflation targeting countries have lower long-term inflation rates, ranging from 2.6% to 4%, with lower long term inflation volatilities ranging from 1.5% to 2.0%. Their findings also confirm that the adoption of an inflation targeting policy contributed to a reduction in inflation persistence across developing countries. Lin and Ye (2007, 2009), taking the same approach, find that an inflation targeting regime has impacts in the non-industrialised countries but not in the industrialised countries.

Mishkin and Schmidt-Hebbel (2007), using quarterly data for 21 advanced and emerging inflation targeting countries along with 13 non-inflation targeting industrialised countries from 1989 to 2004, adopted an instrumental variable approach to compare and evaluate the performance of inflation targeting and non-inflation targeting countries. They find that emerging inflation targeting countries outperformed the industrialised inflation targeting countries in terms of reducing average inflation rates as well as both inflation and output volatilities. Inflation volatility in industrialised inflation targeting countries was twice the size of the volatility in the industrialised non-inflation targeting countries. However, inflation targeting countries have lower

inflation persistence. Despite achieving some favourable improvements, their findings do not suggest that the inflation targeting countries outperformed the control group of non-inflation targeting countries in terms of improved monetary policy. Their findings imply that some industrialised countries have been able to obtain a strong nominal anchor without resorting to inflation targeting monetary policy framework. Nevertheless, gains from inflation targeting seem to be quite significant in emerging countries. One of the drawbacks of their analysis is the use of lagged inflation targeting dummy as an instrument. Ball (2010) argues that if an inflation targeting dummy is affected by other variables affecting inflation, then the lagged inflation targeting dummy will also be guilty of the same charge.

Nevertheless, findings by a number of other studies also suggest that the performance of inflation targeting is better in emerging countries compare to developed countries. Surveying a number of studies, Walsh (2009) concludes that the achievement of an inflation targeting regime is significant in developing countries compared to their developed counterparts. Goncalves and Salles (2008) pointed out that central banks in advanced countries are likely to have higher credibility and expertise than those in emerging countries. Thus, the policymakers of advanced countries already have an advantage compared to those of emerging countries and as a result have very little to gain from this policy framework. Therefore, an inflation targeting regime is much more effective in providing discipline to the monetary policy of emerging countries, therefore overall gain is also much more significant for this group.

3.2.8 Endogeneity of the Regime Choice

Monetary policy regimes are endogenous to various factors. However, the endogeneity of the regimes does not have an impact on our classification exercise as the classification exercise is mainly ex-post by nature. There are three main competing approaches to explaining the choice of exchange rate regime. These are i) the optimal currency area (OCA) theory which relates to the choice of regime to a country's trade links, size, openness and the characteristics of the shocks the economy is subjected to (Mundell, 1961); ii) the financial view, which highlights the consequences of international financial integration; and iii) and the political view, which regards the use of a peg (or, more generally, an exchange rate anchor) as a "policy crutch" for the lack of (nominal and institutional) credibility of the governments.

Rather than considering all of the three aspects together, most of the empirical studies on the determinants of regime choice focused on either one of these aspects. For example, the study by Bayoumi and Eichengreen (1998) focused on the implication of the optimal currency area theory. They find that the theory of optimal currency areas help to explain the patterns of exchange rate variability and interventions across 21 industrialised countries over the period 1963 to 1992. The study by Levy-Yeyati *et al*. (2010), using Reinhart and Rogoff's (2002) classification of exchange rate regimes, provides a comprehensive study on all of the contending hypotheses for regimes endogeneity. They find that when all factors are considered jointly, the choice of exchange rate regime can be traced back to a few simple determinants that include a combination of trade, financial and political variables. The means by which countries choose their exchange rate regime in response to these basic determinants have not changed substantially over the last two decades. They find that size of a country, openness, terms of trade shocks, financial developments and political stability are important factors for regime choice. Weak governments appear to be less prone to implement and sustain pegs, however the finding is not strongly applicable for developed countries.

3.2.9 Contribution of the current study

The current work extends previous studies by conducting the *de facto* classification of all the monetary policy regimes for 123 countries over the period 1970 to 2012, and also comparing the regimes' performances in terms of growth and inflation. We argue that classifying exchange rate regimes without reference to the underlying monetary policy framework would be misleading. For example, consider the Euro and the European Central Bank (ECB). Almost all exchange rate classification studies classify the countries within the Euro area as operating fixed exchange rate regimes. However, this does not acknowledge the Euro-wide setting of monetary policy by the ECB. Monetary policy within the Euro area is not similar to the monetary policy of countries within the CFA Franc zone that operate fixed (or pegged) exchange rate regimes. Treating both groups of countries in the same way and ignoring the monetary policy frameworks would be misleading.

As mentioned previously, Bailliu *et al.* (2003) focused on applying the monetary-policy framework along with the exchange-rate regime. However, there are

some drawbacks. The study does not, when it arises, explain how to resolve a conflict between exchange rate and monetary policy anchors. They have not explicitly identified other monetary policy regimes such as inflation and monetary targeting. The countries with implicit monetary policy targeting are also not taken into account and considered as non-anchoring countries.

The current study attempts to improve the *de facto* classification of monetary policy regimes (Exchange rate regimes, IT regimes and MT regimes) for a sample of 123 countries. In order to classify exchange rate regimes, we have used the volatility of exchange rates, volatility of changes in exchange rates and the volatility ratio of the changes in exchange rates to changes in reserves (RVER). Instead of using normal standard deviations, we measure the volatility of exchange rates by the movements of exchange rates around the mean, eliminating the largest 10% outliers from the mean (both positive and negative) in order to reduce the problem of outliers. For each country the appropriate anchor currency is chosen by checking the parity with a number of currencies and choosing the reference currency with the highest parity. The reference currencies are the US Dollar, British Pound, German Mark (pre 1999), French Franc (pre 1999), Euro, Indian Rupee, Japanese Yen, SDR and NEER. A further sub-category, termed as 'freely falling' is included in the analysis if the rate of inflation is 20 % or more in any country with a freely floating or managed floating exchange rate regimes.

De facto classifications of the other monetary policy regimes are equally important as *de facto* classifications of exchange rate regimes. More than 10% of the regimes are classified as *de facto* inflation targeting and monetary targeting regimes, which were considered as some type of exchange rate regimes by the previous studies. The *de facto* inflation targeting regimes have been classified on the basis of inflation rates, changes in inflation rates and policy interest rates. Most of the inflation targeting countries have a medium term goal to achieve the targeted rate. Therefore, for the *de jure* inflation targeting countries, we have not classified the regime as *de facto* inflation targeting if the particular country failed to achieve the targeted rate for two or more consecutive periods. Only 22% of the time the *de jure* inflation targeting regime was not consistent enough to be classified as a *de facto* inflation targeting regime, whereas nearly 60% of the time these countries missed their targets. There are several reasons why an IT country may not achieve the target range. The main argument is based on the

constrained discretionary nature of the inflation targeting regime. It gives the policy makers of IT countries considerable leeway for responding to economic shocks and financial crises. Many IT countries during the recent financial crisis tried to address other issues. Therefore, the action to prioritise other economic goals such as growth and unemployment is deliberate.

We have also developed a classification criterion for non-inflation targeting countries in order to identify some of the periods as *de facto* inflation targeting countries. For industrialised countries, if the inflation rate is ≤ 2.5% with a lower volatility for three or more consecutive periods and volatility of the interest rate is ≥ 1%, we have classified the regime as *de facto* inflation targeting. The episodes are followed by a converging targeting period when inflation is falling constantly and the rate of change is negative with a volatility of policy rates ≥ 1. Notable countries are the US, ECB, Germany and Switzerland. For many years, US monetary policy has been consistent with an implicit goal of price stability to maintain the target of growth and unemployment. Monetary policy in Germany and Switzerland is quite successful in achieving low inflation rates. Bernanke and Mishkin (1997) suggested that monetary policy in Germany and Switzerland might best be thought of as a hybrid of inflation and monetary targeting, with a strategy closer to inflation targeting than monetary targeting in Friedman's sense. Price stability is also an overriding goal for the ECB. For non-industrialised countries, if the inflation rate is ≤ 3% with a lower volatility and the volatility of the policy rate is ≥ 1%, the period has been classified as *de facto* inflation targeting.

We have identified some regimes for 11 countries over the period 1991 to 2012 as *de facto* monetary targeting regimes. Such regimes have been classified on the basis of changes in broad money, narrow money and the interest rate. If the growth rate of both broad and narrow money is ≤ 10% and the variability of the interest rate is ≥ 1%, we have identified the regime as monetary targeting. There are few episodes where a regime falls into both categories. We have classified those regimes based on the appropriate monetary policy criteria.[41]

[41] Table A3. 6 in Appendix 3.2 provides a list of all the regimes we have classified in our study and table A3.5 explains the coding of the regimes.

The performance of alternative exchange rate regimes and contribution of the current study

Based on our *de facto* classification, we attempt to evaluate the impact of the regimes on growth and inflation. Studies like Bailliu *et al.* (2003) and Ghosh *et al.* (2002) used generalised method of moments (GMM) estimators to address the problem of endogeneity. However, one of the problems of using GMM in a panel with large N and large T is that the asymptotics are different from large N and small T. The Arellano and Bond (1991) GMM estimators, which pool individual groups and only allow the intercepts to differ across groups is not consistent for this type of panel. Thus, instead of using GMM, we have applied pooled mean group estimation (PMG) suggested by Pesaran, Smith and Shin (1997, 1999) for dynamic panels to evaluate the performance. Since it involves pooling and averaging, PMG is an intermediate estimator between dynamic fixed effects (DFE) and mean group estimation. PMG allows short run coefficients, the speed of adjustment and error variances to differ across groups but imposes homogeneity in long run coefficients. This method has been used in growth studies for a number of years (Bassanini and Scarpetta, 2001). We deemed the method to be appropriate for our panel data set of 123 countries over the period 1980 to 2012 and for the first time we attempt to use this method to evaluate regime performance.

The findings from the PMG estimations suggest that fixed exchange rate regimes are more growth enhancing for both industrialised and developing countries. IT regime has greater positive influence in developing countries compared to industrialised countries (where the regime has not outperformed the other regimes). For both groups of countries, monetary policy regimes with some sort of nominal anchors are more growth enhancing. Inflation is lower for both groups of countries over the inflation and monetary targeting regimes. Additionally, fixed exchange rate regimes have the lowest inflation. Inflation is significantly lower and growth is significantly higher for the regimes with nominal anchors for both groups of countries. Our findings, therefore, suggest that the presence of some form of monetary policy anchor is beneficial for economic performance.

3.3: Methodology

3.3.1 Classification criteria for monetary policy regimes

Monetary policy has evolved significantly over the last few decades. In a survey of 94 central banks, Fry (2000) find that only 4 central banks had either an explicit or actual target for monetary policy, however this has grown to 40 by 1998. The survey reveals that 74% of the central banks consider transparency a vital or very important component of their monetary policy framework. Securing credibility is the main reason for adopting explicit targets like inflation targeting or monetary targeting regimes (Fry, 2000). Bernanke and Mishkin (1999) observed that central banks occasionally conduct monetary policy on pure discretionary strategy; they never adhere to strict, ironclad rules. They observed that a common strategy for most of the central banks resembles a hybrid of rules and discretion. Based on this strategy, central banks attempt to apply rules to its medium term and long term policies, while at the same time retains flexibility or discretion to respond to the existing economic conditions in the short term.[42]

Empirical evidence during the monetary targeting regimes suggests that many central banks deviated from the targeted path. More than half of the time inflation targeting regimes across countries also failed to obtain the targeted rate of inflation (Roger, 2010). However, a major advantage of an inflation targeting policy framework is that it combines two distinct elements of rules and discretion, which includes a precise numerical target for inflation in the medium term and a response to economic shocks in the short term. Therefore, it would be worthwhile to verify if these deviations are consistent with the publicly declared policy.

The following sub sections provide the statistical algorithms for classifying monetary policy regimes and also explain the criteria for regime classification. We used statistical algorithms to categorise the monetary policy regimes. Tables 3.2 and 3.3 show the statistical algorithms. The period for yearly classifications includes monthly data from 1970 to 2012 for 123 countries. The sources of data are International Financial statistics (IFS), World Development Indicators (WDI) and various central banks websites.

[42] Bernanke and Mishkin (1992) find their observation challenges the simple view that pure rules and pure discretion are the only policy strategies available.

3.3.1.1 Algorithms for exchange rate classifications

The yearly exchange rate classification is done by the time series of several measures of exchange rate flexibility from monthly data and three years rolling window. Three classification variables are used for the yearly classification of exchange rate regimes; i) Volatility of exchange rate, ii) Volatility of change in exchange rate, iii) Ratio of the volatilities of change in both exchange rates and reserves (RVER). Six regimes have been classified on the basis of these criteria. The seventh regime, 'freely falling' has been classified for a managed float or free float regime, if the inflation rate is 20% or more. Tables 3.2 and 3.3 summarise the algorithms for the exchange rate regime classifications.

If the volatility of the exchange rate is > 5 %, depending on the RVER, the regime is defined as managed float or free float. The reason is that RVER will not exceed 33 % most of the time for any exchange rate regime within ±5% flexibility band accompanied by a 10% volatility of change in reserves (the justification for 10% reserve volatility is discussed below).[43] A ≤ 50 % threshold has been determined in order to distinguish between managed floating and free floating regimes (≥ 50%). Any regime in these categories with high inflation (inflation rate of 20% or more) has been categorised as a freely falling exchange rate regime. However, pegged regimes with a ≤ 20% inflation rate have not been classified as freely falling. The reference currency has been chosen on the basis of the highest correlation across a number of currencies such as the US dollar, the UK pound, German mark, SDR, NEER, Japanese yen and Indian rupee. For example, the Indian rupee has been selected as the reference currency for Nepal based on the highest level of correlation between these two currencies.

[43]To minimise the problem of outliers, the volatility of exchange rate regimes has been defined by the movement of the exchange rates within 80% of the distribution.

Table 3.2: Algorithms for exchange rate regimes classification

Exchange Rate target	Volatility of Exchange rate	Classification algorithms for Exchange rate regimes (ER)	RVER (Volatility of change in Exchange rate to international Reserve)
Hard peg/ fixed	1%≤	ER1%≤ Volatility* of ER≤3%	≤ 33%
Soft peg stable	>1% but 2.25%≤	ER within the band and Volatility of change in ER ≤5%	≤ 33%
Soft peg converging	>2.25% but 3%≤	ER within the band and Volatility of change in ER ≤7%	≤ 33%
Soft peg converging in a wider band	>3% but ≤ 5%	ER within the band and Volatility of change in ER ≤10%	≤ 33%
Managed exchange rate (with no pre-specific bands)	>5% with higher volatility of Reserve	ER within the band and Volatility of change in ER >5%	<50%
Floating with very less intervention	>5% with lower volatility of Reserve	ER within the band and Volatility of change in ER >5%	≥50%
Floating rates with inflation rates ≥ 20%	Volatility high with higher inflation	ER within the band and Volatility of change in ER >5%	≥50%

*To avoid the impact of sudden drastic appreciation or depreciation of exchange rates, we exclude 20% of the extreme outliers from the mean.

Justification for the exchange rate regime algorithms

Volatility of exchange rates and volatility of change in exchange rates have been used quite extensively in the exchange rate classification literature. However, only the volatility of exchange rates or volatility of changes of exchange rates would give partial information to define exchange rate regimes. The level of reserves across countries differs substantially (Haussmann *et al*., 2001). To control exchange rate movements, a country need to have large reserve as a backup. Thus, Levy-Yeyati *et al*. (2005) used volatility of international reserves as an additional variable for classification. An important drawback of isolating the volatility of changes in reserves or volatility of exchange rates is that both of them are vulnerable to external economic shocks and therefore can be misleading. However, the relative volatility of change in exchange rates and international reserves could be a better alternative for flexibility of the exchange rates. In extreme cases of fixed exchange rates, the ratio would approach zero and grow larger if exchange rate volatility increases compare to that of reserves. The threshold volatility of reserves is 10%. We view this as a suitable benchmark to compare the flexibility of exchange rates, as most industrialised floaters keep the stock of reserves below 10 % of their M2 money supply (Hausmann *et al.* (2001).

The usual standard deviation measures of exchange rate volatility could be misleading as it becomes vulnerable to the presence of any outliers. Previous studies take various measures to overcome this issue. For example, Reinhart and Rogoff (2004) used mean absolute deviations to minimise the impact of outliers. Levy Yeyati *et al*. (2005) used the average of the absolute monthly percentage change of nominal exchange rate over a calendar year. We measure the volatility of exchange rate by excluding the 20% outlying observations. This will reduce the divergence from the mean and minimise the problem of outliers as well as give an accurate measure of the dispersion of exchange rates.

Table 3.3: Other Exchange rate arrangements

No separate legal tender
Currency Union / Monetary Union Adoption of a single currency and common central bank by a group of countries. The use of standard instruments of monetary policy is consigned and exercised solely by the central monetary authority (Tavlas *et al.*, 2008).
Currency Board Issues notes and coins convertible on demand under all circumstances, at a fixed rate of exchange, against a foreign anchor currency (Humpage and McIntire, 1995). It has no discretionary monetary power and cannot extend credit.
Dollarization or Euroisation Country officially adopts foreign currency as legal tender and local currency completely replaced by foreign currency.

3.3.1.2 Inflation and monetary targeting regimes

Table 3.4 summarises the algorithms we have used for the yearly classification of inflation and monetary targeting regimes. We follow the definition of Mishkin and Schmidt-Hebbel (2007) for our classification of inflation targeting regime. The targeted rates are adjusted downward during the convergence period, typically over a calendar year. During a stable targeting period, inflation targets are fixed at a constant level or range for an indefinite period. We defined a converging IT regime if the rate of change of inflation is negative and the inflation rate is higher but falling gradually compared to the pre-targeting periods, and the volatility of the policy rate is $\geq$1% for two or more consecutive periods and the inflation rate settles at a lower stable rate after that for three or more consecutive years. Reference inflation rates or ranges for inflation targeting countries depend on the formal rates.

Monetary targeting regimes are defined on the basis of the growth rates of both narrow and broad money. A regime is defined as *de facto* monetary targeting if the volatility of monetary growth rate is ≤10% and the rate of change is ≤5%, and the volatility of change in policy rates is ≥1%. 10% growth rate is decided on the basis of empirical evidence of monetary growth target pursued by many monetary targeting countries over the 1980s.[44]

Justification for the inflation targeting and monetary targeting regime criteria

Typically, an inflation targeting regime has a pre-targeting disinflationary period. The regime shifts to a formal inflation targeting regime once the inflation rate settles down at a lower stable rate, typically around 3% (Roger, 2010). Roger (2010) demonstrates that high income countries typically start the process of disinflation at a rate of around 6% whilst emerging countries start at a higher rate, around 8%.

The average inflation for industrialised inflation targeting countries is around 2.2% and for developing countries 3% (Mishkin and Schmidt-Hebbel, 2007; Roger *et al*., 2009). We have used these rates for the benchmark inflation to classify *de facto* inflation targeting regimes. Inflation targeting rates for the *de jure* inflation targeting countries also depend on the various levels of official inflation targeting range over the period 1989 to 2012. A country has not been classified as having a *de facto* inflation targeting regime if the target is missed over two or more consecutive periods. The reason behind this is that almost all inflation targeting countries share a medium term horizon of almost two years. An inflation targeting policy framework grants more flexibility. The targets are typically defined as a medium term goal due to the lag effects of 2 to 3 years. This strategy also allows addressing other objectives such as smoothing output fluctuations, growth and unemployment. Therefore, an inflation targeting policy framework provides a rule-like framework, which allows the central bank the discretion to respond to shocks.

There is a mismatch between theory and practice in terms of targeting inflation. Ideally, on the basis of theory, inflation should be zero (according to the New Keynesian paradigm), or negative (according to the Friedman rule). However, in practice the inflation target cannot be zero. Part of the reason is purely statistical. Measured inflation tends to overstate actual inflation by around 0.5 percentage points.

[44] Table A2.1 and A2.2 summarised the inflation targeting dates.

It has been argued that the cost of disinflation is greater than the cost of inflation. Hence, targeting a positive rate of inflation reduces the probability of inflation hitting a zero lower bound on nominal rates.

Table 3.4: Algorithms for inflation and monetary targeting regime classification

Regimes	Criteria
Inflation Targeting: Stable	Inflation rate ≤2.5% (For inflation targeting countries official inflation rates are used as a reference). Inflation rate ≤3% for developing country (also depends on the targeted inflation rate).[45]
Inflation Targeting: Converging	Inflation rate >3%*, change of inflation ≤0, volatility≥1% and inflation is stable at a lower rate for a few consecutive years.
Monetary targets: Stable	Growth rate of both narrow and broad measure of money ≤10%, and standard deviation ≤5%. Volatility of policy interest rate ≥1%. **
Monetary targets: Converging	Rate of change in the growth rates of narrow and broad money ≤0 or falling. Volatility of policy interest rate ≥1% and is stable at a lower rate for a few consecutive years.
Others	
Monetary or Exchange rate policy with multiple targets	The episodes which are not in any of the pre specified targeting groups, therefore covers a whole range of intermediate exchange rate regimes.

*Both the growth rates of broad money and narrow money have been used for monetary growth
**Volatility of inflation and interest rates are measured by the standard deviation of levels and changes respectively.

The average monetary growth target during the late 1970s and 1980s was around 10% by the US and many other industrialised countries.[46] Hence, the 10% target rate has been adopted for the monetary targeting countries. Since there is a lack of

[45] Table A3.1 in Appendix 3.1 summarises the inflation rate for the *de facto* inflation targeting countries during the converging and stable inflation targeting period. The official inflation rate has been used for the *de jure* inflation targeting countries.

[46] See, for example Friedman (1988) for detailed analysis.

evidence regarding the official monetary targets and data availability of the benchmark monetary aggregates, we used the growth rate of both broad and narrow money as the references.

3.3.1.3 **Regimes that fall into both monetary and inflation targeting regimes**

The main goal of nominal targeting was to achieve lower and stable inflation and maintain stable nominal income over the late 1970s and 1980s (Mishkin, 2002). Therefore, a lower level of inflation indicates a deliberate action of the monetary authority. A regime has been classified as a *de facto* inflation targeting regime if it qualifies at the same time as both a monetary targeting and inflation targeting regime.

Monetary targeting involves adopting a target of monetary growth every year. It is based on the assumption that controlling money growth allows control over inflation and nominal income.[47] The reference supply of money for a monetary target varies over time and differs across countries. Nevertheless, the target usually refers to slightly broader aggregates than base money.[48] One of the main benefits of monetary targeting is that the data on money supply is usually more available and more quickly accessible than other data, which provides early information on the short term inflation outlook. Also, the nominal money supply is perceived to be more directly controllable than inflation itself.

[47] The origin of this assumption is a popular identity by Irving Fisher known as 'the quantity equation' or 'the equation of exchanges'. According to this identity the value of all economic transactions (more generally all nominal income generated in an economy) has to be paid with money. It implies that money in circulation times money velocity must be equivalent to nominal income. Because of the neutrality of money in the long run, change in the nominal money stock has no impact on change in real output but can have an impact on inflation as long as money velocity is constant.

[48] The broader aggregates refer to the currency in circulation, sight deposits, and time deposits with unrestricted access.

3.4 Findings from regime classification

3.4.1: Distribution of the *de facto* monetary policy regimes

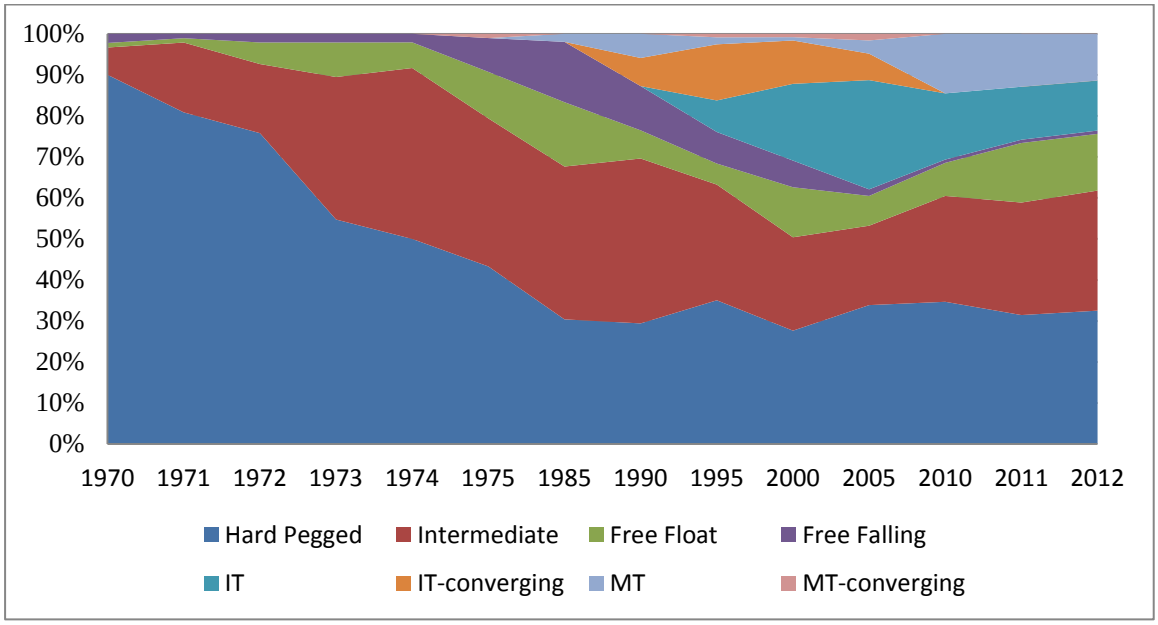
Figure 3.1 shows the evolution of *de facto* monetary policy regimes over the period 1970 to 2012 for 123 countries. Fixed exchange rates seem to be a popular choice over the 1970s, covering almost 90% of monetary policy regimes. Apparently, the *de jure* exchange rate regimes for many countries have become flexible since the collapse of the Bretton Woods system. However, the share of fixed exchange rates started to fall gradually over the early 1990s and is taken over by intermediate exchange rate regimes. The percentage of hard pegged regimes is reduced by 34% up until 2012. A falling share of peg has been taken over by free float and intermediate exchange rate regimes.[49]

After the collapse of the Bretton Woods system, many countries tried to find an alternative exchange rate management policy. Eventually, monetary targeting and inflation targeting frameworks started to take over. MT had been the choice of exchange rate regimes for many industrialised countries over the 1970s and 1980s. However, growing instability of the relationship between monetary aggregates and goal variables such as inflation or nominal income caused this monetary policy strategy to fail in many countries. Some non-industrialised countries still use monetary targeting as their official framework.

By 2005, IT covered almost 24% of monetary policy regimes. However, many IT countries changed their priority to cope with the economic turmoil during the most recent financial crisis. However, the hard pegged regime still dominates, covering almost 40% of all monetary policy regimes. The following sub sections carry out an elaborate description of the findings from monetary policy regime classification.

[49] By intermediate regime we refer to the exchange rate band from 2.25 % to < 5 %.

Figure 3.1: Evolution of *de facto* monetary policy regimes: 1970-2012



Note: Horizontal axis represents the percentage.

For example, between 1970 and 2012 in the UK and US, monetary policy regimes have changed almost 11 times according to our classification. Several decades have been concerned with searching for a suitable nominal anchor for the price level and for credibility of the government to maintain a low and stable inflationary environment. Up to 1973, monetary policy regime in the UK is classified as a fixed exchange rate regime, and from 1974 to 1991 the regime is classified as a managed float or flexible exchange rate regime. From 1992 to 1996, the monetary policy regime is classified as converging towards a stable inflation targeting regime. Since 1997, and until 2007, the regime in the UK is classified as inflation targeting.

In the UK, the monetary targeting regime was adopted officially in July 1976. However, most of the time, the authority had to overshoot their targets and inflation accelerated in the late 1970s. The medium-term financial strategy was introduced under Margaret Thatcher in the 1980s, which proposed a gradual deceleration of M3 growth. Unfortunately, the M3 targets ran into problems similar to those of the M1 targets in the US as they were not reliable indicators to tighten up monetary policy. After 1983, arguing that financial innovation was creating havoc with the relationship between M3 and national income, the Bank of England began to de-emphasise M3 in favor of a narrower monetary aggregate, M0 (the monetary base). The target for M3 was temporarily suspended in October 1985 and was completely abandoned in 1987. From March 1987 to 1990 the pound was informally linked to Deutsche Mark and from

October 1990 to September 1992, the UK was a member of ERM. From October 1992, the Bank of England received its operational independence. Since then inflation rates started to converge to a lower level and from 1997 the Bank of England has officially adopted inflation targeting.

The monetary policy regime in the US has changed seven times, mostly between the two alternative regimes: a flexible exchange rate regime and a *de facto* inflation targeting regime. Similar to the UK, since 1991 inflation rates have started to converge to a lower rate. Since 1977 the goals of US monetary policy are prescribed as the promotion of price stability, and sustainable output and employment. Up until the 1990s, US monetary policy is mostly classified as a flexible exchange rate regime. The regime of the European Central Bank (ECB) is classified as *de facto* inflation targeting as maintaining price stability is one of the primary monetary objective of the ECB.

The monetary policy regime in Guatemala has been changed over eight times. Inflation rates started to converge to a lower level since 2005. However, the exchange rate was virtually fixed. Bank of Guatemala (BoG) has incorporated exchange rate movements into its policy analysis. In 2005, BoG adopted a rule-based mechanism for intervening in the foreign exchange markets. BoG officially identifies the exchange rate as one of the transmission channels of monetary policy. One of the main reasons is high exchange rate pass through, despite the fact that the ultimate goal of the monetary authority is to pursue an inflation targeting regime.

3.4.2 Exchange rate regimes

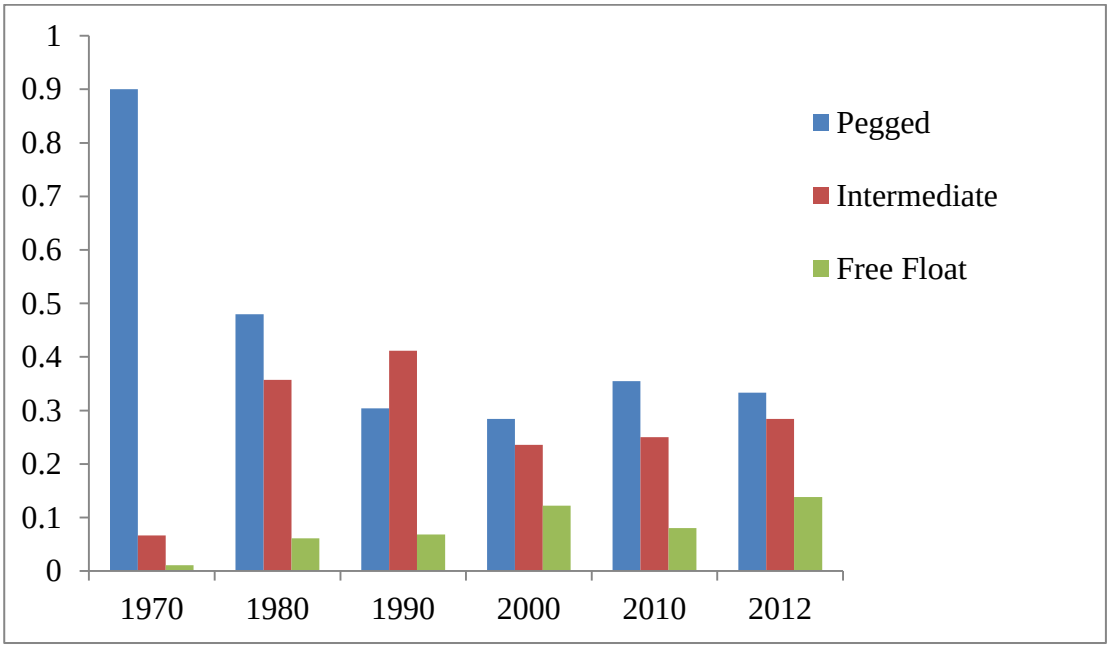
3.4.2.1 Bipolar Hypothesis

Soft peg and intermediate regimes are widely viewed by many as an unsustainable choice. The impossible trinity suggests that in countries with open capital accounts, a traditional soft peg has proved to be unsustainable in the long run as it is prone to financial crises (Obstfeld and Rogoff, 1995). Policymakers involved in dealing with crises over the 1980s and 1990s have warned strongly against the adjustable peg or other soft peg exchange rate regimes for open economies. As a consequence, many countries preferred bipolar or corner solutions. A number of empirical studies try to verify the evidence of bipolar solutions opted for by many countries. Notably, Ghosh *et*

al. (2002) tried to verify this by arranging the IMF *de jure* classifications for 150 countries into a six-way classification and by placing the hard pegs, currency boards and dollarized countries into a single basket. Their findings suggest that the proportion of intermediate regimes have declined by 34 percentage points between 1975 and 1999. Levy Yeyati *et al.* (2005) also came up with similar findings. Their *de facto* classification also reveals a hollowing out pattern over the 1990s, but the move to the corners was slower and less pronounced.

Our analysis also suggests a less pronounced move away from the intermediate regimes since the late 1990s. Intermediate regimes are found to be dominant in the 1990s. However, the share of intermediate regimes dropped by 12 percentage points (from almost 40% to 28%) over the last decade. Despite the falling share since 1970 (almost 57 percentage points), pegged regimes still remain a popular choice for many countries, covering almost 40% of all regimes in 2012. Figure 3.2 represents the distribution of *de facto* exchange rate regimes between 1970 and 2012.

Figure 3.2: Distribution of the *de facto* exchange rate regimes: 1970 to 2012



Note: Horizontal axis represents the percentage.

Table 3.5 below presents the pair wise correlation of the current study with the IMF and Reinhart and Rogoff (2004) classifications. 30% of the time, our classification compares to the IMF official classifications and 45% of the time to Reinhart and Rogoff (2004).

Table 3.5: Pair wise correlation with Reinhart and Rogoff (RR) and IMF *de facto* classifications

Coding	IMF	RR	Current Classification
IMF	1.00		
RR	0.42	1.00	
Current Classification	0.30	0.45	1.00

3.4.2.2 Fear of floating and hidden peg

The IMF *de jure* classification overestimated pegged regimes (exchange rate band ≤ 2%) more than 11% of the time and it overestimated free float regimes around 6 % of the time, compared to the current classification. The share of intermediate regimes is higher in the current classification, around 8%, compared to the RR and IMF classifications. The share of free fall regimes is also 8% more, compared to the RR (2004) classification. One of the main reasons for this is that our classification categorised regimes as freely falling if a managed float or free float had an inflation rate over 20%, whereas RR categorised a regime as freely falling if the inflation rate was over 40%. The IMF *de facto* classification suggest only 0.13% of regimes are freely falling. Table 3.6 summarises the discrepancies between the three regime classifications.

Table 3.6: Percentage of regimes in different classifications

Classification	Pegged	Intermediate	Free Float	Free Fall
RR	64.41%	25.56%	8.30%	1.73%
IMF	55.12%	27.10%	17.67%	0.13%
The current study	44%	34%	12%	10%

3.4.3 *De facto* inflation targeting and monetary targeting regimes

3.4.3.1: Experience with inflation and monetary targeting regimes

To classify the *de facto* inflation targeting countries, official inflation targeting rates have been used as the reference for *de jure* inflation targeting countries. During

the convergence period, the inflation target could be greater than 7% for *de jure* inflation targeting countries. However, both target rates and ranges drop significantly over the course of the inflation targeting period. The official rate of the inflation target varies from 1% to 3% for *de jure* industrialised countries. The inflation targeting range varies from $\pm$ 2.5%. Republic of Korea has the narrowest target of 3% (within $\pm$ 1% band). According to the current classification, inflation rates during the convergence period for non-industrialised countries started from as high as 23%. The official inflation target during the stable periods for both Peru and Czech Republic is 2%. Poland has a target of 2.5 %. Chile, Hungary and Mexico all have a 3% target and Colombia has a target range of 2% to 4%. Ghana has the highest inflation targeting rate of 8.7%. The average targeting horizon is 2 years for most countries.[50]

Roger (2010) finds that, on average, inflation targeting countries missed their target 60% of the time. Similarly, our estimation suggests that over 60% of the time, targeting countries missed the targets. However, only about a third of the time has our classification criteria categorised the periods as inconsistent with an inflation targeting regime, therefore categorising the regime as non-IT. In other words, the finding implies that only 22% of the time we have not identified the *de jure* IT regimes as *de facto* IT regimes.[51]

Non-industrialised inflation targeting countries missed the target more than their industrialised counterparts. 26% of the time, our classification criteria suggests that periods of inflation targeting for non-industrialised countries are not consistent with the policy. Nevertheless, empirical evidence suggests that this group has gained most from adopting an IT regime, with respect to reducing inflation and enhancing economic growth.

3.4.3.2 The reasons for missing the inflation targets

Inflation targeting is a constrained discretionary process. The policy makers pursue the medium run goal of inflation, with flexibility in the short run to address other economic

[50] Table A3.1 in appendix A3.1 provides the inflation rates and range for the *de jure* IT countries with the date of adoption.

[51] Not classified as a *de facto* inflation targeting periods if the targeted inflation rate misses for two or more consecutive years.

urgencies.[52] According to Bernanke (2003), inflation targeting is a compromise between rules and discretion. This approach of conducting monetary policy is increasingly becoming the standard of the new era. During the onset of the current financial crisis, some industrialised countries targeting inflation tried to address other economic issues. The priority of targeting inflation has been shifted toward some other goals. Based on the priority, therefore, it would not be misleading to classify them only as *de jure* rather than *de facto* inflation targeting countries. For example, the UK is one such country. On the inflation briefing, former governor of Bank of England Mervyn King iterated that the prospect of a further prolonged period of above-target inflation must be considered together with the weakness of the real economy.[53] He suggested that any attempt to reduce inflation back to the target sooner would risk derailing the economic recovery and undershooting the target in the medium term.

3.4.3.3 The case of non-industrialised countries

Inflation targeting depends on some stringent preconditions, rendering the framework particularly unsuitable for many emerging economies. The essential preconditions include, for example, the technical capability of the central bank to implement inflation targeting, the absence of fiscal dominance, well-functioning financial markets and an efficient institutional setup. That is one of the main reasons why emerging countries miss their targets.

Emerging market and developing inflation targeting countries face a number of challenges that are different from developed countries. Calvo and Mishkin (2003) highlighted five major challenges for non-industrialised inflation targeting countries. Such as: 1) weak public sector financial management, 2) weak financial sector institutions and markets, 3) low monetary policy credibility, 4) the extensive dollarization of financial liabilities, 5) vulnerability to sharp changes in the capital flows and international investor sentiment. Moreover, many of these countries face greater uncertainty regarding the structure of their economy, monetary transmission mechanism and cyclical position of the economy, compared to developed IT countries

[52] Constrained discretionary approach allows monetary policy authorities the flexibility to respond to economic shocks, financial upheavals, and other unforeseen economic issues.

[53] The Guardian, 13 February, 2013.

(Roger, 2010). That is one of the main reasons why many developing countries frequently miss their targets.

We find that Peru, Poland, Mexico, Ghana and South Africa missed their targets most frequently among developing countries. Countries such as South Africa, Israel and Thailand do not have a point based inflation target, rather these countries use ranges for their targets. Klein (2012) finds that in South Africa, this lack of transparency gives the monetary authority greater discretionary choice. Using a state space approach, Klein (2012) showed that in South Africa, although the official inflation range is 3% to 6%, in practice the South African Reserve Bank (SARB) has mostly aimed at the upper segment of the band, despite the resulting substantial variation in the output gap. The study also suggests that the implicit target varies over time; in recent years it has shifted toward the upper limit of the inflation target range. The findings also suggest that since the outbreak of the recent financial crisis, SARB has become more tolerant towards higher levels of inflation to better support economic activity, in the face of an extremely challenging global environment.

For the case of Ghana, the inflation targeting experience is less than satisfactory. Inflation rose above 10% from mid-2007 to above 20% by early 2009. The high inflation in Ghana was mainly caused by fiscal and non-monetary issues. Poland had some unsuccessful periods of inflation targeting from 1999 to 2002. The lack of well organised money markets, depreciation of the zloty and agricultural shocks are amongst the main reasons for Poland's unsuccessful periods.

There is evidence that IT countries with a history of high and unstable inflation tend to intervene in nominal exchange rates for conducting monetary policy (Edwards, 2006). This is pervasive, particularly in Guatemala. The exchange rate regime of Guatemala is comparable to a pegged regime. The conventional wisdom has long suggested that an inflation targeting central bank should not react directly to exchange rate movements, but only so far as they affect the outlook of inflation and output (Obstfeld and Rogoff, 1995). However for many emerging countries, maintaining such a benign approach to the exchange rate might not have been feasible. This is specifically true for economies with a higher dependency on foreign currencies and limited access to international capital markets (Roger, 2010). Financial systems with a higher dependence on foreign currency tends to exaggerate the importance of the

exchange rate change relative to domestic interest movements in policy transmission. In such circumstances, leaning against exchange rate movements has been appropriate in order to improve macroeconomic performance under inflation targeting (Moron and Winkelried, 2005; Roger *et al.*, 2009; Roger, 2010). The case for Guatemala certainly confirms this fact.

3.4.4 Non inflation targeting countries

We have categorised 74 periods from 1991 to 2012 for 12 non-inflation targeting countries and the ECB as *de facto* inflation targeting regimes. The monetary policy of the US, ECB, Germany (pre euro) and Switzerland is consistent with an implicit inflation targeting framework.[54] Goodfriend (2003) argues that the success of US monetary policy over the 1980s and 1990s can be attributed, in large part, to inflation-targeting policy procedures that the Fed has adapted gradually and implicitly over the last two decades. Bernanke and Mishkin (1992) argue that the monetary policy of Germany and Switzerland is a hybrid of an inflation targeting and a monetary targeting framework, with a dominant strategy of inflation targeting. This has been cited as one of the key reasons for the success of monetary targeting regimes in both of these countries.

Price stability is the overriding primary goal of the ECB, defined by its targeted inflation rates, which should be below and close to 2% (ECB, 2010). The ECB governing council utilises short term interest rates to achieve this goal. The ECB's monetary analysis takes into account the growth rate of M3 to a reference value of 4.5%, merely to facilitate the price stability goal, since money growth provides a signal for inflation in the medium to long term horizon. Even though the ECB falls into both monetary targeting and inflation targeting ranges, it can justly be characterised as a *de facto* inflation targeting regime based on its attitude toward price stability.

Some of the *de jure* as well as non-inflation targeting countries' regimes are classified as both inflation and monetary targeting regimes. Some periods of Canada (2002 to 2012), Australia (2007 to 2012), New Zealand (1989 to 2012), Malaysia (2002 to 2008) and the UK (2001 to 2005, 1991 to 1994 and 2009 to 2012) fall into this

category. However, all of these countries essentially target inflation. Therefore, these periods are categorised as *de facto* inflation targeting regimes. Some episodes of the US (2002 to 2012) and Switzerland (1992 to 2008) also coincide with both inflation targeting and monetary targeting countries. Based on the main underlying principle of price stability, those episodes have been classified as *de facto* inflation targeting regimes.

3.5: Monetary policy regimes, Growth and Inflation

There are debates over the linkage between monetary policy regimes and growth, as the direction of the link is not definitive. Monetary policy regimes have a direct impact on growth through the effects of the adjustment to shocks and indirectly via facilitating important determinants of growth such as investment, international trade, and financial sector development (Bailliu *et al.* 2003). A limited number of studies investigated the relationship between exchange rate regimes and growth (for example, Levy Yeyati and Sturzenegger, 2001; Bailliu *et al.*, 2003; Bohm and Funke, 2001; Dubas and Zhu, 2001). Nominal variables are typically considered to be unrelated to longer term growth performances (Levy Yeyati and Sturzenegger, 2001).[55] Therefore, evaluating this relationship is largely an empirical matter.

However, the findings of empirical studies are often quite diverse. While one group of studies finds that pegged exchange rate regimes stimulate growth, another suggests otherwise. A third group of studies suggests no effect or inconclusive findings. Bailliu *et al.* (2003) find that regimes with nominal anchors enhance growth. On the contrary, there is more or less a consensus that pegged exchange rate regimes work as an anti-inflationary device, if accompanied with the appropriate fiscal policy. The sections below describe the impact of monetary policy regimes on growth and inflation.

3.5.1: Monetary policy regimes and growth

We have followed the general framework of the cross country growth model of Barro and Sala-i-Martin (1995). The growth model represents a combination of neoclassical

[55] Regarding the exchange rate policy, nominal exchange rates are not able to keep the unemployment rate away from the natural rate in the long run. Hence, attempting to over-stimulate the economy by pursing an expansionary monetary policy or by devaluing the currency will result in a higher rate of inflation without any increase in real economic growth (Barro and Gordon, 1983).

and endogenous growth models.[56] The empirical framework relates the real per capita growth rate to two categories: initial state and policy variables and national characteristics. Initial state level variables represent the stock of physical and human capital in the form of educational attainment and health. The second group consists of policy variables and national characteristics, which depend on policy makers as well as on private agents. A detailed description is presented in the sections below.

3.5.1.1 The general framework for growth

The contemporary basic empirical growth literature is based on a general framework, which specifies that a country's growth at time *t* is a function of both state variables *(SV)* and control variables *(CV)* (Barro and Sala-i-Martin, 1995). Equation (3.1) represents a general specification consistent with both neoclassical and endogenous growth model.

$$GRt = F(SV_t; CV_t) \qquad (3.1)$$

In a neo classical framework, state variables represent the initial position of the economy and control variables represent the differences in the steady state level across different countries. The environmental or control variables determine the steady state level of output per effective worker. For some given values of state variables, growth rates can be affected by a change in the savings rate, government policy instruments or the growth rate of the population. A richer economy with a higher level of per capita GDP and human capital tends to grow at a slower rate due to the diminishing returns of reproducible factors. A change in control or environmental variables affects the steady state growth rates in terms of the rate of exogenous technological progress. In contrast, the endogenous growth model implies that an economy is always assumed to be in the steady state; the explanatory variables represent cross country differences in steady state growth rates.[57] Variables that affect R&D intensity also influence the long-term growth rates.

[57]Romer (1990), Barro and Sala-i-Martin (1995, Chs.6 and 7).

Utilising the growth model in equation (3.1) for our empirical analysis is appealing, given that it provides the theoretical basis and is also broad enough to incorporate both types of growth models (Bailliu *et al.*, 2003). This specification does not require assumptions on whether or not a country is in its steady state. Typically, lagged real GDP per capita and a proxy for human capital are used as state variables. However, the theory is not well-defined as to which control variables are most important in the growth process. Nevertheless, Barro and Sala-i-Martin (1995) pointed out that these variables would typically include preferences for savings and fertility, government policies with respect to spending, market distortions and so on.

3.5.1.2 Direct effects of monetary policy regimes on growth

The literature on the impacts of different exchange rate regimes emphasized how an economy's adjustment process following a shock can be different for different types of regimes. It has been widely argued that flexible exchange rate arrangements may foster higher growth, due to their ability to absorb and adapt to economic shocks more easily. Friedman (1953) argues that when economies are hit by real shocks, countries that are flexible and can change relative prices will be able to adjust more smoothly. Broda (2004) tries to verify how the response to negative terms of trade shocks differs substantially across different exchange rate regimes for 75 developing countries over the period 1973 to 1996. Findings from their panel VAR suggests that real GDP responses to real shocks are significantly smoother in floating, compared to pegged, regimes over the short-run. In response to a negative terms of trade shock, the slow and small real depreciation observed in pegged regime is due to the fall in domestic prices. On the other hand, the large and immediate real depreciation in floats reflects a large nominal depreciation in exchange rates.

Levy Yeyati and Sturzenegger (2003) find that the inability of rigid regimes to absorb such shocks results in lower growth. Similarly, Calvo (1999) argues that the need to maintain the peg in the aftermath of a negative term of trade shock may result in high interest rates, stifling the growth process. Rogoff (1999) argues that nominal and real exchange rate variability might be detrimental to growth for developing countries. However, the finding of Husain *et al.* (2005) suggests that the performance of alternative regimes depends on the economic maturity of the countries. For developing countries, fixed or quasi-fixed exchange rate regimes deliver lower inflation

and higher growth, while for developed countries, flexible regimes may be associated with somewhat lower inflation and higher growth.

The long run impact of monetary policy regimes: In the long run, monetary policy has limited capacity to affect any macroeconomic variable. Baxter and Stockman (1989) find that transitions to floating exchange rate regimes leads to a sharp increase in nominal and real exchange rate variability, without any corresponding change in the distribution of fundamental macroeconomic variables. Monetary policy also cannot permanently dictate real interest rates in the long run. For New Zealand, Smith (2004) tries to study how interest rates and inflation affects economic growth.[58] Her finding indicates that keeping inflation low and stable is the most effective contribution that monetary policy can make to real economic performance over the long run. Microeconomic policies that facilitate research and development, acquisition of human capital, transmission of information and incentives for labour force participation are more likely to have substantial impacts on economic growth than monetary policy itself.[59] Kahn *et al.* (2002), using a VAR model, find that the impact of a rise in the Bank of Israel's overnight rate on the long term real interest rate is much smaller than the impact on short term real interest rates.

3.5.1.3 Other control variables for growth

Investment: Empirical evidence on the relationship between exchange rate regimes and growth is mixed (Goldberg, 1993; Huizinga, 1994; Bordo and Schwartz, 1999; and Lafrance and Tessier, 2001). Exchange rate regimes can have an impact on economic growth through effects on the rate of physical capital accumulation. Many have argued that investment tends to be higher in a fixed exchange rate regime due to the reduction in policy uncertainty, real interest rates and variability in exchange rates. On the contrary, by eliminating an important adjustment mechanism, fixed exchange rates can exacerbate protectionist pressures and reduce the efficiency of the stock of capital, therefore causing misalignments and distortions in the efficient allocation of

[58] Reserve Bank of New Zealand Bulletin, Vol. 67, No.3

[59] Theoretical models like Romer (1990), Grossman and Helpman (1991) and Aghion and Howitt (1992) illustrate the role of microeconomic policies, such as R&D, on growth. The survey by Griliches (1992) reported a wide range of estimations of the social return of R&D, with values clustering around the range of 20 to 60%, which makes R&D a major source of growth. Therefore, both empirical and theoretical evidence on the benefits of this kind of policy is overwhelming.

investment. However, Bohm and Funke (2001) argue that exchange rate uncertainty plays a very modest role in determining investment spending.

Openness and international trade: Endogenous growth literature predicts a positive relationship between openness, international trade and economic growth. A country more open to international trade is likely to grow faster, as it has greater ability to absorb technological spillovers and has access to larger market (Edwards, 1998; Barro and Sala-i-Martin, 1995). There are also positive spillovers in the non-tradable sector. Frankel and Romer (1999), using the instrumental variable method and geographic components of trade, find that a rise of one percentage point in the ratio of trade to GDP increases per capita income by one and a half percentage points. International trade appears to increase per capita income by spurring the accumulation of physical and human capital and increasing output for a given level of capital.

Capital formation: Bailliu (2000) emphasises that international capital flows can promote growth by increasing domestic financial intermediation. Dooley (1994) argues that a fixed or quasi fixed exchange rate regime, combined with regulatory distortions and prudential oversight, can increase speculative capital flows. This was the case with capital flows in emerging economies over the 1990s. Capital flows are also less likely to enhance growth if allocated into unproductive investments. Krugman (1998) and Corsetti *et al.* (1998) demonstrate that capital is channeled into unproductive investments when foreign creditors believe that they will be bailed out by the government for lending to local banks. Poorly regulated banks have higher incentives to invest in risky projects when they believe that their liabilities are implicitly guaranteed by the government.

Development of financial markets: Long run sustainable growth is related to the ability to raise the rates of accumulation of physical and human capital, to utilise the resulting assets more efficiently and to ensure accessibility to these assets (FitzGerald, 2006). Financial development and economic growth are very much related and there is an ongoing debate over this issue. The pioneering studies by King and Levine (1993a), Levine and Zervos (1998), Levine (2000) and Beck *et al.* (2000) find that three indicators of financial sector development best describe the differences in economic growth across countries over long run. These are: bank credit to the private sector, stock market activity (proxied by the turnover rate or the ratio of traded value to GDP) and legal system features such as the extent of shareholder and creditor protection.

They find a significant positive relationship between these indicators and growth. On the other hand, De Gregorio & Guidotti (1995) find a negative correlation between growth and higher bank credit to GDP ratios in Latin America over the 1970s and 1980s. They suggest that inadequate regulation and deposit insurance policies resulted in an unwarranted over-expansion in credit and subsequently led to the banking crises. According to FitzGerald (2006), despite the considerable benefits of financial development to economic growth, the benefits cannot be taken for granted. They depend on the construction of the appropriate institutional structure.

3.5.1.4 Methodology for growth

Studies like Bailliu *et al.* (2001, 2003) and others used Generalised Method of Moments (GMM) to estimate the impacts of exchange rate regimes on growth. However, GMM has some drawbacks. The asymptotic properties of a large number of cross sectional (*N*) and time series observations (*T*) for dynamic panels are different. Small T panel estimation relies on fixed or random effects estimators, or a combination of fixed effects (FE) or instrumental variable estimators like Arellano and Bond (1991) GMM estimations. One of the drawbacks of these estimators is that they only allow the intercept to vary, by assuming the homogeneity of the slope coefficients. One of the central findings for large *N* and *T* panel data is that the assumption of homogeneity in slope coefficients is not always appropriate.[60]

There are several estimation procedures for large *N* and *T*. For example, FE estimation allows time series data for each group to pool and allows only intercepts to differ across groups. Therefore, FE estimation would be misleading if the slope coefficients are not identical. On the other hand, the model could be fitted separately for each group and a simple arithmetic average of the coefficients could be calculated. Pesaran, Shin and Smith (1997, 1999) have proposed the Pooled Mean Group (PMG) estimation that combines both pooling and averaging.

The PMG estimator allows the intercept, short run coefficients and error variances to differ across groups, but constraints long run coefficients to be equal across the groups. There are some other advantages of the PMG estimation procedure.

[60] This has been pointed out by Pesaran and Smith (1995); Im, Pesaran, and Shin (2003); Pesaran *et al.* (1997, 1999); and Phillips and Moon (2000).

It is an intermediate estimator. The null hypothesis of long run homogeneity is usually compared with the Mean Group (MG) estimation using a Hausman (1978) test.[61]

3.5.1.5 The PMG specification for Growth model

Equation (3.2) is the error correction equation, and provides the PMG specification for growth

$$\begin{aligned}\Delta \ln gpc_{it} = \emptyset_i\,[lngpc_{it-1} - \alpha_0 - \alpha_1 lngcf_{it} - \alpha_2\, lnbc_{\ it} - \alpha_3 lnse_{it} - \alpha_4\, lntrade_{it}] \\ +\ \delta_{1i}\Delta lngcf_{it} + \delta_{2i}\Delta lnbc_{it} + \delta_{3i}\Delta lnse_{it}\ + \delta_{4i}\Delta lnopn_{it} \\ + D_{it}\ Monetary\ Regimes\ Dummy \\ + \varepsilon_{it} \qquad (3.2)\end{aligned}$$

Here, i is the country and t is time. The Dependent variable, Δgpc_{it}, is growth in real GDP per capita, gcf_{it} is gross capital formation as a percentage of GDP (used to measure domestic investment), bc_{it} is the percentage of credit provided by the banking sector (used as a proxy of domestic financial sectors), $trade_{it}$is trade as a percentage of GDP, se_{it} is the percentage of secondary education enrolment (proxy for human capital) and gpc_{it-1} is the lag of the per capita GDP (typically used for initial GDP). A pegged regime is the reference category for the monetary policy regimes dummies.

3.5.2 Inflation

Studies by Ghosh *et al*. (1997, 2002) suggest that pegged exchange rate regimes, by enhancing credibility and discipline in monetary policy, reduce inflation. However, they find that the relationship between pegged regimes and inflation is relevant for countries in a lower income group. Reinhart and Rogoff (2004) find that inflation in developed countries has declined with greater exchange rate flexibility but the experience of developing countries is exactly the opposite. The subsequent findings by Edwards (2001), Ghosh *et al.* (2000) and Bleany and Francisco (2005) suggest that a strong commitment to the pegged regime will reduce average inflation. For inflation targeting countries, Vega and Winkelried (2005), Mishkin and Schmidt-Hebbel (2001, 2007) and many others suggested that inflation has declined in many countries after the

[61] Proposed by Pesaran, Smith and Shin (1995), MG is a heterogeneous panel estimator. The intercepts, slope coefficients and error variances are allowed to differ across groups with this estimator.

adoption of an inflation targeting regime. Apart from monetary policy regime, inflation is likely to be dependent on the following variables.

GDP growth rates: Higher GDP growth can contribute to higher inflation by raising the demand pressure in the economy.

Openness: Trade openness is defined as $\frac{(X+M)}{Y}$, which is the ratio of exports and imports to GDP. The variable is included to proxy a variety of effects, especially to capture the disciplinary effect imposed by higher costs of monetary expansion in open economies and the strength of international arbitrage (Romer, 1993; Lane, 1997).

Terms of trade growth: Exchange rate response to terms of trade is crucial for inflation. Gruen and Dwyer (1996) tried to find the impact of terms of trade on the domestic inflation rate in a small open economy framework. Their study suggested that the effects of terms of trade depend on the share of importable goods and services in consumption. With a reasonable share of importable goods and pass through, they find that if the movement of the real exchange rate is about half of the terms of trade, a rise in terms of trade will have almost no impact on inflation.[62] However, if the real exchange rate moves almost one for one with the terms of trade, a rise in terms of trade puts downward pressure on inflation, at least in the short run.[63]

3.5.2.1 Econometric specification

Similar to the growth estimation, we have applied PMG methodology for estimating the impact of monetary regime and other control variables on inflation. We have compared the results with MG. Hausman (1978) test is used to check heterogeneity in the long run slope coefficients. Equation (3.3) provides the specification:

$$\Delta inf_{it} = \emptyset_i [inf_{it-1} - \alpha_0 - \alpha_1 lnopn_{it} - \alpha_2 lntot_{it} - \alpha_3 lngdp_{it}] - \delta_{1i} lnopn_{it} + \delta_{2i} lntot_{it} + \delta_{3i} lngdp_{it} + D_{it} Monetary\ Regimes\ Dummy + \varepsilon_{it} \quad (3.3)$$

[62] As estimated by Gruen and Wilkinson 1991.

[63] Blundell-Wignall *et al*. (1993).

Here, inf is the rate of inflation, opn is openness, tot is term of trade and gdp is growth rate of per capita GDP.[64] A hard pegged regime serves as the reference category for the regime dummies.

3.6 The impact of monetary policy regime on growth and inflation

This section explains the findings from the analysis of the impact of monetary policy regime on growth and inflation. For analytical purposes, countries are divided between industrialised and non-industrialised countries. We have 34 industrialised countries in our sample of 123 countries.[65] To keep the comparison even, we have used 34 non-industrialised countries for the analysis. Monetary policy regimes have different transmission processes in different economies, therefore dividing the countries between the two groups will allow us to get a more appropriate outcome. Data availability is also another issue here. A wide range of data were simply not available for many of the countries in our sample. We begin our analysis by discussing some basic summary statistics. The next parts focus on the findings from the PMG estimation.

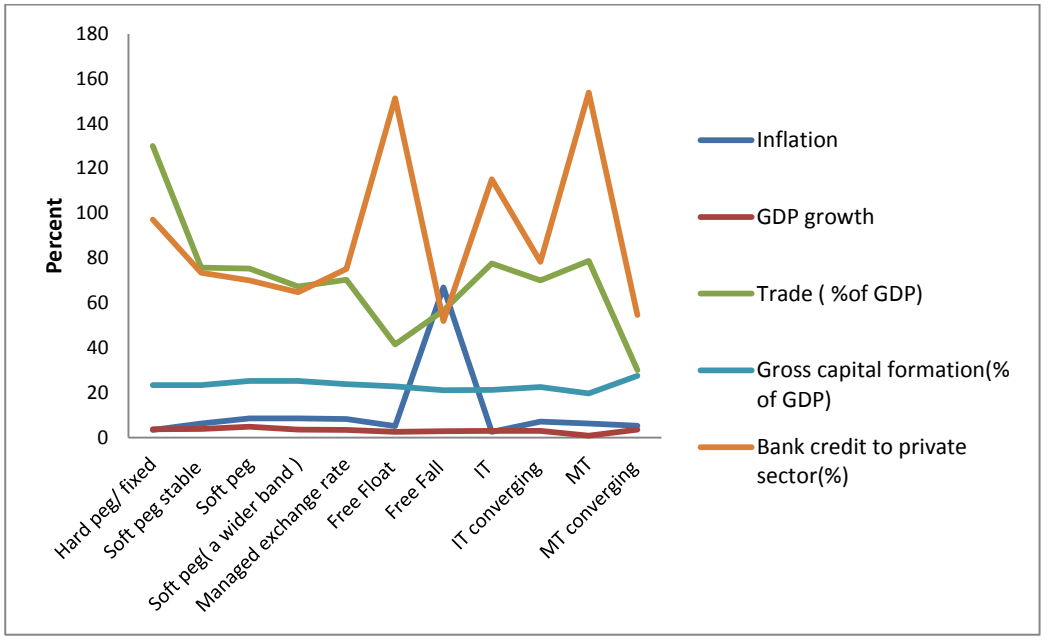
3.6.1 Basic Summary statistics for industrialised and non-industrialised countries

Figure 3.3 (table A3.3 in appendix 3.1) displays basic summary statistics for the 34 industrialised countries. IT regimes have the lowest inflation rate (2.59%), followed by fixed exchange rate regimes (3.48%). However, average growth is the highest in pegged and soft pegged regimes (3.88% and 4.88% respectively). Trade is the highest in hard pegged regimes (130%), followed by monetary targeting regimes. Gross investment (measured by gross capital formation as % of GDP) is highest for the monetary targeting converging periods (27.55%). Domestic banking credit to the private sector is highest for the free float and monetary targeting regimes (151% and 158%) followed by inflation targeting regimes (115%).

[64] Openness has been calculated by the share of export and import as a percentage of GDP, terms of trade has been calculated by the ratio of dollar value of exports and imports.

[65] Representing mainly OECD except Saudi Arabia and Hong Kong.

Figure: 3.3 Mean of the variables for industrialised countries

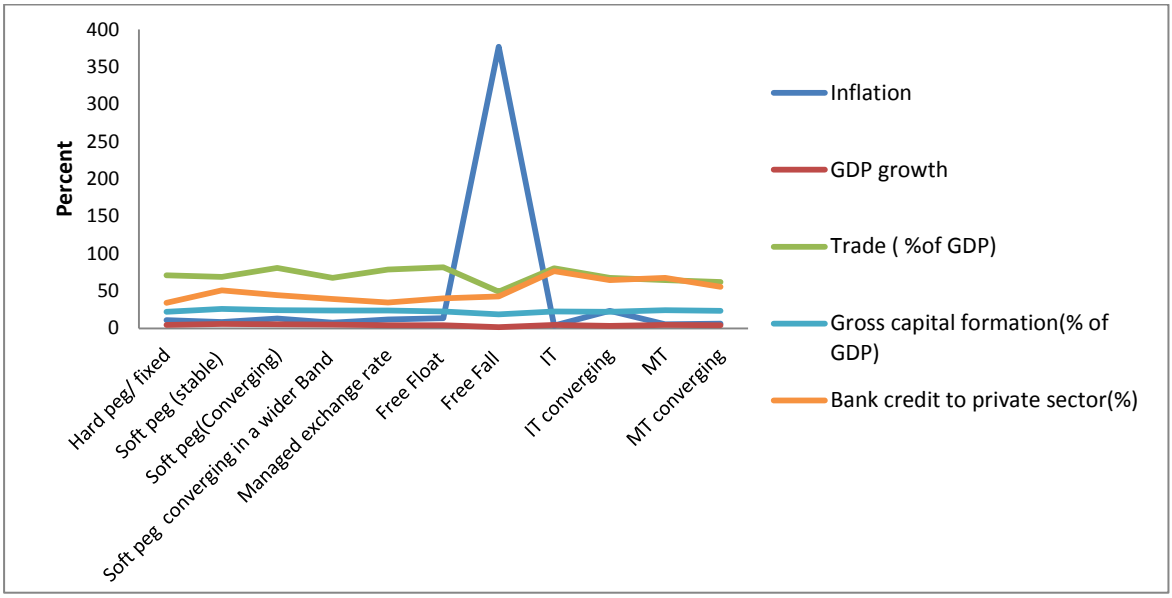


Note: Horizontal axis represents percentage and the vertical axis represents the monetary policy regimes.

Basic Summary statistics for non-industrialised countries

Figure 3.4 (and table A3.4 in appendix 3.1) provides the basic summary statistics for non-industrialised countries. For this group, inflation is also the lowest in IT (3.77%) regimes followed by monetary targeting (5.37%) regimes. Among the exchange rate regimes, intermediate regimes like soft peg (converging) has a mean inflation rate much lower than the pegged regime (7.84% and 11.19% respectively). Unlike the industrialised countries, trade as a percentage of GDP is highest in free float (81.66%) followed by IT and soft peg converging (80% and 81% respectively). Average gross capital formation as a percentage of GDP is highest during the stable soft pegged regime (25.98%). Domestic banking sector credit is the highest in regimes with IT and MT (76.81% and 67.69% respectively).

Figure: 3.4 Mean of the variables for non-industrialised countries



Note: Horizontal axis represents percentage and the vertical axis represents the monetary policy regimes.

In summary, the simple mean analysis suggests that both for industrialised and non-industrialised countries, average inflation is lowest in IT regimes. However, among the exchange rate regimes, average inflation for industrialised countries is the lowest for hard pegged regimes but for non-industrialised countries, average inflation is lowest under the soft pegged regimes. For growth, the performance of IT is not very impressive compared to the other regimes. Average GDP growth is highest for the soft pegged regimes for both groups.

3.6.2. Findings from pooled mean group estimation

3.6.2.1: Growth

Table 3.7 presents the findings from pooled mean group estimation of growth in industrialised countries. Results obtained from the mean group estimation have been presented alongside. The Hausman test has been performed to check heterogeneity in the long run coefficients. The test could not reject the null of no systematic difference for the long run coefficients. The long run coefficient of convergence is negative and significant at 1 % level.

Table 3.7 Growth and monetary policy regimes for Industrialised countries

Dependent variable: Growth in per capita GDP	Pooled mean group	Hausman test	Mean Group
Convergence coefficient: lY_{t-1}	-0.054***	0.66 (0.955)	-0.1593*
Long run coefficients			
$lgcf$	0.837***		6.214
lbc	0.004		-0.074
lse	0.704***		4.677
$ltrade$	0.1521**		5.547
Short run coefficients			
$\Delta lgcf$	0.0144***		0.100***
Δlbc	0.0021		-0.0555
Δlse	-0.0501		-0.9043
$\Delta ltrade$	0.0159*		0.3937
R_2	0.0131		0.0142
R_3	-0.0013		0.0046
R_4	-0.0033		-0.0052
R_5	-0.0071**		-0.0124
R_6	-0.0046**		-0.0051
R_7	0.0012		0.0005
R_8	-0.0012		-0.0005
R_9	-0.0051		-0.0086
R_{10}	-0.0077*		-0.0002
R_{11}	0.0002		-0.000
$Constant$	0.274***		3.954*
No of countries	34		34
No of observations	1080		1080
$Log\ Likelihood$	3282.431		3015.03

Note: ***1% significant level, **5% level significant, *10% significant level.

PMG estimation of growth for industrialised countries suggests that, except for domestic credit to the private sector (set as a proxy to measure the development of financial sectors), all the variables show a significant positive impact on long term growth. However, only investment (represented by gross capital formation as % of GDP) and trade are found to be significant for growth in the short run. The finding indicates that the growth rate is higher during soft pegged regimes (horizontal band ≤ 2.25%), compared to the base category of hard pegged regimes. The growth rate in inflation targeting (R_8), monetary targeting (R_{10}), managed float (R_5) and free float (R_6) is lower compared to the base category of hard pegged regimes (R_1).

Table 3.8 represents the results from the PMG estimation of growth for non-industrialised countries. Estimation of MG has been presented alongside. Homogeneity of the long run slope coefficients could not be rejected by the Hausman test. All the coefficients are significant in the long run. However, in the short run, only gross capital formation (% of GDP) affects growth. Among the regime dummies, IT dummy (R_8) and Stable soft peg regimes (R_2) facilitate higher growth in non-industrialised countries.

Table 3.8 Growth and monetary policy regimes for non- industrialised countries

Dependent. variable: Growth in per capita GDP	Pooled mean group	Hausman test	Mean Group
Convergence coefficient: lY_{t-1}	-0.1507***	2.92 (0.57)	-0.4962***
Long run coefficients			
$lgcf$	0.4289***		0.7324
lbc	0.1776***		0.0527
lse	0.3182***		1.1642**
$ltrade$	0.01291***		-0.0471
Short run coefficients			
$\Delta lgcf$	0.0428**		-0.0007
Δlbc	-0.0303		0.0594**
Δlse	-0.0028		-0.0029
$\Delta ltrade$	-0.0010		-0.0015**
R_2	0.0144***		-0.005
R_3	-0.002		-0.0123
R_4	-0.105*		0.0265
R_5	-0.005		-0.0221
R_6	0.003		0.0267
R_7	-0.0112**		-0.0101**
R_8	0.0118*		0.0049*
R_9	0.0046		-0.0010
R_{10}	-0.0042		0.0310
R_{11}	-0.0063		0.0154
$Constant$	1.074***		4.528***
No of countries	34		34
No of observations	980		980
Log Likelihood	2085.65		2054.42

Note: ***1%significant level, **5% level significant, *10% significant level.

The next step is to see if there is any specific role for nominal anchors in growth over the short run. Table 3.9 reports the findings after rearranging the regime dummies according to the monetary policy anchors. Thus, regimes with hard pegged and stable soft pegged (where the movement of the exchange rate is within ± 2.25%) and inflation and monetary targeting regimes have been categorised as a single dummy. The base category represents the various intermediate exchange rate regimes without any form of specific nominal anchor. For both industrialised and non-industrialised groups, growth performance is better for the regimes with some sort of nominal anchor.

Table 3.9 Growth and monetary policy regimes with and without anchor

	Industrialised	Non Industrialised
Dependent. variable: Growth in per capita GDP	Pooled mean group	Pooled mean group
Convergence coefficient lY_{t-1}	-0.0388***	-0.1879***
Long run coefficients		
$lgcf$	0.868***	0.422***
lbc	-0.295***	0.004
lse	0.541***	0.153***
$ltrade$	0.4067***	0.493***
Short run coefficients		
$\Delta lgcf$	0.1559***	0.024
Δlbc	0.0012	-0.0664**
Δlse	0.0097	-0.018
$\Delta ltrade$	0.0082	-0.059*
$Regime_{anchor}$	0.0043**	0.018*
$Constant$	0.2464***	1.377***
No of countries	34	34
No of observations	1080	980
Log Likelihood	3100.111	2000.366

Note: ***1%significant level, **5% level significant, *10% significant level.

Thus, our result supports the evidence presented by Bailliu *et al.* (2003), that monetary policy with an anchor exerts a positive influence on growth, irrespective of the economic status of a country.

3.6.2.2 Inflation

Tables 3.10 through 3.12 present the PMG estimation of inflation for industrialised and non-industrialised countries. The result from MG estimation has been presented alongside. Results varied significantly with MG estimation. However, the Hausman test could not reject the null hypothesis that there is no systematic difference in the long run slope coefficient at the 1% level in both cases.

For the industrialised countries, all the long run slope coefficients are significant at 1% level. The long run convergence coefficient is negative and highly significant; indicating that almost 70% of the disequilibrium in the short run is corrected in the long run. The year dummy is significant and negative, showing a negative trend in inflation over the long run. Both openness and GDP growth have a positive relationship in the short run and the long run. However, terms of trade growth has a negative relationship in the long run, suggesting that the improvement in the terms of trade contributes significantly to the reduction of inflation in these countries.

Typically, inflation is lower in an open economy, because a deterioration in the terms of trade increases the cost of expansionary monetary policy. Romer (1993) and Lane (1997) show that it is the inability of the government to commit to a more discretionary policy that is crucial for determining the inflation rates. However, the findings of the current study are in contradiction with the findings of Romer (1993) and Lane (1997). Cooke (2010), in a two country dynamic general equilibrium framework, showed that the relationship between openness and inflation can also depend on the underlying structure of the economy. When the terms of trade are favourable for the domestic economy, a one unit gain in output will lead to a relatively large change in consumption and the government might have the incentive to create a large surprise change in money supply. As the economy becomes more open, it gets more exposed to the movements of the terms of trade, therefore inflation rises.

Regarding, the regime dummies, inflation is lower in inflation targeting and monetary targeting regimes for the industrialised countries. However, there is no significant relationship with the exchange rate dummies.

Table 3.10: For industrialised countries

Dependent variable: Inflation	Pooled mean group	Hausman Test	Mean Group
Convergence coefficient ec_{t-1}	-0.697***		-0.990***
Long run coefficients		4.920	
$lopnness$	0.292***	(0.178)	0.465**
$ltot$	-0.186***		-0.380
$lgdpgrowth$	0.076***		0.197
$year$	-0.0139***		-0.026
Short run coefficients			
$\Delta lopeness$	0.467**		0.523
$\Delta ltot$	0.567**		1.118*
$\Delta lgdpgrowth$	0.284**		0.179*
R_2	0.032		0.229
R_3	-0.257		0.019
R_4	0.0391		0.103
R_5	0.222		0.103
R_6	0.019		0.098
R_7	0.001		0.006
R_8	-0.043*		-0.062
R_9	0.013		0.017
R_{10}	-0.216*		-0.296
R_{11}	-0.004		0.001
$Constant$	17.52***		77.86***
No of countries	34		
No of observations	1080		
Log Likelihood	843.30		

Note: ***1%significant level, **5% level significant, *10% significant level

Table 3.11 shows the results for the non-industrialised countries. The long run convergence coefficient is negative and significant. There is a negative significant trend for inflation in the non-industrialised countries. Openness is positively related to GDP growth in both the short and long run. The relationship between terms of trade and growth is negative but not statistically significant.

Table 3.11 for non-industrialised countries

Dependent variable: Inflation	Pooled mean group	Hausman Test	Mean Group
Convergence coefficient ec_{t-1}	-0.924***		-1.044***
Long run coefficients		1.91	
		(0.75)	
$lopness$	0.1922***		-1.289
$ltot$	-0.004		0.076
$lgdpgrowth$	0.0129***		-0.623
$year$	-0.0019***		-0.015
Short run coefficients			
$\Delta lopeness$	0.0632		0.904
$\Delta ltot$	-0.120		-0.222
$\Delta lgdpgrowth$	0.0642		0.632
R_2	0.079*		0.376
R_3	-0.037		-0.059
R_4	0.013		0.023*
R_5	0.002		-0.299
R_6	0.084		0.074
R_7	0.200		0.169*
R_8	-0.001		-0.009
R_9	0.007		0.001
R_{10}	-0.056		-0.188
R_{11}	-0.032		-0.451
$Constant$	4.096***		79.75***
No of countries	34		
No of observations	980		
Log Likelihood	355.668		350.98

Note: ***1%significant level, **5% level significant, *10% significant level

These countries have typically higher exchange rate pass through from imports to consumer prices and they have a larger share of imported goods in consumer baskets. This might be one of the primary reasons for positive relationship with openness and negative but insignificant relationship between terms of trade and inflation. Inflation targeting, monetary targeting and soft peg regimes have lower inflation, but the negative relationship is not statistically significant.

Table 3.12 presents the findings from industrialised and non-industrialised countries with and without an anchor. The base categories represent the regimes with anchors. Both groups share a negative long run trend in inflation. The long run convergence coefficients are highly significant. For the industrialised countries, both GDP growth and terms of trade have a significant long term negative impact on inflation.

Table: 3.12 Industrialised and Non-Industrialised countries with Anchor

Dependent variable: Inflation	Industrialised Countries	Non-Industrialised Countries
	Pooled mean group	Pooled mean group
Convergence coefficient ec_{t-1}	-0.664***	-0.900***
Long run coefficients		
$lopnness$	0.139***	0.007
$ltot$	-0.077***	-0.004
$lgdpgrowth$	-0.0034	0.006***
$year$	-0.0082***	-0.002***
Short run coefficients		
$\Delta lopeness$	0.434**	0.122
$\Delta ltot$	0.445*	0.030
$\Delta lgdpgrowth$	0.362**	0.195*
$Regime_{noanchor}$	0.010	0.0395
$Constant$	10.88***	4.189***
No of countries	34	34
No of observations	1080	980
Log Likelihood	755.61	307.327

Note: ***1%significant level, **5% level significant, *10% significant level

However, in the short run they are positively related to inflation. In the non-industrialised countries, GDP growth has a significant positive relationship with inflation in both the long and short run. For both groups, inflation is higher compared to the base categories of monetary policy regimes with anchors.

3.7: Conclusion

In this study, we have provided an alternative *de facto* classification of monetary policy regimes, and assessed the impact of these regimes on growth and inflation for 124 countries over the period 1970 to 2013. The literature on the *de facto* classification of exchange rate regimes is quite substantial. However, such an effort in classifying *de facto* monetary policy regimes is lacking. Many of the studies on regime classification attempt to evaluate the impact of these regimes on inflation and a relatively lower number of studies try to assess the impact on growth. However, performances of regimes based only on the *de facto* exchange rate classifications would be misleading, as the regimes could have different underlying monetary policy frameworks.

Firstly, we classify monetary policy regimes based on some set criteria. Our *de facto* classification of monetary policy regimes classified eleven categories, including seven exchange rate regimes and four inflation and monetary targeting regimes. The yearly classification of exchange rate regime has been conducted using monthly data and on the basis of volatilities of exchange rates and their changes and relative volatility of changes in exchange rates and reserves. Inflation targeting and monetary targeting regimes have been classified on the basis of policy rates, changes in inflation and monetary growth of both broad and narrow money. 10% of the regimes are classified as *de facto* inflation and monetary targeting regimes, which according to the previous *de facto* classification studies, would have been classified as an exchange rate regime. We have also identified some periods as converging inflation and monetary targeting regimes. A regime that falls into both monetary and inflation targeting categories has been classified as inflation targeting regime, according to the classification criteria, as in most of the cases inflation control is the main goal variable.

Secondly, we try to evaluate the growth and inflation performances of the regimes, based on our *de facto* classification. The evaluation of performance has been conducted on 34 industrialised and 34 non-industrialised countries from 1970 to 2013. Monetary transmission varies between the developed and developing countries, therefore, dividing the countries into these two groups would give us a more accurate outcome. Pooled mean group estimation has been used as a method to evaluate the performance of the regimes. Even though GMM estimation has widely been used in the literature (for example, Bailliu *et al.*, 2003; Ghosh *et al.*, 2002), this method has some drawbacks. GMM is based on the assumption of homogeneity across groups and allows

only intercepts to differ, therefore will not be consistent for the heterogeneous dynamic panel with large T and N. PMG estimation combines both pooling and averaging. The short run coefficients are allowed to vary across groups but homogeneity of the long run coefficients is assumed. Our findings from PMG estimation do not indicate overwhelming benefits of flexible exchange rate regimes in industrialised countries. IT and MT regimes are associated with lower inflation, whilst a pegged regime is associated with the highest growth. We find that flexible regimes are beneficial at providing platforms to conduct independent monetary policy.

For the non-industrialised countries, IT regimes perform well in reducing inflation and enhancing growth. A monetary policy with nominal anchors has positive consequences for growth and inflation in the short run for both groups of countries.

Appendix 3.1

Table: A3.1 Inflation targeting countries

Country	Effective IT adoption	Converging target period	Inflation target period	Inflation targeting level for 2012
New Zealand	1990Q1	1986-1990	1991-2010	1-3%
Canada	1991M2	1990-1994	1995-2012	1-3%
UK	1992M10	1992-1996	1997-2012	2%
Sweden	1993M1	1992-1995	1996-2012	2
Finland	1993M2	1990-1992	1993-1998	2-3%
Australia	1993M4	1990-1991	1992-2012	2-3%
Spain	1995M1	1991-1996	1997-1998	1-3%
Czech Republic	1997M12	1998-2003	2004-2012	2(+/-1)%
Israel	1997M6	1991-1998	1999-2012	1-3%
Poland	1998M10	1996-2002	2003-2012	2.5(+/-1)%
Brazil	1999M6	1995-2005	2006-2012	4.5(+/-2)%
Chile	1999M9	1993-2000	2001-2012	3(+/-1)%
Colombia	1999M9	1997-2004	2005-2012	2-4%
South Africa	2000M2	1995-1998	1999-2012	3-6%
Thailand	2000M5	2001-2004	2005-2012	3(+/-1.5)%
Korea	2001M1	1998-1999	2000-2012	3(+/-1)%
Mexico	2001M1	1991-2002	2003-2010	3(+/-1)%
Iceland	2001M3	2000-2003	2004-2010	2.50%
Norway	2001M3	1990-2000	2001-2012	2(+/-0.5)%
Hungary	2001M6	2000-2004	2005-2012	3(+/-1)%
Peru	2002M1	1988-2001	2002-2012	2(+/-1)%
Philippines	2002M1	1998-2001	2002-2012	4(+/-1)%
Guatemala	2005M1	2005-2008	2009-2012	4.5(+/-1)%
Slovakia	2005M1	2001-2006		
Indonesia	2005M7	2003-2006	2007-2012	4.5(+/-1)%
Romania	2005M8	2001-2005	2006-2012	3(+/-1)%
Turkey	2006M1	2003-2008	2009-2012	5(+/-2)%
Serbia	2006M9	2003-2006	2007-2010	4(+/-1.5)%
Ghana	2007M5	2001-2007	2008-2012	8.7(+/-2)%

Note: Inflation targeting level for 2012 has been adopted from Centre for Central Banking Studies, Hand Book No 29, Bank of England. Converging periods are calculated by the author, based on inflation and policy rates data and information from central banks website.

Table A3.2 Adoption of inflation targeting

Country	Inflation targeting adoption date	Inflation rate at the beginning	Inflation range at 2009	Target inflation rate in 2009	Inflation range at 2012	Inflation at 2012	Target horizon
New Zealand	1990	3.3	0.8	1 – 3	1%–3%	1.07%	Medium term
Canada	1991	6.9	0.3	2 +/– 1	2% (mid point of 1%–3%)	1.3%	Six-eight quarters; current target extends of 1%–3%) to December 2016
United Kingdom	1992	4.0	2.2	2 +/– 1	2%	2.7%	At all times
Sweden	1993	1.8	-0.3	2 +/– 1	2%	0.9%	Normally two years
Australia	1993	2.0	1.9	2 - 3	2-3%	2.2 %	Medium term
Czech Republic	1997	6.8	1.0	3 +/– 1	1-3%	3.3%	12-18 months
Israel	1997	8.1	3.3	2 +/– 1	1-3%	2.4%	Within two years
Poland	1998	10.6	3.8	2.5 +/– 1	2.5%	2.33%	Medium term
Brazil	1999	3.3	4.9	4.5 +/– 2	4.5% ±2	5.84%	Yearly target
Chile	1999	3.2	1.5	3 +/– 1	3% ±1	1.48%	Around two years
Colombia	2000	9.3	4.2	2 – 4	2%–4%		Medium term
South Africa	2000	2.6	7.1	3 – 6	3%–6%	5.71%	On a continuous basis
Thailand	2000	0.8	–0.9	0.5 – 3	3.0% ±1.5	3.0%	Eight quarters
Korea Rep	2001	2.9	2.8	3 +/– 1	3% ±1	2.2%	Three years
Mexico	2001	9.0	5.3	3 +/– 1	3% ±1	4.1%	Medium term
Iceland	2001	4.1	12.0	2.5 +/– 1.5	2.5%	5.2%	On average
Norway	2001	3.6	2.2	2.5 +/– 1	2.5%	0.7%	Medium term
Hungary	2001	10.8	4.2	3 +/– 1	3%	5.7%	Medium term
Peru	2002	–0.1	2.9	2 +/– 1	2% ±1	3.7%	At all times
Philippines	2002	4.5	1.6	4.5 +/– 1	4.0% ±1	3.2%	Medium term (from 2012–2014)
Guatemala	2005	9.2	1.8	5 +/– 1	4.5% ±1	3.8%	End of year
Indonesia	2005	7.4	4.6	4 – 6	4.5% ±1	4.3%	On average
Romania	2005	9.3	5.6	3.5 +/– 1	3% ±1	3.3%	Medium-term target from 2013
Turkey	2006	7.7	6.3	6.5 +/– 1	5.0% ±2	8.9%	Multi year (Three years)
Serbia	2006	10.8	7.8	4 – 8	4.0% ±1.5	7.3%	Medium term
Ghana	2007	10.5	19.3	14.5 +/– 1	8.7% ±2	9.3%	18-24 months
Armenia	2006	5.20	3.40	3+/-1	4% ±1.5	2.5%	Medium term

Table A3.3: Summary statistics of variables for industrialised countries

Regime	Inflation	GDP growth	Trade as a %of GDP	FDI	Gross capital formation% of GDP	% Banking Credit to Private Sector
Hard peg/ fixed	3.48 (3.48)	3.66 (3.17)	130.00 (109.24)	6.19 (26.35)	23.37 (4.88)	97.11 (54.55)
Soft peg stable	6.34 (5.35)	3.88 (7.01)	75.82 (25.00)	0.88 (1.66)	23.34 (6.46)	73.55 (34.07)
Soft peg converging	8.51 (5.99)	4.88 (6.19)	75.37 (37.30)	0.96 (1.27)	25.23 (5.78)	70.12 (32.99)
Soft peg converging in a wider band	8.62 (5.24)	3.60 (5.22)	67.37 (27.02)	0.862 (1.81)	25.19 (5.29)	64.74 (28.56)
Managed exchange rate (with no pre-specific bands)	8.28 (8.47)	3.37 (2.77)	70.36 (30.07)	1.73 (2.28)	23.88 (5.17)	75.24 (48.01)
Free Float	5.099 (4.61)	2.56 (2.65)	41.58 (30.85)	0.92 (1.13)	22.88 (4.81)	151.25 (89.83)
Free Fall	66.96 (62.47)	2.80 (3.96)	56.58 (29.14)	0.99 (1.73)	21.17 (3.39)	51.97 (43.04)
IT	2.59 (2.12)	2.97 (2.37)	77.69 (33.19)	4.40 (6.27)	21.24 (4.49)	115.22 (45.88)
IT converging	7.18 (6.32)	3.02 (2.99)	70.02 (32.05)	3.19 (3.27)	22.59 (3.90)	78.40 (39.75)
MT	6.29 (14.99)	0.91 (3.48)	78.71 (45.97)	4.27 (7.81)	19.75 (6.36)	153.88 (76.62)
MT converging	5.31 (3.84)	3.56 (1.88)	30.17 (2.67)	1.38 (0.13)	27.55 (1.37)	54.69 (11.77)

Note: mean of the variables, standard deviations in the parentheses

Table A3.4: Summary statistics of variables for non-industrialised countries

Regimes	Inflation	GDP growth	Openness	FDI	Gross capital formation% of GDP	% Banking Credit to Private Sector
Hard peg/ fixed	11.19 (22.01)	4.63 (6.49)	71.15 (44.43)	1.85 (4.74)	22.20 (9.27)	34.24 (31.85)
Soft peg stable	8.50 (11.87)	5.90 (6.84)	69.12 (38.13)	3.41 (8.64)	25.98 (11.93)	50.79 (36.93)
Soft peg converging	13.07 (24.29)	5.54 (5.68)	80.96 (40.91)	2.31 (3.49)	24.37 (8.07)	44.47 (29.48)
Soft peg converging in a wider band	7.84 (6.06)	5.03 (4.84)	67.73 (37.84)	4.27 (8.52)	23.84 (7.79)	39.47 (26.35)
Managed exchange rate (with no pre-specific bands)	11.86 (15.39)	4.29 (5.42)	78.96 (42.46)	4.59 (11.99)	23.93 (11.33)	34.84 (26.95)
Free Float	13.55 (19.77)	4.24 (4.64)	81.66 (41.00)	4.51 (8.59)	22.62 (6.95)	40.40 (55.26)
Free Fall	377.06 (1984.00)	1.74 (5.80)	49.39 (30.00)	1.53 (2.12)	18.95 (7.46)	42.82 (29.32)
IT	3.77 (2.79)	4.56 (2.62)	80.41 (50.28)	4.32 (7.92)	22.49 (4.73)	76.81 (52.62)
IT converging	23.33 (79.00)	3.57 (3.79)	67.77 (41.23)	4.44 (7.78)	22.39 (6.07)	64.48 (58.14)
MT	5.37 (4.68)	4.45 (3.68)	64.82 (35.01)	3.35 (5.39)	24.40 (9.66)	67.69 (62.69)
MT converging	6.24 (6.46)	4.03 (4.99)	62.11 (38.77)	2.48 (3.25)	23.61 (7.71)	55.48 (27.21)

Note: *mean of the variables, standard deviations in the parentheses

Appendix 3.2

Table A3. 5The Monetary Policy Regimes Classifications Code

Classification codes	
1	No separate legal tender
1	Pre announced peg or currency board arrangement
1	Pre announced horizontal band that is narrower than or equal to +/-1%
1	*De facto* peg with horizontal band +/-1%
2	Crawling band that is >1% but +/-2.5%
3	Crawling band that is greater than 2.5% but +/-3%
4	Crawling band that is greater than 3% but +/-5%
5	Managed Float
6	Freely Floating
7	Freely Falling
8	*De facto* Inflation targeting regime
9	*De facto* Inflation target -converging regime
10	*De facto* monetary targeting regime
11	*De facto* monetary target-converging regime

Table A3. 6 Monetary Policy Regimes

Year	Albania	Algeria	Angola	Argentina	Armenia	Australia	Austria	Bahrain	Bangladesh	Belgium
1970		1		7		1	2	1		1
1971		1		7		1	2	1		1
1972		2		1		1	2	1		1
1973		4		1		3	4	1		1
1974		4		1		4	4	1	1	1
1975		5		7		11	4	1	7	6
1976		2		7		11	2	1	7	4
1977		2		7		10	2	1	2	2
1978		3		7		10	4	1	4	2
1979		2		7		10	4	1	5	3
1980		5		7		2	4	1	5	2
1981		5		7		2	4	1	5	3
1982		5		7		4	4	1	5	2
1983		4		7		4	4	1	2	4
1984		4		7		4	4	1	4	5
1985		5		7		5	5	1	4	4
1986		4		7		5	5	1	2	2
1987		5		7		4	4	1	2	2
1988		5		7		5	4	1	3	2
1989		5		7		5	4	1	1	2
1990		5		7		9	4	1	1	9
1991	7	5		7		9	9	1	5	9
1992	7	5		1		8	9	1	5	9
1993	7	5		1		8	9	1	2	9
1994	7	9		1	7	8	9	1	1	9
1995	7	9		1	3	8	8	1	2	8
1996	7	9		1	3	8	8	1	4	8
1997	5	9		1	3	8	8	1	5	8
1998	5	9	6	1	4	8	8	1	4	8
1999	6	9	6	1	4	8	8	1	4	8
2000	6	9	6	1	4	8	8	1	1	8
2001	4	9	6	1	4	8	8	1	1	8
2002	6	9	6	6	4	8	8	1	1	8
2003	6	9	5	6	4	8	8	1	1	8
2004	11	8	5	6	5	8	8	1	3	8
2005	11	8	5	2	5	8	8	1	4	8
2006	11	2	1	2	6	8	8	1	4	8
2007	11	5	1	2	5	8	10	1	1	10
2008	10	5	1	5	4	5	10	1	1	10
2009	10	5	1	5	4	5	10	1	1	10
2010	10	4	1	5	4	5	10	1	2	10
2011	10	4	2	5	4	5	10	1	5	10
2012	10	5	1	5	4	4	10	1	5	10

Table A3. 6 Monetary Policy Regimes (continued)

Year	Benin	Bolivia	Botswana	Brazil	Brunei	Bulgaria	Burkina Faso	Burundi	Cameroon	Canada
1970		1		5	1	1	1	1	1	5
1971		1		5	4	1	1	1	1	2
1972		7		5	3	1	1	1	2	3
1973		7		5	5	1	1	1	5	1
1974		1		5	4	1	1	1	3	3
1975		1		5	4	1	1	1	3	4
1976		1		5	3		1	1	2	4
1977		1		5	2		1	1	1	5
1978		1	1	5	2		1	1	4	5
1979		7	4	5	2		1	1	3	3
1980		7	4	5	5		1	1	4	3
1981		7	6	7	5		1	1	4	2
1982		7	5	7	2		1	1	4	4
1983		7	6	7	2		1	7	3	1
1984		7	6	7	4		1	7	4	5
1985		7	6	7	5		1	5	4	3
1986		7	5	7	5		1	5	4	2
1987		5	5	7	4		1	5	4	2
1988		5	6	7	5		1	5	3	4
1989		5	6	7	4		1	5	4	3
1990		5	6	7	2		1	5	3	9
1991		5	6	7	5		1	5	4	9
1992		5	6	7	4	7	1	5	4	9
1993		4	6	7	4	7	1	5	4	9
1994		4	6	7	4	7	1	5	3	9
1995		4	6	9	4	7	1	5	4	8
1996		4	6	9	2	7	1	7	3	8
1997		4	6	9	5	7	1	7	4	8
1998		4	6	9	5	1	1	6	2	8
1999	5	4	6	9	3	1	1	6	2	5
2000	5	4	6	9	3	1	1	5	2	5
2001	5	4	6	9	4	1	1	5	2	8
2002	6	4	6	9	4	1	1	5	2	8
2003	6	2	6	9	4	1	1	3	2	8
2004	5	2	6	9	2	1	1	1	2	8
2005	5	1	6	9	4	1	1	5	2	8
2006	5	1	6	8	2	1	1	6	2	8
2007	5	1	6	8	2	1	1	5	2	8
2008	5	1	6	8	2	1	1	5	2	8
2009	5	1	6	8	2	1	1	1	2	8
2010	5	1	6	6	5	1	1	1	2	8
2011	5	1	6	6	4	1	1	5	2	8
2012	5	1	1	6	4	1	1	5	2	8

Table A3. 6 Monetary Policy Regimes (continued)

Year	Cape Verde	Central African Republic	Chile	China	Colombia	Croatia	Czech republic	Cyprus	Denmark	Dijabuti
1970	1	1	7		4			1	1	1
1971	4	2	1		4			1	1	1
1972	2	2	6		4			1	2	1
1973	5	2	6		4			4	5	1
1974	4	1	6		7			4	4	1
1975	5	1	6		7			5	3	1
1976	5	1	4		7			5	4	1
1977	5	1	4		4			5	5	1
1978	5	1	4		4			5	2	1
1979	5	1	4		4			5	5	1
1980	5	1	4		7			5	2	1
1981	5	1	1		7			6	3	1
1982	5	1	4	5	7			6	5	1
1983	5	1	4	2	7			6	2	1
1984	5	1	4	7	7			6	2	1
1985	2	1	4	7	7			6	2	1
1986	2	1	4	7	7			6	2	1
1987	2	1	4	7	7			6	3	1
1988	4	1	4	1	7			6	2	1
1989	3	1	4	1	7			5	1	1
1990	2	1	4	5	7			5	2	1
1991	5	1	4	1	7	7		5	2	1
1992	5	1	4	5	7	7		6	2	1
1993	5	1	9	2	7	7		6	5	1
1994	4	1	9	2	7	3		6	1	1
1995	2	1	9	2	7	4	2	9	1	1
1996	4	1	9	1	7	4	4	9	1	1
1997	4	1	9	1	9	4	6	9	1	1
1998	4	1	9	1	9	4	9	9	1	1
1999	5	6	9	1	9	4	9	9	1	1
2000	5	6	9	1	9	4	9	9	1	1
2001	4	6	8	1	9	2	9	9	1	1
2002	5	6	8	1	9	2	9	9	1	1
2003	5	5	8	1	9	2	9	9	1	1
2004	11	11	8	1	9	4	8	9	1	1
2005	11	11	8	2	8	4	8	8	1	1
2006	11	10	8	2	8	2	8	8	1	1
2007	10	10	5	2	8	2	6	4	1	1
2008	10	10	5	2	8	2	5	10	1	1
2009	10	10	5	1	8	2	8	10	1	1
2010	10	10	8	2	8	2	8	10	1	1
2011	10	4	8	2	8	2	4	10	1	1
2012	4	5	8	1	8	2	4	10	1	1

Table A3. 6 Monetary Policy Regimes (continued)

Year	Ecuador	Egypt	Equatorial Guinea	Eritrea	Estonia	Ethiopia	Finland	France	Gabon	Gambia
1970	1	1	1			1	1	1	1	
1971	1	1	1			1	1	1	1	
1972	1	1	1			1	1	1	1	4
1973	1	1	1			1	5	5	1	3
1974	1	1	1			1	5	6	1	3
1975	1	1	1			1	4	4	1	2
1976	1	1	1			1	2	5	1	2
1977	1	1	1			1	5	5	1	4
1978	1	1	1			1	4	5	1	4
1979	1	1	1			1	4	5	1	4
1980	1	1	1			1	2	5	1	4
1981	1	1	1			1	4	5	1	4
1982	6	1	1			1	1	6	1	4
1983	6	1	1			1	4	5	1	4
1984	6	1	1			1	5	6	1	7
1985	6	1	1			1	5	6	1	7
1986	6	1	1			1	3	4	1	4
1987	6	1	1			1	3	2	1	4
1988	6	1	1			1	4	5	1	4
1989	6	1	1			1	4	5	1	4
1990	5	1	1			1	9	4	1	4
1991	5	7	5			1	9	5	1	4
1992	5	1	1			1	9	6	1	4
1993	5	1	5		4	1	8	6	1	4
1994	5	1	7		4	1	8	5	1	4
1995	5	1	2		4	1	8	6	1	4
1996	5	1	5		4	2	8	5	1	4
1997	5	1	5	6	4	2	8	6	1	3
1998	5	1	5	5	2	2	8	5	1	3
1999	5	1	1	5	2	2	8	8	1	3
2000	5	2	5	5	1	2	8	8	1	3
2001	1	2	2	4	1	2	8	8	1	3
2002	1	2	3	4	1	1	8	8	1	3
2003	1	2	1	1	1	1	8	8	1	3
2004	1	2	1	1	1	1	8	8	1	3
2005	1	1	1	1	1	1	8	8	1	3
2006	1	1	1	1	1	1	8	8	1	3
2007	1	4	1	1	1	2	10	10	1	3
2008	1	10	1	1	1	2	10	10	1	11
2009	1	10	1	1	1	2	10	10	1	11
2010	1	10	1	1	1	2	10	10	1	10
2011	1	10	1	1	1	2	10	10	1	10
2012	1	10	1	1	1	2	10	10	1	10

Table A3. 6 Monetary Policy Regimes (continued)

Year	Germany	Ghana	Greece	Guatemala	Guinea Bissau	Guyana	Hong Kong	Hungary	Iceland	India
1970	2	1	1	1	1	1			1	1
1971	2	1	1	1	1	3			1	1
1972	2	1	1	1	1	5			1	1
1973	6	1	1	1	1	5			5	1
1974	6	1	1	1	1	5			5	1
1975	6	1	6	1	1	5			5	5
1976	6	1	6	1	1	5			5	4
1977	5	1	4	1	1	1			5	11
1978	6	7	4	1	1	1			5	11
1979	6	1	4	1	1	1			5	10
1980	6	1	6	1	1	1			5	10
1981	5	1	6	1	1	5			7	10
1982	5	1	6	1	1	5			7	4
1983	5	7	6	1	1	1			7	4
1984	5	7	6	1	1	5			7	6
1985	5	7	6	1	1	5			7	6
1986	5	1	6	1	1	5			7	6
1987	4	7	6	1	1	5			7	6
1988	5	7	6	5	2	5			7	6
1989	5	7	6	5	2	6			7	5
1990	4	7	4	6	2	6			5	5
1991	5	6	5	3	2	6			5	5
1992	9	5	5	4	2	2			5	11
1993	9	5	5	5	6	2			5	11
1994	9	5	4	4	6	2			5	11
1995	8	5	3	4	6	1			5	11
1996	8	5	3	3	6	1		7	4	11
1997	8	5	3	4	6	1	1	7	4	10
1998	8	5	6	4	2	6	1	7	4	10
1999	8	5	8	5	2	6	1	5	4	10
2000	8	7	8	2	1	6	1	9	9	10
2001	8	9	8	4	1	2	1	9	9	10
2002	8	9	8	4	1	1	1	9	9	10
2003	8	9	8	4	1	2	1	9	8	10
2004	8	9	8	4	1	2	1	9	8	10
2005	8	9	8	9	1	1	1	8	4	10
2006	8	9	8	9	1	1	1	8	4	10
2007	10	9	10	9	1	1	1	8	4	10
2008	10	8	10	9	1	1	1	8	4	10
2009	10	5	10	8	1	1	1	8	4	10
2010	10	2	10	8	1	1	1	8	4	10
2011	10	3	10	8	1	1	1	8	4	10
2012	10	3	10	8	1	1	1	5	4	10

Table A3. 6 Monetary Policy Regimes (continued)

Year	Indonesia	Iran	Iraq	Ireland	Israel	Italy	Japan	Jordan	Kenya	Kuwait
1970	5	1	1	1	1	1	1	1	1	1
1971	5	1	1	3	1	3	1	1	1	1
1972	1	1	1	6	1	6	2	3	1	1
1973	1	1	1	6	1	6	5	2	1	2
1974	1	1	1	4	1	4	5	1	1	2
1975	1	2	1	6	7	5	4	1	7	3
1976	1	2	1	6	7	3	4	1	2	2
1977	1	1	1	6	7	3	5	1	2	2
1978	1	1	1	5	7	5	5	1	5	2
1979	1	1	1	4	7	3	5	1	4	2
1980	1	4	1	5	7	2	6	1	4	2
1981	2	4	1	5	7	2	6	1	7	4
1982	6	4	1	5	7	4	6	1	6	2
1983	6	4	1	5	7	5	6	1	5	1
1984	6	5	1	5	7	2	6	1	5	4
1985	3	5	1	5	7	2	6	1	4	5
1986	6	5	1	5	7	5	5	1	3	3
1987	6	5	1	5	4	1	5	3	5	4
1988	4	10	1	5	4	1	10	3	5	4
1989	4	10	1	5	5	1	10	3	5	4
1990	4	10	1	5	4	1	10	3	5	2
1991	4	10	1	5	9	1	10	3	5	3
1992	2	10	1	5	9	2	10	3	5	3
1993	2	7	1	5	9	5	6	3	4	2
1994	2	7	1	5	9	3	6	3	5	1
1995	4	10	1	4	9	3	10	1	5	2
1996	2	10	1	5	9	5	10	1	5	1
1997	6	10	1	5	9	4	10	1	5	1
1998	6	1	1	5	9	2	6	1	5	2
1999	6	1	1	8	8	1	6	1	6	1
2000	6	11	1	8	8	1	6	1	6	1
2001	6	11	7	8	8	1	6	1	2	1
2002	6	11	7	8	8	1	6	1	2	2
2003	9	10	3	8	8	1	6	1	5	2
2004	9	10	3	8	8	1	10	1	5	1
2005	9	10	3	8	8	1	10	1	4	1
2006	8	10	4	8	8	1	10	1	4	1
2007	8	10	1	10	5	1	10	1	5	5
2008	8	10	1	10	5	1	10	1	7	4
2009	8	10	1	10	5	1	10	1	6	2
2010	8	10	1	10	8	1	10	1	5	4
2011	8	4	1	10	8	1	10	1	6	2
2012	8	4		10	8	1	6	1	6	2

Table A3. 6 Monetary Policy Regimes (continued)

Year	Latvia	Lebanon	Lesotho	Liberia	Lithuania	Luxembourg	Malawi	Malaysia	Maldives	Mali
1970		4	1	1			1	1		1
1971		4	1	1			1	2		2
1972		5	4	1			5	2		2
1973		5	4	1			5	5		2
1974		5	4	1			3	5		1
1975		6	5	1			1	5		1
1976		6	1	1			1	2		1
1977		4	1	1			1	3		1
1978		6	1	1			1	3		1
1979		5	2	1			1	3		1
1980		6	5	1			1	3		1
1981		7	5	1			1	3		1
1982		7	5	1			1	3	5	1
1983		7	5	1			5	3	1	1
1984		6	5	1			5	3	1	1
1985		6	5	1			5	3	2	1
1986		6	5	1			5	3	2	1
1987		6	5	1			5	2	6	1
1988		6	5	1			5	2	5	1
1989		6	5	1			5	2	5	1
1990		6	4	1			5	2	6	1
1991		6	5	1			5	2	6	1
1992		6	5	1	7		4	2	5	1
1993		3	5	1	7	6	4	9	5	1
1994	1	2	4	1	3	6	7	9	5	1
1995	1	2	2	1	1	6	1	9	1	1
1996	1	2	5	1	1	6	1	9	1	1
1997	1	1	5	1	1	6	7	9	1	1
1998	1	1	5	1	1	6	7	9	1	1
1999	1	1	3	5	1	8	7	8	1	5
2000	1	1	5	4	1	8	7	8	1	5
2001	1	1	5	5	1	8	7	8	6	5
2002	1	1	5	5	2	8	5	8	1	5
2003	2	1	5	5	2	8	5	8	1	5
2004	1	1	5	5	2	8	1	8	1	10
2005	4	1	5	5	2	8	1	4	1	10
2006	4	1	5	4	2	8	5	3	1	10
2007	4	1	5	4	2	10	1	4	1	10
2008	5	1	5	2	2	10	1	5	1	10
2009	4	1	5	5	2	10	1	8	1	5
2010	5	1	5	2	2	10	1	8	1	5
2011	4	1	5	1	2	10	5	8	6	1
2012	4	1	5	3	2	10	5	8	1	1

Table A3. 6 Monetary Policy Regimes (continued)

Year	Malta	Mauritania	Mexico	Morocco	Mozambique	Namibia	Nepal	Netherlands	New Zealand	Nicaragua
1970	1	5	1	1			1	2	1	
1971	1	5	1	1			1	3	1	
1972	1	2	1	2			1	2	1	
1973	5	2	1	4			1	2	2	
1974	4	5	1	4			1	2	5	
1975	4	4	1	2			6	2	6	
1976	4	3	1	4			1	2	6	
1977	3	4	1	3			1	2	4	
1978	4	5	1	3			4	2	4	
1979	4	5	1	2			1	3	5	
1980	5	4	2	2			1	2	3	
1981	5	3	5	2			6	2	5	
1982	5	4	7	5			4	2	4	
1983	5	2	7	5			4	2	5	
1984	5	2	7	5			5	1	5	
1985	5	5	7	4			6	1	5	
1986	5	5	7	4			4	1	5	
1987	3	5	7	4			2	1	9	
1988	3	5	7	4			5	1	9	
1989	5	3	7	4			5	1	9	
1990	3	5	7	5			5	1	9	
1991	4	3	9	3			6	1	8	
1992	5	3	9	4			6	1	8	5
1993	4	4	9	9		5	6	1	8	5
1994	4	6	9	9		4	9	1	8	5
1995	4	5	9	9		2	9	1	8	5
1996	4	5	9	8		5	9	1	8	5
1997	4	5	9	8		5	9	1	8	5
1998	4	5	9	8	5	5	9	1	8	5
1999	3	5	9	8	5	5	9	8	8	5
2000	3	4	9	8	6	5	8	8	8	5
2001	3	5	9	8	6	6	8	8	8	5
2002	3	4	9	8	6	6	8	8	8	5
2003	3	3	8	8	6	6	5	8	8	5
2004	3	1	8	8	6	5	4	8	8	6
2005	3	2	8	8	6	5	4	8	8	6
2006	3	3	8	5	6	5	4	8	8	5
2007	3	1	8	5	5	5	5	10	5	5
2008	10	5	6	5	5	6	5	10	6	5
2009	10	5	6	5	5	6	5	10	8	5
2010	10	3	4	5	5	5	4	10	8	5
2011	10	5	6	5	5	6	5	10	8	5
2012	10	5	6	5	5	6	1	10	8	5

Table A3. 6 Monetary Policy Regimes (continued)

Year	Nigeria	Norway	Oman	Pakistan	Paraguay	PERU	Philippines	Poland	Portugal
1970	1	1		1	1	1	1	1	1
1971	1	4	1	1	1	1	1	1	4
1972	1	2	1	1	1	1	1	1	6
1973	1	5	1	1	1	1	1	1	6
1974	5	2	1	1	1	1	4	1	6
1975	3	2	1	1	1	7	4	1	6
1976	2	2	1	1	1	7	1	1	5
1977	4	5	1	1	1	7	1	1	6
1978	4	4	1	1	1	7	1	1	5
1979	5	4	1	1	1	7	1	1	4
1980	5	5	1	1	1	7	2	1	5
1981	5	4	1	1	1	7	5	4	6
1982	5	5	1	5	1	7	5	4	6
1983	5	5	1	5	1	7	6	5	5
1984	5	2	1	5	7	7	6	5	5
1985	5	4	1	2	7	7	2	5	5
1986	11	5	1	5	7	7	2	3	5
1987	11	6	1	2	7	7	2	5	4
1988	11	4	1	5	7	9	2	5	2
1989	10	5	1	5	7	9	4	5	2
1990	10	9	1	5	7	9	5	5	2
1991	10	9	1	5	2	9	5	7	4
1992	10	9	1	3	7	9	5	7	5
1993	10	9	1	5	7	9	5	7	5
1994	10	9	1	1	2	9	5	7	5
1995	1	9	1	5	1	9	5	5	6
1996	1	9	1	5	1	9	5	9	6
1997	1	9	1	5	1	9	6	9	6
1998	1	9	1	4	1	9	9	9	6
1999	7	9	1	5	5	9	9	9	8
2000	4	9	1	6	5	9	9	9	8
2001	4	8	1	5	6	9	9	9	8
2002	5	8	1	2	6	8	8	9	8
2003	7	8	1	2	6	8	8	8	8
2004	2	8	1	4	6	8	8	8	8
2005	3	8	1	2	6	8	8	8	8
2006	1	8	1	2	6	8	8	8	8
2007	5	8	1	1	6	5	8	5	10
2008	9	8	1	7	6	5	8	5	10
2009	9	8	1	4	6	5	8	5	10
2010	8	8	1	2	6	4	8	5	10
2011	8	8	1	3	6	4	8	6	10
2012	8	8	1	3	6	4	8	6	10

Table A3. 6 Monetary Policy Regimes (continued)

Year	Romania	Russia	Rwanda	Saudi Arabia	Senegal	Serbia	Seychelles	Sierra Leon
1970			1		1			1
1971			1	1	2			3
1972			1	1	2			5
1973			1	1	5			6
1974			1	1	5			4
1975			1	1	5			5
1976			1	1	5			5
1977			1	4	5			4
1978			1	1	5			5
1979			1	2	4			1
1980	1		1	2	11			1
1981	1		1	1	11		1	1
1982	1		1	2	11		1	1
1983	7		1	2	10		1	6
1984	7		1	2	10		1	5
1985	1		1	3	10		1	7
1986	1		1	1	4		1	7
1987	1		1	1	2		1	7
1988	1		1	1	10		1	7
1989	6		1	1	10		1	7
1990	6		1	1	10		1	7
1991	6		1	1	10		1	7
1992	6	7	1	1	10		1	7
1993	6	7	1	1	10		1	4
1994	6	7	1	1	5		1	4
1995	5	7	1	1	5		1	4
1996	5	7	1	1	2		1	4
1997	5	3	1	1	5		1	5
1998	5	7	1	1	5		2	7
1999	6	7	1	1	5		2	7
2000	5	7	1	1	5		2	7
2001	9	5	1	1	4		5	7
2002	9	5	1	1	5		5	5
2003	9	4	1	1	5	9	5	5
2004	9	4	1	1	4	9	1	5
2005	9	4	1	1	4	9	1	2
2006	8	2	1	1	4	9	1	2
2007	5	2	1	1	5	5	5	1
2008	6	5	1	1	5	6	6	2
2009	1	6	1	1	5	6	6	5
2010	8	6	1	1	5	6	5	5
2011	8	6	1	1	4	6	5	4
2012	8	6	1	1	4	6	5	4

Table A3. 6 Monetary Policy Regimes (continued)

Year	Singapore	Slovak Republic	Slovenia	South Korea	Spain	Sri Lanka	Surinam	Swaziland	South Africa
1970					1	1			1
1971	1			1	2	1			1
1972	3			1	4	6			4
1973	5			1	4	5			4
1974	5			1	4	4			4
1975	5			1	6	5		1	4
1976	4			1	6	5		1	1
1977	4			1	6	6		1	1
1978	4			1	6	4		1	1
1979	4			1	6	1		2	1
1980	4			3	6	5		7	5
1981	4			3	6	5		7	5
1982	4			4	6	5		5	5
1983	2			4	5	5		5	5
1984	2			4	5	4		6	6
1985	2			5	5	3	1	6	6
1986	2			3	5	4	1	6	6
1987	3			5	4	5	1	5	6
1988	3			5	5	5	1	5	6
1989	3			2	6	5	1	5	6
1990	3			3	6	5	1	5	5
1991	4		7	4	9	4	1	5	5
1992	2		7	2	9	4	1	5	5
1993	4		7	2	9	5	1	5	5
1994	9	3	7	2	9	1	1	4	5
1995	8	3	5	4	9	6	1	2	2
1996	8	3	5	5	9	4	1	5	9
1997	8	3	5	5	8	4	1	5	9
1998	8	5	5	9	8	6	1	5	9
1999	8	5	5	9	8	4	1	5	9
2000	8	4	5	8	8	5	1	6	9
2001	8	9	5	8	8	5	1	6	8
2002	8	9	5	8	8	3	1	6	8
2003	8	9	5	8	8	2	1	5	8
2004	8	9	1	8	8	5	1	5	8
2005	8	9	1	8	8	3	1	5	8
2006	8	3	1	8	8	4	1	5	8
2007	2	3	1	8	10	4	1	5	8
2008	2	6	1	8	10	2	1	5	6
2009	2	1	1	8	10	1	1	5	6
2010	4	1	1	8	10	3	1	5	6
2011	4	1	1	8	10	4	1	6	6
2012	4	1	1	8	10	4	1	6	6

Table A3. 6 Monetary Policy Regimes (continued)

Year	Sweden	Syria	Switzerland	Tanzania	Thailand	Togo	Tunisia	Turkey
1970	1	1	1	1	1	1	1	6
1971	4	1	1	1	1	1	1	1
1972	4	1	1	1	1	2	2	1
1973	5	2	1	4	1	6	5	1
1974	5	3	1	1	1	6	5	4
1975	5	1	1	5	1	5	5	7
1976	5	1	1	2	1	5	2	7
1977	5	1	1	3	1	3	2	7
1978	5	1	1	5	1	5	2	7
1979	4	1	1	1	1	5	2	7
1980	4	1	1	1	1	5	2	7
1981	6	1	10	2	2	5	5	7
1982	6	1	10	5	2	5	5	7
1983	6	1	10	5	1	5	5	7
1984	5	1	10	5	2	5	5	7
1985	5	1	10	5	2	5	5	7
1986	5	1	10	5	2	5	5	7
1987	5	1	10	5	2	5	5	7
1988	5	1	10	5	2	5	5	7
1989	4	1	10	5	2	5	3	7
1990	5	1	10	5	2	5	2	7
1991	5	1	10	5	2	5	5	7
1992	9	1	10	5	2	5	5	7
1993	9	1	9	5	2	7	5	7
1994	9	1	8	5	2	7	2	7
1995	9	1	8	5	2	5	4	7
1996	8	1	8	5	2	4	2	7
1997	8	1	8	4	6	5	4	7
1998	8	1	8	2	6	5	4	7
1999	8	5	8	5	6	5	4	7
2000	8	1	8	1	6	5	4	7
2001	8	1	8	5	9	5	4	7
2002	8	1	8	4	9	5	2	7
2003	8	1	8	4	9	5	1	9
2004	8	1	8	5	9	5	2	9
2005	8	1	8	6	8	5	4	9
2006	8	1	8	6	8	5	1	9
2007	2	1	8	5	8	5	2	9
2008	2	1	8	6	8	5	6	9
2009	8	1	8	5	8	5	4	8
2010	8	1	8	5	8	5	4	8
2011	8	1	5	6	6	5	5	8
2012	8	1	5	6	6	5	5	8

Table A3. 6 Monetary Policy Regimes (continued)

Year	Uganda	UAE	UK	Uruguay	US	Venezuela	Yemen Republic	Zambia	Zimbabwe	ECB
1970	1	1	1	1	1	1		1	1	
1971	1	1	1	1	6	1		1	1	
1972	1	1	1	7	2	1		1	1	
1973	4	1	1	7	6	1		1	1	
1974	2	1	5	7	6	1		1	5	
1975	5	1	4	7	6	1		1	5	
1976	1	1	5	7	6	1		5	1	
1977	1	1	6	7	6	1		5	1	
1978	1	2	5	7	6	1		5	5	
1979	1	2	5	7	5	1		4	2	
1980	1	1	5	7	6	1		4	5	
1981	6	1	5	7	6	1		4	5	
1982	5	1	6	7	6	1		4	5	
1983	5	1	6	7	6	1		5	5	
1984	5	1	6	7	6	1		5	5	
1985	6	1	6	7	6	1		6	5	
1986	6	1	6	7	6	1		7	5	
1987	6	1	3	7	6	1		7	4	
1988	6	1	3	7	6	1		7	5	
1989	6	1	3	7	5	7		7	5	
1990	5	1	3	7	5	7		7	5	
1991	5	1	6	7	9	7	1	7	7	
1992	5	1	9	7	9	7	1	7	7	
1993	4	1	9	7	9	7	1	7	7	
1994	5	1	9	7	9	7	1	7	7	
1995	5	1	9	7	9	7	1	7	7	
1996	5	1	9	7	9	7	1	7	5	
1997	6	1	8	7	8	7	1	7	7	
1998	6	1	8	7	8	7	1	7	7	
1999	6	1	8	7	8	7	1	7	1	8
2000	6	1	8	6	8	7	1	7	7	8
2001	5	1	8	6	8	7	1	7	1	8
2002	5	1	8	6	8	7	1	7	1	8
2003	4	1	8	5	8	1	1	7	7	8
2004	6	1	8	5	6	1	1	7	7	8
2005	6	1	8	5	6	1	1	7	7	8
2006	3	1	8	5	6	1	1	7	7	8
2007	3	1	8	6	6	1	1	7	7	10
2008	5	1	5	6	8	1	1	6	7	10
2009	5	1	6	6	8	1	1	6	7	10
2010	5	1	6	6	8	1	1	6	7	10
2011	5	1	6	5	6	1	1	6	7	10
2012	5	1	6	5	6	1	1	6	7	10

Chapter Four: Financial Development and Growth: The Effects of Quality and Quantity

4.1 Introduction

The last few decades have witnessed a resurgence of interest in the nature of the relationship between financial development and growth. Levine (2005) suggests that financial institutions and markets can foster economic growth through several channels, e.g., by (i) easing the exchange of goods and services and through the provision of payment services, (ii) mobilising and pooling savings from a large number of investors, (iii) acquiring and processing information about enterprises and possible investment projects, thus allocating savings to their most productive use, (iv) monitoring investment and carrying out corporate governance and (v) diversifying liquidity and reducing intertemporal risk.

However, there is widespread debate over the finance-growth nexus and the outcome is inconclusive. Nearly three decades earlier, Goldsmith (1969), McKinnon (1973), Shaw (1973) and subsequently many others produced considerable evidence of correlation between financial development and growth. Nevertheless, Robinson (1952) argues that financial development follows economic development and not vice versa. Aghion *et al.* (2005) find that financial development exerts an effect on convergence only up to a certain threshold and that there is no significant impact of financial development once a country reaches that threshold. Obtaining satisfactory empirical measures of financial development is also one of the most important and contentious issues in assessing the relationship between financial development and economic growth. Some argue that the quality of financial institutions is as important as the quantity (for example, Levine, 1997; Hasan *et al.*, 2009). Nevertheless, there is a lack of suitable proxies to measure financial quality.

The pioneering study by King and Levine (1993) and subsequent work by Levine and Zervos (1998), Levine (2000), Levine *et al*. (2000) and Beck and Levine (2001) identified three indicators of financial development that are best at explaining the differences in economic growth over the long run. They are bank credit to the private sector, stock market activity (proxied by the turnover rate or the ratio of traded value to GDP) and features of the legal system, such as the extent of shareholder and creditor protection.

Most of the studies examining the relationship between finance and growth utilised traditional measures of the volume of credit such as (i) financial depth, measured by liquid liabilities of the financial system divided by GDP, (ii) ratio of commercial bank credit to that of central bank credit, which measures the degree to which commercial banks, compared to the central bank, allocate society's savings, (iii) private credit, which equals the value of credits by financial intermediaries to the private sector divided by GDP and (iv) various proxies of the legal system. However, these traditional measures of financial development have some shortcomings. For example, the commonly used financial depth measure may not accurately gauge the effectiveness of the financial sector in ameliorating informational asymmetries and easing transaction costs (Levine, 2000). The ratio of commercial to central bank measure also has limited ability to measure the effectiveness of banks in mobilising savings, easing transactions, offering efficient risk management facilities to the clients, exerting corporate controls and innovations. Furthermore, a mere expansion of credit or liquid liabilities does not always indicate a qualitative improvement of financial intermediaries' ability to channel scarce funds from savers to borrowers (Romero-Avila, 2007). These variables also depend on the business cycle. The stock market variables used in studies such as Demirguc-Kunt and Levine (1995), Levine and Zervos (1998) and Beck and Levine (2003) find strong correlation with stock market development and growth.[66] However, banks provide different services to those provided by stock markets. The bank based view of financial development suggests that bank based systems at early stages of economic development foster economic growth to a greater degree than the market based financial system.

Although there is substantial evidence regarding the role of financial systems in enhancing economic growth, there are shortcomings associated with measuring the quality of the financial development under consideration. There is a lack of cross-country measures of the degree to which financial systems enhance the quality of services and hence the efficiency of resource allocation. The quality of financial institutions can enhance the quality of information about firms and the efficiency of resource allocation, exert sound corporate governance on firms to funnel resources,

[66]Usually represented by capitalisation, turnover, and international integrations.

provide effective mechanisms for managing, pooling and diversifying risk, mobilise savings to the most efficient projects and facilitate trade (Čihák *et al.*, 2012).

In a simple endogenous two input 'AK' growth model, Pagano (1993) shows how the quality of financial developments can potentially affect growth. Financial intermediaries absorb resources during the process of transforming savings into investments. Thus, a dollar saved generates less than a dollar worth of investment by a certain fraction. Pagano (1993) shows that by increasing the efficiency of services, financial development can reduce the absorption of resources and turn more savings into productive resources. Financial development also enhances growth by increasing the efficient allocation of funds to those projects with a higher marginal productivity of capital.

A number of other studies such as Caporale *et al.* (2009) and Ayadi *et al*. (2009) used some indirect measure of financial quality. Caporale *et al.* (2009) used the spread between the borrowing and lending rates of interest as a measure of quality, finding a significant relationship between per capita growth and the quality of 10 new transitional European countries. Ayadi *et al.* (2013) used meta-efficiency in order to calculate bank efficiency.[67] Their findings suggest that financial sector development is positively associated with growth. However, they find that improvements in banking sector efficiency are not sufficient to improve growth in southern Mediterranean countries, additional conditions such as better quality institutions, regulations and supervision are also important.

Hasan *et al.* (2009) suggests a more direct measure of the quality of financial institutions, thereby addressing the issue of the suboptimal empirical proxies for theoretical counterparts raised by Levine (2005). They test whether better bank efficiency (estimated with bank level data) significantly spurs economic growth in the 147 NUTS2 regions of eleven European countries over the period 1996 to 2004.[68] As a direct measure of financial quality, they calculated profit and cost efficiencies for approximately 7000 banks and also examined the spatial effects of banking sector growth in this region. Quantity was measured by the volume of bank credit, relative to

[67] *Meta-efficiency* is the distance of a bank from the meta-frontier, which is defined by the product of a country's cost efficiency and technical rate of growth (TRG).

[68] NUTS: Nomenclature des unités territoriales statistiques.

GDP. The findings from their GMM estimations suggest that quality rules over quantity. They find that volume of credit is not significant for growth in GDP per worker in these economically developed regions. On the contrary, the interaction of quality, measured by profit and cost-efficiencies, is significant for economic growth. An improvement in bank efficiency spurs five times more regional growth compared to an identical increase in credit volume. Hence, their findings suggest that any future research should take into account the quality of financial services rather than a volume or quantity measurement. A general extension of Hasan *et al.* (2009) would be to see if similar effects hold for developing economies. Unlike developed countries, most developing countries are yet to achieve their steady state growth rates.

One of the key contributions of this study is also to address these sub-optimal empirical proxies, in order to gauge the effect of the quality of financial institutions on economic growth. We examine the relationship between financial development and economic growth for 8 South and South-East Asian developing countries. These countries are emerging economies and share, to some extent, a similar kind of financial background compared to countries like Singapore or Hong Kong in these regions. Due to the lack of available data, we could not incorporate Bangladesh, one of the South Asian countries in our analysis. We adopt a similar approach to Hasan *et al.* (2009) and measure financial quality by profit and cost efficiency of the banks for these countries, in order to observe the impact of quality and quantity of financial development. However, access to bank level data is quite a challenge for these developing countries. In some of these countries, a sufficient amount of data was not available for a number of banks to conduct a valid analysis.

We calculate quality for 191 banks of the 8 countries, over the period 2003 to 2012. Limited data availability is one of the main reasons for this sample choice. The profit and cost efficiencies are calculated by a fixed effects version of Schmidt and Sickles' (1984) panel data stochastic frontier analysis (SFA). The volume of financial development has been measured by bank credit to the private sector as a percentage of GDP, as well as broad money to GDP ratios. Real GDP per worker has been used for the dependent variable. Other control variables are the percentage of secondary school enrolment, inflation and openness. The model has been estimated by two-step system GMM in order to control for the endogeneity of the dynamic panel. Partially contrasting the findings of Hasan *et al.* (2009), our findings suggest that both quality and quantity measures of the financial sectors matter for these developing countries.

The interaction term is also found to be significant. Therefore, our findings also highlight the importance of specifying three distinct channels through which banks may foster productivity growth: by channeling more credit, developing more efficient intermediaries and the interaction of two. The findings also imply that the quality and volume of financial developments are complimentary to each other in these regions.

The rest of the chapter is organised as follows. Section 4.2 sets out the empirical evidence of the financial development-growth nexus. Section 4.3 discusses the methodology of the studies. Section 4.4 discusses the findings and section 4.5 concludes the chapter.

4.2 Literature review

It has been argued that long term sustainable economic growth depends on the ability to raise the rate of accumulation of physical and human capital, to use the resulting productive assets more efficiently and to enable access to these assets for the population (FitzGerald, 2006). Financial intermediation can affect economic growth in several ways. For example, it can enhance economic growth by acting on the savings rate, on the fraction of savings channeled to investment or through the social marginal productivity of investment (Pagano, 1993).

Starting from Goldsmith (1969), McKinnon (1973), and Shaw (1973), this subject has been extensively studied for several decades. One of the pioneers, Goldsmith (1969), suggests that differences in a country's financial organization, and its financial habits and attitudes influences the direction of economic development and affects the speed of economic growth. Goldsmith (1969) used the ratio of financial intermediaries' assets to GNP to estimate the depth of financial development and also to observe if there is a positive correlation between the size of the financial system and the provision and quality of financial services. Goldsmith (1969), for 35 countries over the period 1860 to 1963, observed a rough parallelism between economic and financial development. His finding provides the indication that for a few countries, faster economic growth has been accompanied by an above-average rate of financial development. Even though Goldsmith (1969) provided the basis for subsequent research in this area, his study has several weaknesses. The study does not systematically control for other factors influencing economic growth (Levine and Renelt, 1992) nor does it examine whether financial development is associated with productivity growth and capital accumulation. Levine and Renelt (1992) argue that the size of financial intermediaries might not be a proper measure of the functioning of financial system. The high correlation between the size of the financial system and economic growth does not clearly identify the direction of causality.

Subsequent studies by King and Levine (1993a, 1993b) on 80 countries over the period 1960 to 1989, addressed the issues of Goldsmith (1969). By systematically controlling for other factors affecting long run growth, their study examined the impact of capital accumulation and productivity growth channels on economic growth. They utilised four alternative measures of the level of financial development and analyse if the level of financial development predicts long-run economic growth, capital

accumulation, and productivity growth. The first measure, DEPTH, represents the size of financial intermediaries and liquid liabilities of the financial system (currency plus demand and interest bearing liabilities of bank and non bank financial intermediaries) divided by GDP. They find a strong positive correlation between real per capita GDP and DEPTH. The second measure, BANK, represents the degree to which the central banks versus commercial banks are allocating credit. BANK equals the ratio of bank credit to bank credit plus central bank domestic assets. The underlying reason is that the commercial banks are more likely to generate financial activities than the central banks. The remainder of the two measures are partially concerned with the allocation of credit. The third measure, PRIVATE, equals the ratio of credit allocation to private enterprises to that of total domestic credit (excluding credit to the banks). The fourth measure, PRIVY, equals the ratio of credit to private enterprises and GDP. The main assumptions underlying these measures are that financial systems that allocate more credit to private firms are more engaged in researching firms, exerting corporate control, providing risk management services, mobilising savings and facilitating transactions than financial systems that simply funnel credit to the government or state owned enterprises. The three growth indicators used are: the average rate of real per capita GDP growth, the average rate of growth in the capital stock per person and total productivity growth.[69] They assessed the strength of the empirical relationship between each of these four indicators of financial development and three growth indicators, all averaged over the period 1960 to 1989. The findings from the cross section studies suggest a strong positive relationship between each of the four financial development indicators and the three growth indicators.[70]

Furthermore, to examine the causal relationship between financial development and growth, King and Levine (1993b) examine whether the value of financial depth in 1960 predicts the rate of economic growth, capital accumulation and productivity growth over the next 30 years. Their findings suggest that the initial level of financial development predicts subsequent rates of economic growth as well as physical capital accumulation and economic efficiency over the next 30 years, even after controlling for

[69] Defined by a 'Solow residual' defined as real per capita GDP growth minus (0.3) times the growth rate of the capital stock per person.

[70] The other conditioning variables are income per capita, education, political stability, indicators of exchange rate, trade, fiscal and monetary policy.

income, education, political stability, and measures of monetary, trade and fiscal policy.

Levine and Zervos (1998) extends Levine (1993a) by using a measure of deposit money bank credits to the private sector and stock market liquidity over the period 1976 to1993, for 47 countries. They try to evaluate if banking and stock market indicators are both robustly correlated with the current and future rates of economic growth, capital accumulation, productivity growth and private savings. Their findings suggest that stock market liquidity and banking development both positively predict growth, capital accumulation and productivity improvements, even after controlling for economic and political factors. Their findings also suggest that the functioning of the banking sector is different to the functioning of stock markets in the growth process. Overall, the study suggests that financial factors are an integral part of growth and there is a strong positive link between financial development and economic growth.

Despite the finding of many studies, that there are beneficial effects of financial development on economic growth, there still exists extensive debate on the issue. Many have argued that the impact of financial development on growth is limited, once an economy reaches to a certain level of development. Contrary to some previous studies, Aghion *et al.* (2005) claims that financial development can only explain the convergence to steady state growth, but it does not exert a direct impact on growth once a country reaches steady state. The study explores the hypothesis that financial constraints prevent poor countries from taking full advantage of technology transfers and this is the reason that some countries diverge from the growth rate of the world frontier. The paper developed and tested a Schumpeterian model of cross country convergence with financial constraints. The model implies that all countries above some critical level of financial development should achieve convergence in growth rates, and financial development has an initial positive but eventually vanishing effect on steady state growth. The implications of their model have been tested on 71 countries, with a split sample of cross section growth regression from 1960 to 1995. The samples are split according to their level of financial intermediation.[71] They find that within the bottom half of the countries, the convergence parameter is not significantly different from zero and the coefficient of private credit is significantly

[71] The US serves as a benchmark. The average growth rates and log per capita GDP of each country have been subtracted from that of the US at the frontier.

positive, whilst in the top half of countries, the convergence parameter is negative and the significance of private credit is substantially lower than in the bottom half. As an alternative to the split sample regression (which might be inflicted with small sample bias), they perform the tests with an interaction analysis using a standard growth model, instrumental variable and GMM approach. They use private credit as a measurement of financial intermediation, with an interaction term between financial intermediation and the country's initial relative output.[72] The findings suggest that convergence depends positively on financial development. A country can converge as long as the level of private credit exceeds the critical value, which, according to their estimate, is 25%. Those countries with extremely low financial intermediation will fail to join convergence. Their result implies that a lack of financial development accounts for the failure of some countries to converge to the global technology frontier, but that financial development certainly has limited impact on mature and steady state economies.

Arcand *et al.* (2012) also study whether there is a threshold, above which any financial development stops contributing to economic growth. Their finding suggests that the relationship between financial depth and economic growth disappears in countries with a very large financial sector. Credit to the private sector above 80 to 100% of GDP has a negative impact on economic growth. The study suggests two possible reasons for this negative impact: i) excessive credit growth, which could lead to high economic volatility and probability of financial crisis, and ii) high credit volume, which is generally related to potential resource misallocation. Cecchetti and Kharroubi (2012) examine the impact of size and growth of the financial system on productivity growth and economic level, using a sample of 50 countries over the period 1980 to 2009. The study also suggests that financial sector size has an inverted U-shaped effect on productivity growth. A further increase in the size of financial system contributes negatively to total factor productivity growth. Thus, the finding implies that more finance is not always necessarily better.

[72] They used few other alternative measures of financial intermediation for robustness. The first one is liquid liabilities, which is currency plus demand and interest bearing liabilities of banks and non bank financial intermediaries divided by GDP. The second alternative measure is bank assets, the value of all credits by banks (excluding other financial intermediaries). The third is the same as Levine *et al.* (1993), the ratio of commercial bank assets to the sum of commercial plus central bank assets. The results are robust to all of these measurements.

There are controversies over the indicators of financial development. For example, the widely used ratio of liquid liabilities raises some issues. FitzGerald (2006) shows that the widely used M_2/Y is not a reliable indicator of financial depth as it varies enormously over time as well as across countries and responds to changing monetary policy stances. It is also highly likely to be related to the asset bubble. Some interpretative problems also emerged from earlier studies (Pagano, 1993). Most of the studies are not very clear about the way financial development enhances growth. There is no clear suggestion as to whether the growth has been achieved by increasing investment or by enhancing the efficiency of investment. Moreover, empirical analysis at the aggregate level is unlikely to capture the complexity of financial structures in industrial countries and their growth process. A mere expansion of credit does not necessarily reflect a qualitative improvement of the financial intermediaries to channel funds in the economy and gives only a partial picture of the extent of financial development. The degree of financial development is assumed to be exogenous in most of the studies. According to Pagano (1993), financial development is too generic a term. Therefore, to gauge its impact on growth, one must specify the particular financial market concerned. As such, the quality of banking sectors can be a candidate for a more direct measure of economic growth. Few studies try to find suitable proxies for qualitative assessment of financial development.

A distinctive study by Hasan *et al.* (2009), attempted to investigate regional significance of both financial quality and quantity for eleven European countries.[73] They explicitly measure the financial quality by cost and profit efficiencies of financial intermediaries, using a translog production function. The translog production function is calculated by stochastic frontier analysis (SFA). The true fixed effects model developed by Greene (2002) is used for this SFA.[74] Financial volume is measured by the bank credit volume relative to GDP.[75] Their finding suggests the relative importance of financial quality over volume, for 11 industrialised countries. A 1%

[73] They allocate the financial quality and quantity indicators around 147NUTS 2 regions across 11 European countries.

[74] They use unconsolidated financial data for approximately 7000 banks in 11 EU countries, between 1996 and 2004

[75] The dependent variable is gross domestic product per worker. Regional controls are the growth rate of the working population and spatial lags of financial volume and quality. They have also used a direct and a square time trend to control for time specific effects.

increase in banks' ability to convert inputs into financial services spurs regional growth, by almost 0.06%. However, the quantity effect on its own is found to be insignificant, despite the significance of interaction between quality and quantity. Their results highlight the importance of specifying three distinct channels through which banks may foster productivity growth. That is, more credit, more quality and, above all, more interaction between quantity and quality. Studies such as Caporale *et al.* (2009) and Ayadi and Arbak (2013) also try to assess financial quality in different ways.

Caporale *et al.* (2009) examines the relationship between financial development and economic growth for 10 new EU countries, by estimating a dynamic panel model over the period 1994 to 2007. Three financial indicators have been used to analyse the link between financial sector development and economic growth. The indicators are: the ratio of private credit to GDP, liquid liabilities and stock market capitalisation. Additionally, they have measured the efficiency of the financial sector by interest margin, which measures the difference between deposits and lending rates in the banking sector. The EBRD index of institutional development, which measures the progress in reforming the financial sector, has also been used as a financial development indicator.[76] Their finding from the dynamic panel estimation suggests that the effects of credit to the private sector are insignificant, possibly due to numerous banking crises, which resulted in a large proportion of the non performing loans in these transition economies. The stock market capitalisation to GDP ratio has a positive but minor effect on economic growth. The ratio of liquid liabilities to real GDP has a positive and significant effect, thus consistent with the idea that money supply helps growth by facilitating economic activities. Both of the efficiency measurements have a significant impact on growth. The findings suggest that shrinking the interest margin enhances economic growth and efficiency. Banking and financial sector reform has the same positive impact on growth.

Ayadi and Arbak (2013) find that better institutions and low inflation are key factors for economic growth in the region of northern and southern Mediterranean countries over the period 1985 to 2009. However, private sector credit and bank deposits have a negative impact. Five measures of financial development (bank credit

[76] The spread between the deposit and the lending rate measures the transaction costs within the sector but also reflects an improvement in the quality of borrowers in the economy. If the margin declines due to a decrease in transaction costs, the share of savings going to investment increases and economic growth accelerates.

to the private sector (as % of GDP), share of bank deposits (as % of GDP), meta-efficiency of banks, Stock market capitalisation (as % of GDP), total value traded in stock market (as % of GDP) and stock market turnover) are used in their study. [77,78] Their findings suggest that both the size and liquidity of stock market bears a significant role in economic growth in this region, compared to banking credit and efficiency. The quality of the institution has an insignificant role. Investment, whether domestic or FDI, contributes significantly to economic growth.

The above analysis of some previous studies suggest that despite a significant amount of research having been conducted in this area, there still remains a great amount of controversy regarding the role of efficiency in the financial sector. Moreover, the literature reports a wide range efficiency measures. However, measuring banking sector efficiency as a proxy for the efficiency of financial intermediation is important, particularly in the context of developing countries. Stiglitz and Weiss (1988) argue that banks are a crucial device for the selection of entrepreneurs and the allocation of financial resources. Therefore, banking sector efficiency is essential to economic development. Banks also ensure the quality of the borrowers. We try to provide an insight into this argument by directly measuring banking efficiencies and comparing them with other measures of financial development for economic growth. However, before proceeding further, the first important issue is to define how the quality of financial intermediation can be linked to economic growth as the traditional growth literature does not recognise a direct impact of the quality of financial intermediation on economic growth. The following section provides a theoretical approach linking the quality of financial intermediation to growth.

4.2.1 The relevance of quality of financial institutions: a theoretical approach

In traditional growth theory, instead of exerting a direct effect on growth, financial intermediation is assumed to be related to the level of capital stock per worker or to the level of productivity. The latter was ascribed to exogenous technical progress. The

[77] Meta-efficiency is the distance of a bank from the meta-frontier, which is defined by the product of country cost efficiency and technical rate of growth (TRG)

[78] Other control variables are financial openness and inflation. A composite index on legal quality and democratic accountability is constructed, using four indicators from the International Country Risk Guide (ICRG), published by the PRS Group. Capital flow variables, controlling for net foreign direct investments (FDI) and portfolio investments are also included.

endogenous growth model provides the vital theoretical link between growth and financial development. This model suggests that growth can be self sustaining without exogenous technical progress. Growth rate can be related to preferences, technology, income distribution and institutional arrangements. This provides the theoretical basis, which early contributions lacked, suggesting that financial intermediation can have not only level, but also growth effects.

In a simple endogenous 'AK' growth model, Pagano (1993) shows how financial development can potentially effect growth. Equation (4.1) depicts the model, where aggregate output is a linear function of the aggregate capital stock:

$$Y_t = K(K, L) = AK_t \qquad (4.1)$$

Here, A is an exogenous constant and *K* is, broadly defined, aggregate capital. Therefore, *K* can include not just physical, but also human capital, as well as the stock of knowledge and financial capital. This is a reduced form production function, resulting from one of two underlying frameworks. One represents a competitive economy with external economies, as in Romer (1989), where the firm faces constant returns to scale, but productivity is an increasing function of aggregate capital stock.

For simplicity, it has been assumed that the population is stationary and the economy produces a single good, which can either be invested or consumed. δ represents the depreciation rate per period, if product is invested. Then the gross investment I_t equals:

$$I_t = K_{t+1} - (1 - \delta)K_t \qquad (4.\ 2)$$

In a closed economy, with no government, capital market equilibrium requires that gross saving S_t equals gross investment I_t. A proportion 1-∅ of the flow of saving is lost in the presence of financial intermediation. Therefore, gross investment can be expressed as:

$$\emptyset S_t = I_t \qquad (4.3)$$

From equation (4.1), the growth rate at time t+1 can be expressed as $g_{t+1} = {}^{Y_{t+1}}/_{Y_t} = {}^{K_{t+1}}/_{K_t}$. By using equation (4.2) and dropping the steady state time indices, the steady state growth rate can be written as:

$$g = A\frac{\mathrm{I}}{Y} - \delta = A\emptyset s - \delta \qquad (4.4)$$

Here, the capital market equilibrium equation (3) has been used and s represents the gross saving rate S/Y. Equation (4.4) depicts how financial development can affect growth. It can increase $\emptyset$, the proportion of saving funnelled to investment, it may increase A, the social marginal productivity of capital and it can influence s, the private saving rates.

Financial intermediaries absorb resources during the process of transforming saving into investment. A dollar saved generates less than a dollar worth of investment, by a fraction $\emptyset$. The remaining fraction $1 - \emptyset$ goes to banks as the spread between lending and borrowing rates, and to securities brokers and dealers as commissions, fees etc. This absorption of resources by the financial sector is primarily a reward for services supplied; however, it may also reflect the inefficiency of the intermediaries and their market power (Pagano, 1993). Moreover, activities of financial institutions are often subjected to legislation in the form of taxation (high reserve requirements, transaction taxes, etc.) and by restrictive regulations, translating into higher margins (Roubini and Sala-i-Martin; 1991).[79] Therefore, financial development increases the growth rate, g, by reducing these leakages of resources, i.e. by raising $\emptyset$ in equation (4.4) (Pagano, 1993).

Financial development also enhances growth, by increasing the efficient allocation of funds to projects with a higher marginal productivity of capital. Financial intermediaries increase the productivity of capital, 'A', in two ways: (i) by collecting information to evaluate alternative investment projects and (ii) by inducing individuals to invest in riskier but more productive technologies, thus by providing better risk sharing (Pagano, 1993). Therefore, the development of financial institutions channels savings more efficiently and enhances higher productivity of capital. A higher productivity of capital enhances growth.

[79] The implicit assumption here is that the quasi-rents earned by financial intermediaries and the tax revenue extracted from them are entirely spent on private and public consumption respectively. Their detrimental effect on growth is tempered if they are partly spent on investment.

4.3 Methodology

Our panel analysis, exploring the linkage between financial development and economic growth, consists of annual data for eight developing countries from 2003 to 2012. The time period has been guided by the availability of data. We try to focus on the developing countries of South and South-East Asia. The selected countries share similar financial backgrounds and growth. Those included in the sample are: India, Pakistan, Nepal, Sri Lanka, Malaysia, Indonesia, Philippines and Thailand. All data for the panel analysis have been obtained from the World Bank's World Development Indicators (WDI). We have estimated profit and cost efficiencies for 191 banks of the eight countries, to substitute for a measurement of financial quality. The number of banks are also selected on the basis of data availability for these countries. Some of these countries do not have bank level data sufficient enough to conduct the analysis for a longer period of time. Yearly bank level data are obtained from the Bankscope database.

4.3.1 Methodology for the panel estimation

We attempt to gauge the relationship between financial development and growth by estimating an augmented Barro growth regression model, which takes into account financial development. We specify a reduced form growth model as a dynamic panel model of the form of equation (4.5):

$$lnY_{i,t} = \alpha_2 lnY_{i,t-1} + \beta_1 lnFV_{i,t} + \beta_2 lnFQ_{i,t} + \beta_3 lnX_{i,t} + \mu_i + \varepsilon_{i,t} \qquad (4.5)$$

Here, $lnY_{i,t}$ is real GDP growth per worker. In traditional growth theory the role of financial intermediation is related to the level of capital stock per worker or to the level of productivity. However, as we have discussed earlier, traditional growth theory does not recognize any direct relationship between the capital stock and the growth rate of labour productivity. Levine (2000) shows that the impact of financial developments on growth works mainly by enhancing total factor productivity rather than through capital accumulation or saving rates. $lnY_{i,t-1}$ is initial real GDP per worker, included to control for convergence predicted by Solow-Swan growth models. *i* represents a country and *t* represents the time period. μ_i and $\varepsilon_{i,t}$ are two error terms. μ_i is an unobserved country specific component of the error term, that does not necessarily have a zero mean, and ε_{it} is a white noise error term, with zero mean. Time invariant

country characteristics, such as geography and demographics are usually correlated with the explanatory variables. The fixed effects take the account of the unobserved country specific effects. $\beta_1$and β_2 are the coefficients that capture the finance-growth relationship.

Financial development is measured in terms of quality and quantity. $lnFV_{i,t}$ measures the volume of financial development. Two alternative indicators have been used for volume: i) domestic credit to the private sector provided by banks as a percentage of GDP and ii) broad money as a percentage of GDP. $lnFQ_{i,t}$ measures the quality of bank efficiency, which has been calculated separately through profit and cost efficiencies for the 191 banks. $lnX_{i,t}$ represents other control variables, generally proxies for human capital, trade and degrees of uncertainty in the future markets. Secondary school enrolment has widely been used for the measure of human capital. We have used the percentage of gross secondary school enrolment to represent human capital. Additionally, we have included trade openness and inflation. Some empirical evidence suggests that in the long run, more outward-oriented countries experience higher economic growth (e.g. Sachs and Warner, 1995; Edwards, 1998; Frankel and Romer, 1999; Dollar and Kraay, 2004). Uncertainty in financial sectors has been measured by inflation.

The model is dynamic in nature. Apart from the country specific characteristics, the estimation of β_i can be biased in many different ways. The quality and quantity of the financial sectors can be endogenous, meaning the more developed a country is, the more would be the quality and quantity of the financial sector. The panel data set has a short time dimension $(t = 10)$. Measurement error, reverse causality and omitted variable bias can be common in this model. The presence of lagged initial GDP per worker is also susceptible to autocorrelation. Therefore, a suitable estimation method is required in order to obtain unbiased, consistent and efficient estimators of the dynamic model in equation (4.5). Estimation of dynamic panel regression models with lagged values of the endogenous variables as instruments can be a suitable estimation procedure ((Beck *et al*. (2000), Rioja and Valev (2004), Hasan *et al*. (2009)). Unlike the normal pooled cross section models, they control for endogeneity and measurement errors, not only in the financial development variables but also other explanatory variables in the model.

Equation (4.5) has been estimated using system GMM. The Arellano-Bover and Blundell-Bond estimator augments Arellano and Bond (1991), by making an additional assumption that the first difference of the instrumented variables are uncorrelated with the fixed effects. This allows the introduction of more instruments and can dramatically improve efficiency. It builds a system of two equations, the original equation and the transformed one, hence known as system GMM (Roodman, 2009). Blundell and Bond (1998) present Monte Carlo evidence to show that the inclusion of the level regression in the estimation reduces the potential bias in finite samples and the asymptotic inaccuracy associated with the difference estimator. In two step estimation, the standard covariance matrix is robust to panel specific autocorrelation and heteroscedasticity.

The consistency of the GMM estimator depends on the validity of the instruments. To address this issue we consider two specification tests suggested by Arellano and Bond (1991), Arellano and Bover (1995), and Blundell and Bond (1998). The first one is the Sargan test of over-identifying restrictions, which tests the overall validity of the instruments, by analyzing the sample analogous of the moment conditions used in the estimation process.[80] The second test, Arellano-Bond test for AR (2), tests for serial correlation in the error term $\epsilon_{i,t}$. The Sargan test has a null hypothesis of, 'the instruments as a group are exogenous'. Therefore, higher probability value of the $Sargan$ statistic indicates exogeneity of the instruments. The Arellano-Bond (AR_2) test for autocorrelation has a null hypothesis of no autocorrelation and is applied to the differenced residuals. It detects autocorrelations in levels.

4.3.2 Methodology for bank efficiency

The bank level data, which is used to calculate the profit and cost efficiencies of 191 Banks across 8 South and South East Asian countries, has been collected from the Bankscope data base. The sample period covers 2003 to 2014. The necessary bank level data for many banks is not available for a valid analysis prior to the sample period. The data for suitable analysis has been found for only 191 banks of the eight countries over this period.

The standard profit function for bank efficiency can be augmented and written in logarithmic form as:

[80] Sargan, J.D.(1958). 'The Estimation of Economic Relationships Using Instrumental Variables', Econometrica, 26, 393-415.

$$\ln(\pi_{bt}+\theta) = f_{\pi}(P_t, w_{t,} z_{bt}, v_t) + lnu_{\pi bt} + ln\epsilon_{\pi bt} \quad (4.6)$$

Equation (4.6) represents a profit function. The function f_{π} represents optimising behaviour and relates the log of variable profits ,π_{bt}, of bank b at time t *(*plus a constant θ) to a vector of input prices, P_t , a vector of variable inputs, $w_{t,}$ a vector of semi fixed netputs z_{bt}, and some environmental and structural variables v_t. The term, $\epsilon_{\pi bt}$, represents a random error that varies from period to period. The fixed effects are captured by $u_{\pi bt}$. Profit can be negative, so the constant θ is needed to ensure that the argument remains positive. The cost function can be estimated, similarly, as the profit function. The cost function can be written in the following form:

$$\ln(C_{bt}) = f_c(y_{bt}, w_{t,} z_{bt}, v_t) + lnu_{cbt} + ln\epsilon_{bt} \quad (4.7)$$

Here, y_{bt} is the output of bank b at time t. We have used stochastic frontier analysis (SFA) to calculate the efficiencies.

Frontier analysis has been used extensively to measure the performance of financial institutions. There are four main frontier approaches, each differing in the assumptions made about the shape of the frontier, the treatment of the random error and the distributions assumed for inefficiency and the random error. The methods of calculating efficiency often differ in terms of the underlying concept of efficiency, either technological or economical. Nonparametric data envelopment analysis (DEA) usually focuses on technological efficiency and parametric approaches like stochastic frontier analysis (SFA), thick frontier approach (TFA) and distribution free approach (DFA) are used for measuring economic efficiency.[81,82]

Each approach has its own advantages and disadvantages. An advantage of using parametric methods over the nonparametric method is that they allow for random errors. The DEA usually does not allow for random errors due to measurement problems associated with using accounting data, the factors that cause ups and downs in inputs and outputs or error specification (Bauer, Berger, Ferrier and Humphrey, 1998). Therefore, parametric methods are less likely to misidentify measurement error,

[81] The early nonparametric frontier models include Charnes, Cooper and Rhodes (1978) and parametric model includes Aigner, Lovell and Schmidt (1977). They mainly focus on technological inefficiency.

[82] Technical or cost efficiency requires only input and output data, but economic efficiency requires also price data. Technological efficiency scores will also tend to be higher than economic efficiency scores on average due to the higher standards of allocative efficiency.

transitory differences in cost or specification error as inefficiency. One of the main challenges in implementing the parametric method is determining how best to separate unobserved random errors from the equally unobserved inefficiency (Bauer, Berger, Ferrier and Humphrey, 1998). However, the parametric methods have a disadvantage relative to nonparametric methods in that it imposes more restrictions on the shape of the frontier by specifying a functional form.

We have used stochastic frontier approach (SFA) to analyse bank efficiency. The SF model is motivated by the theoretical idea that no economic agent can exceed the ideal frontier and the deviations from this extreme represent individual inefficiencies (Belotti *et al.*, 2012). From a statistical point of view, this idea has been implemented by specifying a regression model characterised by a composite error term, in which the classical idiosyncratic disturbance trying to capture measurement error and any other classical noise, is included together with a one sided disturbance term to represent inefficiency in the production process. SFA employs a composed error model in which inefficiencies are assumed to follow an asymmetric distribution.[83] This means that the error terms from the cost function, given by $u_i \; and \; \epsilon_i$, represent inefficiency and follow some statistical distribution, and also represent random errors and behave according to a normal distribution. The reason behind this is that inefficiencies cannot subtract from costs and so must be drawn from a truncated distribution, whereas random errors can both add and subtract costs and so may be drawn from a symmetric distribution. Both the inefficiencies and the random errors are assumed to be orthogonal to the regressors specified by the underlying function. The following equations are specifying the SF model.

$$y_i = \alpha + x_i'\beta + \epsilon_i, \qquad i = 1 \dots N \tag{4.8}$$

$$\epsilon_i = \; v_i - u_i, \tag{4.9}$$

$$v_i \sim N(0, \sigma_v^2) \tag{4.10}$$

$$u_i \sim F \tag{4.11}$$

Here, y_i represents the logarithm of the output (or cost, if we estimate the cost function) of the *ith* productive unit, x_i is a vector of inputs. β is the vector of technology parameters. The composite error term,ϵ_i , is the sum (or the difference, if it is a cost function) of a normally distributed disturbance, v_i.

v_i represents measurement and specification error. u_i, a one sided disturbance, represents inefficiency. The sign of the term u_i could be positive or negative depending on whether the frontier describes a cost or production function respectively. The parameters u_i and v_i are assumed to be independent of each other and orthogonal across observations. To make the model estimable, assumptions about the distribution, which is denoted by F, of u_i are needed. Aigner *et al.* (1977) assumed half normal distribution, i.e. $u_i \sim N^+(0, \sigma_v^2)$. Meeusen and Broeck (1977) advocated for an exponential distribution where $u_i \sim (\sigma_u)$. Other frequently adopted distributions are the Truncated Normal (Stevenson, 1980) and the Gamma distributions (Greene, 1980a, 1980b, 2003). The distribution assumption required for the identification of the inefficiency term implies that the model is usually estimated by maximum likelihood (ML), even if modified least squares or generalised method of moments estimators are possible.

Pitt and Lee (1981) is the first to extend the original cross section model of SF to longitudinal data. They proposed the ML estimation of the following normal-half normal SF model.

$$y_i = \alpha + x_{it}'\beta + \epsilon_{it}, \quad i = 1 \dots Nt = 2 \dots, T_i \tag{4.12}$$

$$\epsilon_{it} = v_{it} - u_{it}, \tag{4.13}$$

$$v_{it} \sim N(0, \sigma_v^2) \tag{4.14}$$

$$u_{it} \sim N^+(0, \sigma_u^2) \tag{4.15}$$

The generalization of this model to the Normal-Truncated Normal case has been proposed by Battese and Coelli (1988). Schmidt and Sickles (1984) pointed out that the estimation of a SF model with time variant inefficiency can also be performed by adapting conventional fixed effects estimation techniques, allowing inefficiencies to be correlated with the frontier regressors and avoiding distributional assumptions about u_i. However, the time invariant nature of the error term has been questioned, especially in the presence of empirical applications based on long panel data sets. The approach by Cornwall *et al.* (1990) proposed a SF model with individual specific slope parameters. Lee and Schmidt (1993) proposed a specific model, where $u_{it}$is specified with time dummies. Battese and Coelli's (1992) 'time decay' model is another approach. Nevertheless, we have adopted Schmidt and Sickles (1984) time-invariant

inefficiency models for the analysis, because of our small data set, consisting of only ten years. The fixed effects version of this model has been estimated using STATA.

The standard profit and the cost function for the full sample is taken in the form of following translog production function.[84]

$$lnProf_t = \alpha_i + \beta_1 \ln(INTR) + \beta_2 \ln(NTR)^2 + \beta_3 \ln(INTC) + \beta_4 \ln(INTC)^2 + \beta_5 \ln(OTHC) + \beta_6 \ln(OTHC)^2 + \beta_7 \ln(CPRS) + \beta_9 \ln(INTR) \ln(INTC) + \beta_{10} \ln(INTR) \ln(OTHC) + \beta_{11} \ln(INTR) \ln(CPRS) + \beta_{12} \ln(INTC) \ln(OTHC) + \beta_{13} \ln(INTC) \ln(CPRS) + \beta_{14} \ln(OTHC) \ln(CPRS) + e_{it} \quad (4.16)$$

For a simplistic representation, we have omitted the subscripts. The description of the variables is provided in table 4.1. To estimate the cost function, $lnProf_{it}$ is replaced by lnC_{it} and $ln(INTR)$ is replaced by $ln(OUTP)$.

Equation (4.16) includes one output price, *INTR*, two input prices: *INTC* and *OTHC*, one netput, *CPRS*, and all the cross products. Table 4.1 describes the variables used for calculating bank efficiency.

Table 4.1: Variable definitions

Prof (per unit)	Pre tax profit / total assets
Cost (per unit)	Total costs / total assets
OUTP	Total earning assets / total assets
INTR	Interest receipts / earning liabilities
OTHC	Other costs / earning liabilities
CPRS	Capital and reserves / total assets

Here, total variable costs are the sum of interest costs and fees and other non interest costs. All bank specific variables, except prices, are divided by total assets to normalise the difference in size between institutions. The bank's output (*OUTP*) is

[84] One of the main advantages of the translog production function is that unlike Cobb Douglas production functions, it does not assume rigid premises such as perfect or smooth substitution between production factors, nor does it require perfect competition (J.Klacek *et al.*, 2007). Also, this production function permits to pass from a liner relationship between the output and the production factors to a non linear one. Due to these properties, the translog production function can be used for second order approximation of a liner homogeneous production estimation of a production frontier, the Allen elasticises of substitution or the measurement of total factor productivity dynamics.

represented by total interest and dividend earnings. The unit price of bank's output (denoted by *INTR*) is defined as total income from interest receipts and dividends, divided by total earning assets. The unit price of borrowed funds (*INTC*) is defined as total interest expenses and fees, divided by funding liabilities. Data on the number of employees was missing for many banks, so it was not possible to measure the labour cost per employee. However, non interest unit costs are estimated as wage costs, rent, depreciation, directors and auditors fees and sundry operating expenses, divided by payable liabilities. Other costs are denoted as *OTHC*. The only netput included is the sum of each banks capital and reserves (*CPRS*), which provide an alternative to deposits and interbank borrowing in the financing of the bank's operations.

4.3.4 The Estimation Results

4.3.4.1 Data summary and estimation results from bank efficiency:

Table 4.2 provides descriptive statistics of the variables used for the panel analysis. The mean GDP growth rate across the sample is 3.15%. The average bank credit to the private sector is 50.76% of GDP. Average inflation is 6.61%. Average broad growth as a percentage of GDP is 70.99%. Average trade to GDP ratio is 81.28%.

Table 4.2 Descriptive statistics of variables

Variables	Mean	St. Dev	Min	Max
GDP growth per worker	3.15	2.71	-3.65	11.67
Debt to the private sector by the banking sector	50.76	32.66	16.80	118.59
Inflation	6.61	4.22	-0.84	22.56
Secondary Education	68.01	19.12	27.75	99.33
Broad money	70.99	33.39	34.55	141.17
Labour force growth	1.27	1.50	-2.62	6.79
Openness	81.28	51.25	30.06	210.37

Note: GDP per worker is the per capita real GDP per person employed (constant at 1999 US$), Bank credit is the domestic bank credit to the private sector as a % of GDP, broad money growth is expressed as a percentage of GDP, secondary education is measured by gross secondary school enrolment as a % of GDP and Openness is measured by the ratio of trade to GDP.

Table 4.3 provides a synopsis of the variables across countries. Malaysia has the highest per capita GDP per worker (13976.15 Dollars) followed by Thailand and Sri Lanka. However, the growth rate of GDP per employee is highest in India followed by Sri Lanka and Indonesia. The average bank credit to the private sector is also highest in Malaysia followed by Thailand and India. These three countries (respectively) also have the highest average rate of broad money growth. Secondary education rate is highest in Sri Lanka followed by the Philippines and Thailand.

Nepal, Pakistan and India, the three South Asian countries, respectively, have the lowest GDP per worker. Nevertheless, India and Sri Lanka scores the fastest growth across the eight countries. Pakistan, Indonesia and Sri Lanka have the lowest average bank credit to the private sector, respectively. The same countries have the lowest broad money growth rate amongst the eight countries. The trade to GDP ratio is highest in Malaysia and Thailand.

Table 4.3: Descriptive statistics

Country	GDP (per worker)		Growth rate		Bank credit		Broad money/Y		Secondary education		Openness	
	Mean	St.dev	Mean	St.dev	Mean	St.dev	Mean	St.dev	Mean	St.dev	Mean	St.dev
India	2216.54	458.38	5.69	1.19	44.03	6.70	71.02	6.11	59.85	6.31	45.33	7.77
Indonesia	3010.06	372.47	3.59	1.17	25.72	2.66	41.26	3.17	71.19	7.99	54.17	5.76
Malaysia	13,976.15	1105.59	2.32	2.70	108.91	6.98	131.50	6.90	67.89	2.17	184.15	18.53
Pakistan	2144.26	61.49	1.06	2.91	24.38	4.50	43.83	4.01	32.44	2.68	33.31	1.71
Sri Lanka	3482.64	594.26	5.06	3.76	30.13	2.95	38.86	2.15	97.62	0.845	65.38	9.94
Thailand	5039.69	399.73	2.53	3.01	100.18	7.26	116.22	8.17	76.78	8.09	140.14	9.55
Nepal	669.44	49.82	2.39	0.90	42.17	13.35	66.09	11.29	55.58	7.77	44.79	1.60
Philippines	3143.16	269.19	2.55	1.82	30.51	1.91	59.09	2.45	82.79	2.05	82.96	15.52

Note: GDP per worker is the per capita real GDP per person employed (constant 1999 US$), Bank credit is the domestic bank credit to the private sector as a % of GDP, ratio of M2/Y is the ratio of M2 to GDP, secondary education is measured by gross secondary school enrolment as a % of GDP and Openness is measured by the ratio of trade to GDP.

Table 4.4 summarises profit and cost efficiency, estimated using data from 191 banks across eight countries. We have used Schmidt and Sickles (1984) fixed effect SFA analysis. Profit can be negative. Therefore, we have added 1 with profit data, in order to avoid negative values. We have not distinguished between private and public banks, due to the small sample size. Malaysia has the highest profit efficiency followed by Philippines. These two countries also have the highest cost efficiency. The lowest profit efficiency is recorded for India, followed by Indonesia and Nepal. Indonesian banks are found to be the least cost efficient. [85]

[85] Tables A4.1 to A4.8 in appendix 4.1 provide the estimation results for profit and cost efficiencies.

Table 4.4: Estimation of bank efficiency

	Profit efficiency		Cost Efficiency	
	Mean	St. dev	Mean	St. dev
India	57%	0.10	59%	0.13
Indonesia	53%	0.21	55%	0.24
Malaysia	90%	0.04	92%	0.03
Nepal	59%	0.12	62%	0.77
Pakistan	60%	0.10	60%	0.12
Philippines	89%	0.19	92%	0.52
Sri Lanka	70%	0.01	85%	0.07
Thailand	68%	0.09	82%	0.45

Note: the profit and cost efficiencies have been calculated using equation 4.17

4.3.4.2 Estimation results from dynamic panel for Bank credit and broad money

Results from the growth model estimation of equation (4.5) are represented in the following tables. We assumed GDP per worker and the profit and cost efficiency as endogenous variables. Table 4.5 presents the estimation results, using both of the measures of financial volume. The results from the two-step system GMM suggest the relevance of both of the financial volume measurements for growth rate of GDP per worker. Both of the variables for our volume measurement are significant at the 10% level. However, the human capital (measured by gross secondary school enrolment) and openness (proportion of trade to GDP) variables are only significant for the estimation with the bank credit volume.

The next level of analysis considers the effects of financial development on economic growth in terms of the quality of financial development, which is measured by bank profit and cost efficiencies for the 8 countries of the sample. In this case, we have only used bank credit to compare the volume with the quality of financial developments.

Table 4.5: Financial volume effects on economic growth

Variable	Quantity (bank credit to the private sector)	Broad money
GDP_{t-1}	0.052**	0.521**
	(0.92)	(1.79)
$Bankcredit$	0.297*	-
	(0.10)	
$Broad\ money$		0.471*
		(0.10)
$Inflation_{t-1}$	-0.003	-0.003
	(0.10)	(0.13)
$Inflation_{t-2}$	-0.005	0.003
	(0.29)	(0.67)
$SecEducation$	1.387***	0.437
	(0.024)	(0.42)
$openness$	0.173*	0.019
	(0.091)	(0.83)
$Observations$	64	64
$Countries$	8	8
AR_2	1.60	-0.70
$Prob > Z$	0.110	0.95
$Sargantest\chi^2$	66.47	70.54
$Prob > \chi^2$	0.12	0.12

Note: p statistics in the parentheses. *significant at 10%, **significant at 5% and ***significant at 1%

Table 4.6 presents the effects of the profit efficiency and interaction of profit efficiency with bank credit volume. The profit efficiency effect on regional growth is positive and significant. Marquez (2002) theoretically demonstrates that increasing competition can induce banks to lend excessively to borrowers with low credit ratings, thereby causing inefficiencies, which can be detrimental to growth. Therefore, in column two of the table we specify the quantity of bank credit and profit efficiency simultaneously. The measure of both quality and quantity is positive and significant. The result is slightly contradictory to Hasan *et al.* (2009), where they find significance of bank efficiency over the volume, for 11 European countries. Our result is more

plausible due to the fact that the 8 countries in our sample are developing, not mature economies and are yet to achieve their steady state growth rate. Therefore, both the volume and quality can be complementary to each other for economic growth.

We also verify if the interaction between bank quality and the volume of bank credit is significant in column three of table 4.6. The interaction term is also positive and significant. Secondary education and openness are also found to be significant for this analysis. Therefore, our findings suggest that both the volume and quality of financial development are important for these regions and they complement each other.

Table 4.7 summarises the results from the analysis of cost efficiency. The findings are similar to that of profit efficiency and growth. Cost efficiency on its own, as well as with bank credit, is important for economic growth. The interaction term is also highly significant. Our estimation suggests that better banking combined with the volume of bank credit to the private sector enhance economic growth.

However, in contrast to Hasan *et al.* (2009), we have not found any significant difference between the quality and volume effects of bank credit, cost and profit efficiency. Both of the measures of quality and volume are equally important for our estimation. Our results indicate that for the financial sector of developing countries, both efficiency and volume is important. One of the reasons for the contrast of the findings with Hasan *et al.* (2009) is that their analysis is based on 11 European countries and these are mature economies close to achieving their steady state growth rate. In this case, financial quality, rather than quantity, is more important for growth. However, from the perspective of developing economies, financial volume is still significant to ensure basic access of the population, and quality complements volume. Therefore, developments of both are important for emerging economies.

Table 4.6: Financial volume and financial quality effects on growth

Variable	Profit efficiency	Quantity +quality	Interaction
GDP_{t-1}	0.576	-0.031	0.39
	(0.00)***	(0.95)	(0.207)
$Bankcredit$		0.988**	
		(0.07)	
$Profitefficiency$	2.099*	0.953*	
	(0.08)	(0.081)	
$Inflation_{t-1}$	0.015*	0.100*	0.01*
	(0.06)	(0.09)	(0.10)
$Inflation_{t-2}$	0.001	0.013**	0.01**
	(0.59)	(0.023)	(0.035)
$Education$	-0.287	0.002	0.575*
	(0.13)	(0.67)	(0.094)
$Openness$	-0.115	0.081	0.335**
	(0.42)	(0.56)	(0.05)
$Quality$		-	0.058*
$* Quantity$			(0.12)
$Observations$	64	64	64
$Countries$	8	8	8
AR_2	-0.51	0.180	0.66
$Prob > Z$	0.60	0.857	0.51
$Sargantest\chi^2$	62.49	60.00	72.82
$Prob > \chi^2$	0.04	0.05	0.60

Note: p statistics in the parentheses. *significant at 10%, **significant at 5% and ***significant at 1%

Table 4.7: Financial volume and financial quality (cost efficiency) effects on growth

Variable	Cost efficiency	Quantity +quality	Interaction
GDP_{t-1}	0.492	0.072	0.183
	(0.05)	(0.87)	(0.62)
$Costefficiency$	3.17*	1.055**	
	(0.09)	(0.05)	
$Bankcredit$		0.691**	
		(0.07)	
$Inflation_{t-1}$	0.01*	0.010*	
	(0.08)	(0.07)	
$Inflation_{t-2}$	.001	0.012**	
	(0.16)	(0.01)	
$Education$	0.19**	0.003	0.980
	(0.03)	(0.89)	(0.02)
$Openness$	-0.000	0.098	0.203*
	(1.00)	(0.50)	(0.07)
$Quality$			0.100**
$* Quantity$			(0.02)
$Observations$		64	64
$Countries$		8	8
AR_2	-0.34	0.50	1.13
$Prob > Z$	0.734	0.62	0.26
$Sargan\ test\ \chi^2$	67.28	60.74	70.15
$Prob > \chi^2$	0.10	0.05	0.082

Note: p statistics in the parentheses. *significant at 10%, **significant at 5% and ***significant at 1%

4.4 Conclusion

The role of financial development in resource allocation and hence on sustainable economic growth, has long been a subject of interest amongst economists and policymakers. The hypothesis that financial development facilitates the efficient allocation of resources dates back to at least Schumpeter (1912), who presumed that banks identify entrepreneurs with good growth prospects and therefore help to reallocate resources to their most productive use. Starting from Goldsmith (1969), a large body of studies including McKinnon (1973), King and Levine (1993), Levine and Zervos (1998), Levine (2000), Levine *et al.* (2000), Beck and Levine (2001), Hasan *et al.* (2009) and many others provided evidence in favour of the role of financial development and growth.

Nevertheless, there is a debate over the importance of the financial sector. Some find a limited ability of financial development to stimulate growth. Robert Lucas (1988) asserts that economists 'badly over-stress' the role of financial factors in economic growth. Aghion *et al.* (2005) find the direct effect of financial intermediation is not significantly different from zero once a country achieves the steady state growth rate. It can only enhance the convergence to steady state growth.

Many studies have pooled developed and developing countries together in order to examine the relationship between financial development and economic growth. However, it is quite plausible that the impact of financial development depends on the stage of development of a country. The level of financial intermediation may be an important factor for economic growth at initial stages of development. However, for developed countries, the efficiency and composition of financial intermediation may be more important determinants for economic growth (Fitzgerald, 2006). Despite substantial and varied evidence, there are shortcomings associated with measuring the central concept under consideration, the functioning of the financial system (Čihák *et al.*, 2012).

Much research is based on a measure of the volume of financial intermediation, traditionally represented by monetary aggregates or the size of the banking industry. However, size is not always a good indication of quality, efficiency or stability. The traditional quantity proxies used to measure the financial development do not fully reflect the ability of the financial systems to enhance economic growth. Therefore,

some studies, such as Hasan *et al.* (2009) try to find an alternative measure. They estimated a more direct measure of the quality of financial institutions, by estimating profit and cost efficiency for approximately 7000 banks of 147 NUTS 2 regions, across eleven European countries. Their findings suggest that the efficiency effect is approximately three times as large as the quantity effects in the eleven European countries. The importance of quality over quantity has been emphasised for these mature economies, even though the interaction between them is also highly significant.

This current study also tries to gauge the impact of financial development, in terms of both quality and quantity, on eight South and South-East Asian developing countries over the period 2003 to 2012. The volume of financial development has been measured by bank credit to the private sector as a percentage of GDP and broad money growth as a percentage of GDP. The profit and cost efficiency of the banking sectors assessed the quality of financial intermediaries. The efficiencies are measured by stochastic frontier analysis using Schmidt and Sickles (1984) fixed effects model. Our findings from the profit and cost efficiency of banks suggests that there still remains substantial room for improvement of banking efficiency for most of these emerging countries.

The finding from the two-step system GMM estimation suggests that both financial volume and quality matters for the growth rate for these eight developing countries. We find that both measures of the volume of financial developments are important for growth, therefore, contrasting the findings of Hasan *et al.* (2009), where they find volume is insignificant for growth. Our results draw attention to the importance of specifying three distinct channels through which banks may enhance productivity and therefore, economic growth. They are: more efficient financial intermediaries, more private sector credit and, most importantly, the interaction between financial quality and quantity. The findings also imply that some of the fastest growing countries like India and Sri Lanka in our sample can enhance growth rates further by improving financial quality and quantity.

There are various aspects of financial intermediation. One of the shortcomings of our study is that we have not taken into account the stock and bond markets. Rather, the study concentrates largely on the development of the banking sector. The development of the stock and the bond market is much more relevant for developed than for developing countries. Developed countries have experienced significant non-

bank financial development, whilst financial development has mostly occurred within the banking system in developing countries (Khan and Senhadji, 2000).

However, efficiency of the financial institutions should not be taken for granted, especially as gathering information is one of their key functions (FitzGerald, 2006). Asymmetric information, externalities in financial markets (Stiglitz & Weiss, 1992) and imperfect competition can lead to sub-optimal levels of financing and investment, inefficient allocation of capital, or have other undesirable consequences such as bank runs, fraud or illiquidity which are detrimental for growth, particularly in the context of developing countries. The recent financial crisis is one such example. When financial institutions create complex financial instruments and sell them to unsophisticated investors, this might boost the bonuses of the financial engineers and executives associated with marketing the new-fangled instruments, while simultaneously distorting the allocation of society's savings and impeding economic prosperity. Improvements in risk sharing and household credit markets might also decrease saving as well as growth rates (Pagano, 1993). Therefore, appropriate regulations and oversight by public bodies with legal and institutional background is crucial in order to enhance the efficiency of financial markets and promote economic growth. Future research should incorporate the overall quality of financial intermediaries for evaluating its impacts on economic growth.

Appendix 4.1

Profit and cost efficiencies for eight countries

Table A4.1 Estimated coefficients of efficiency frontiers for India

Variables	$LnProf_t$	$LnCostf_t$
$\ln(INTR)$	0.03** *	1.10***
$\ln(NTR)^2$	0.00***	-0.07***
$\ln(INTC)$	-0.10***	0.98***
$\ln(INTC)^2$	0.01**	-0.09***
$\ln(OTHC)$	0.12***	-0.49***
$\ln(OTHC)^2$	0.01***	-0.07***
$\ln(CPRS)$	0.03***	-0.41***
$\ln(INTR) * \ln(INTC)$	-0.00**	
$\ln(INTR) * \ln(OTHC)$	0.003*	
$\ln(INTR) * \ln(CPRS)$	-0.006**	
$\ln(INTC) * \ln(OTHC)$	-0.03***	0.09
$\ln(INTC) * \ln(CPRS)$	-0.02***	0.02
$\ln(OTHC) * \ln(CPRS)$	0.02***	0.02
$\ln(Output) * \ln(INTC)$		0.11
$\ln(Output) * \ln(OTHC)$		0.14*
$\ln(Output) * \ln(OOC)$		0.04
Constant	0.12***	0.45***

Note: *** indicates significant at 1% level, ** indicates significant at 5% level and * indicates significant at 10% level

Table A4.2 Estimated coefficients of efficiency frontiers for Indonesia

Variables	$LnProf_t$	$LnCostf_t$
$\ln(INTR)\ or\ \ln(cost)$	0.013*	-0.51*
$\ln(NTR)^2$	-0.01	-0.07
$\ln(INTC)$	-0.01	0.17
$\ln(INTC)^2$	0.00	0.02
$\ln(OTHC)$	-0.00	-0.27
$\ln(OTHC)^2$	-0.00	-0.02
$\ln(CPRS)$	0.02	-0.27
$\ln(INTR) * \ln(INTC)$	-0.01	
$\ln(INTR) * \ln(OTHC)$	-0.00	
$\ln(INTR) * \ln(CPRS)$	-0.01	
$\ln(INTC) * \ln(OTHC)$	-0.00	-0.23
$\ln(INTC) * \ln(CPRS)$	0.00	-0.03
$\ln(OTHC) * \ln(CPRS)$	0.01	0.18
$\ln(Output) * \ln(INTC)$		0.36
$\ln(Output) * \ln(OTHC)$		-0.56
$\ln(Output) * \ln(OOC)$		-0.23
Constant	0.01***	1.90**
No of Observation	499	499

Note: *** indicates significant at 1% level, ** indicates significant at 5% level and * indicates significant at 10% level

Table A4.3 Estimated coefficients of efficiency frontiers for Malaysia

Variables	$LnProf_t$	$LnCostf_t$
$\ln(INTR)$ *or* $\ln(Cost)$	0.03**	0.87**
$\ln(NTR)^2$	-0.01	0.08**
$\ln(INTC)$	-0.07*	0.45*
$\ln(INTC)^2$	0.010	0.14
$\ln(OTHC)$	0.017**	0.63**
$\ln(OTHC)^2$	-0.00	0.06
$\ln(CPRS)$	-0.01	0.75*
$\ln(INTR) * \ln(INTC)$	-0.01	
$\ln(INTR) * \ln(OTHC)$	0.035***	
$\ln(INTR) * \ln(CPRS)$	0.012	
$\ln(INTC) * \ln(OTHC)$	-0.01	-0.25*
$\ln(INTC) * \ln(CPRS)$	-0.02	0.096**
$\ln(OTHC) * \ln(CPRS)$	-0.01	-0.06
$\ln(Output) * \ln(INTC)$		0.12
$\ln(Output) * \ln(OTHC)$		0.21
$\ln(Output) * \ln(OOC)$		0.03
Constant	-0.04**	1.73*
No of Observation	121	121

Note: *** indicates significant at 1% level, ** indicates significant at 5% level and * indicates significant at 10% level

Table A4.4 Estimated coefficients of efficiency frontiers for Nepal

Variables	$LnProf_t$	$LnCostf_t$
$\ln(INTR)\ or\ \ln(Cost)$	0.04**	-0.53**
$\ln(NTR)^2$	-0.05	0.13 *
$\ln(INTC)$	-0.07**	1.48 *
$\ln(INTC)^2$	-0.02 *	0.12
$\ln(OTHC)$	-0.03 ***	1.19
$\ln(OTHC)^2$	-0.00	1.65
$\ln(CPRS)$	0.40 *	-0.82
$\ln(INTR) * \ln(INTC)$	-0.05	
$\ln(INTR) * \ln(OTHC)$	-0.00	
$\ln(INTR) * \ln(CPRS)$	-0.00	
$\ln(INTC) * \ln(OTHC)$	0.07	-0.00
$\ln(INTC) * \ln(CPRS)$	-0.00	-0.08
$\ln(OTHC) * \ln(CPRS)$	0.10	0.08
$\ln(Output) * \ln(INTC)$	0.05	2.21
$\ln(Output) * \ln(OTHC)$		-0.04
$\ln(Output) * \ln(OOC)$		-0.04
Constant	-0.24***	3.13***
No of Observation	135	135

Note: *** indicates significant at 1% level, ** indicates significant at 5% level and * indicates significant at 10% level

Table A4.5 Estimated coefficients of efficiency frontiers for Pakistan

Variables	$LnProf_t$	$LnCostf_t$
$\ln(INTR)$	0.06 **	-0.37*
$\ln(NTR)^2$	-0.05*	0.12
$\ln(INTC)$	-0.19***	0.93 ***
$\ln(INTC)^2$	-0.03	-0.01
$\ln(OTHC)$	0.00	-0.13
$\ln(OTHC)^2$	0.00	-0.08
$\ln(CPRS)$	0.03	-0.53
$\ln(INTR) * \ln(INTC)$	0.03	
$\ln(INTR) * \ln(OTHC)$	-0.08	
$\ln(INTR) * \ln(CPRS)$	-0.01	
$\ln(INTC) * \ln(OTHC)$	-0.0*	-0.12
$\ln(INTC) * \ln(CPRS)$	0.005	-0.00
$\ln(OTHC) * \ln(CPRS)$	0.020	0.054
$\ln(Output) * \ln(INTC)$		0.031*
$\ln(Output) * \ln(OTHC)$		-0.09
$\ln(Output) * \ln(OOC)$		0.00
Constant	-0.22	-0.68
No of Observation	85	85

Note: *** indicates significant at 1% level, ** indicates significant at 5% level and * indicates significant at 10% level

Table A4.6 Estimated coefficients of efficiency frontiers for Philippines

Variables	$LnProf_t$	$LnCostf_t$
$\ln(INTR)\ or\ \ln(cost)$	-0.08	1.18*
$\ln(NTR)^2$	0.02	0.04
$\ln(INTC)$	0.17**	0.08*
$\ln(INTC)^2$	0.01	-0.08
$\ln(OTHC)$	-0.05 **	-0.49
$\ln(OTHC)^2$	-0.00	0.03
$\ln(CPRS)$	-0.00	0.53
$\ln(INTR) * \ln(INTC)$	-0.02*	
$\ln(INTR) * \ln(OTHC)$	-0.06	
$\ln(INTR) * \ln(CPRS)$	0.00	
$\ln(INTC) * \ln(OTHC)$	0.04	-0.05
$\ln(INTC) * \ln(CPRS)$	0.01	0.10 ***
$\ln(OTHC) * \ln(CPRS)$	-0.01	0.39
$\ln(Output) * \ln(INTC)$		0.80
$\ln(Output) * \ln(OTHC)$		-0.57
$\ln(Output) * \ln(OOC)$		-0.06*
Constant	0.13***	-0.56** *
No of Observation	240	240

Note: *** indicates significant at 1% level, ** indicates significant at 5% level and * indicates significant at 10% level

Table A4.7 Estimated coefficients of efficiency frontiers for Sri Lanka

Variables	$LnProf_t$	$LnCostf_t$
$\ln(INTR)\ or\ \ln(Cost)$	-0.19 **	-0.16
$\ln(NTR)^2$	-0.11	-0.01
$\ln(INTC)$	0. 02*	0.56*
$\ln(INTC)^2$	-0.04	0.00
$\ln(OTHC)$	0.04	-0.12
$\ln(OTHC)^2$	0.009	-0.00*
$\ln(CPRS)$	0.011*	-0.18
$\ln(INTR) * \ln(INTC)$	0.11	
$\ln(INTR) * \ln(OTHC)$	-0.02	
$\ln(INTR) * \ln(CPRS)$	0.00	
$\ln(INTC) * \ln(OTHC)$	0.01	-0.37
$\ln(INTC) * \ln(CPRS)$	-0.00	0.01
$\ln(OTHC) * \ln(CPRS)$	0.00	0.58
$\ln(Output) * \ln(INTC)$		-0.06
$\ln(Output) * \ln(OTHC)$		0.18
$\ln(Output) * \ln(OOC)$		0.09
Constant	-0.06	-0.94**
No of Observation	129	129

Note: *** indicates significant at 1% level, ** indicates significant at 5% level and * indicates significant at 10% level

Table A4.8 Estimated coefficients of efficiency frontiers for Thailand

Variables	$LnProf_t$	$LnCostf_t$
$\ln(INTR)$	-0.03	1.15***
$\ln(NTR)^2$	-0.00	0.11 ***
$\ln(INTC)$	-0.06	-0.86 ***
$\ln(INTC)^2$	0.007	-0.01
$\ln(OTHC)$	0.008	-0.24***
$\ln(OTHC)^2$	0.007	-0.04**
$\ln(CPRS)$	0.023	-0.11
$\ln(INTR) * \ln(INTC)$	-0.02***	
$\ln(INTR) * \ln(OTHC)$	0.012**	
$\ln(INTR) * \ln(CPRS)$	0.01*	
$\ln(INTC) * \ln(OTHC)$	-0.02***	-0.13 ***
$\ln(INTC) * \ln(CPRS)$	-0.00	0.06 *
$\ln(OTHC) * \ln(CPRS)$	-0.01	0.14**
$\ln(Output) * \ln(INTC)$		0.18*
$\ln(Output) * \ln(OTHC)$		0.05 **
$\ln(Output) * \ln(OOC)$		0.01
Constant	0.84***	-0.92***
No of Observation	326	326

Note: *** indicates significant at 1% level, ** indicates significant at 5% level and * indicates significant at 10% level

Chapter Five: Conclusion

5.1 Summary of the thesis

In this thesis, three separate research questions have been addressed. The chapters are mutually exclusive, but linked to each other by sharing different areas of applied macroeconomics. The thesis deals with empirical issues relating to exchange rate pass through, classification of monetary policy regimes and the role of financial development on economic growth.

There has been a resurgence of interest in the issue of the importance of monetary policy. Two main factors motivate this. First of all, a stream of empirical research beginning in the late 1980s has, successfully, demonstrated that monetary policy can significantly influence the short term course of the real economy (e.g., Romer and Romer, 1988; Bernanke and Blinder, 1992). Secondly, considerable improvements in the underlying theoretical framework used for policy analysis have contributed greatly to the success of modern monetary policy. Institutional support is designed to anchor inflation expectations in order to secure the credibility of a central bank's commitment to reducing inflation (Gurkaynak *et al*., 2007). There now seems to be broad agreement that the choice of how to conduct monetary policy has important consequences for aggregate activities. Therefore, it is no longer an issue to downplay.

The success of central banks in reducing inflation over the last three decades has contributed to economic growth and many other positive outcomes in both developed and developing countries. There has also been a decline in the pricing power of firms. Even though some have argued that the decline in pricing power has helped to keep inflation low, Taylor (2000) and many others have suggested vice versa. They argue that the decline in pass through or pricing power is due to the low inflation environment that has recently been achieved by many countries. In a microeconomic price setting model, Taylor (2000) demonstrated that lower pass through is a consequence of a lower perceived persistence of cost changes. Evidence is then presented showing that low inflation has, itself, caused low pass through. With the aid of an economy-wide model consistent with the micro model, he attempts to illustrate how changes in pricing power affect output and inflation dynamics in a favourable way. However, the benefits can disappear quickly if there are changes in monetary policy preferences or expectations.

Over recent decades, many leading economists have proposed specific policy rules, or have at least staked out a position on the general course of what monetary policy should be. A few of them have advocated for monetary policy regimes with some kind of nominal anchors, deeming them to be more appropriate for growth and inflation. Both growth theory and the literature on monetary policy regimes suggest that the type of regime could have consequences for short and medium-term growth, either directly through its impacts on shock adjustment, or indirectly through its impacts on other important determinants of growth (*e.g.,* investment, international trade, and financial sector development). However, there is no clear indication provided by economic theory as to what kind of regimes are more likely to promote growth. Therefore, the issue is largely empirical. The chapters of the thesis have addressed some of these ongoing issues, where monetary policy has a great deal of influence.

The 2nd chapter of the thesis examines exchange rate pass through. Firstly, we have estimated exchange rate pass through for 39 countries over the period 1981 to 2010, as well as across different monetary policy regimes, to account for structural changes based on inflation. Pass through elasticities are not constant over time. Therefore, it is crucial to take account of structural changes when estimating pass through elasticities. Independent break tests, such as CUSUM tests, have been used to select the structural breaks. We have also constructed a trade weighted exchange rate index and foreign producers' price index to replace the nominal effective exchange rate and foreign producers cost, in order to estimate pass through elasticities. In the second step, we have examined the macroeconomic factors behind the pass through elasticities.

Our findings suggest a decline in pass through elasticities for many countries over the last decade. However, over the period of financial crisis, some countries experienced an upward shift in pass through elasticities (e.g., India, Malaysia, Pakistan, Singapore, and the UK). Findings from the second stage analysis suggest that both average inflation and inflation volatility have a strong negative impact on pass through elasticities. Inflation targeting regimes and greater central bank autonomy reduce pass through elasticities.

We have conducted a *de facto* classification of monetary policy regimes for 123 countries from 1970 to 2013 in the 3rd chapter. We try to separate the exchange rate regimes from other monetary policy regimes, such as inflation or monetary targeting regimes. We have specified some criteria to classify 7 exchange rate regimes and 4

inflation and monetary targeting regimes. The yearly classification of exchange rate regimes has been carried out by using monthly data, and on the basis of volatilities of exchange rates and their changes, and the relative volatilities of changes in exchange rates and reserves. Inflation targeting and monetary targeting regimes have been classified on the basis of policy interest rates, changes in inflation and monetary growth of both broad and narrow money. Overall, 10% of regimes have been classified as either some kind of inflation and monetary targeting regime. There is evidence of a less pronounced move away from the intermediate regimes since the late 1990s. 22% of the time, inflation targeting regimes are not identified as *de facto* inflation targeting regimes. 74 periods of 12 non-inflation targeting countries are found to be consistent with *de facto* inflation targeting regimes. The regime classification has a 33% correlation with that of the IMF and a 45% correlation with Reinhart and Rogoff's (2002) exchange rate regime classification.

We also examine the impact of our estimated *de facto* regimes on growth and inflation. We find that regimes with nominal anchors perform better than others for growth and inflation. Inflation is significantly lower in inflation targeting and monetary targeting regimes, particularly for non-industrialised countries. Regimes characterised as fixed exchange rates also have lower inflation, compared to the rest of the exchange rate regimes. Overall, our findings suggest that monetary policy regimes with nominal anchors are beneficial for growth.

The impact of financial development on growth is analysed in the 4th chapter. We examine the relationship between financial development and growth for eight South and South East Asian developing countries over the period 2003 to 2012. Unlike most previous studies, we attempt to measure financial development in terms of both quality and quantity. We measure the quality of financial intermediation, for the first time in these countries, by the cost and profit efficiencies of 191 banks, covering the period 2003 to 2012. The quantity of financial intermediaries has been measured by the broad money growth and credit to the private sector provided by the banking industry, both as a percentage of GDP. The findings from two-step system GMM estimations suggest that both financial volume and quality matters for growth in these eight developing countries. Therefore, an interaction between quantity and quality is desirable for growth enhancement.

5.2 Limitations and Future Research

This thesis has examined some key questions in applied macroeconomics by constructing and analysing new datasets and regime classifications, and has arrived at a number of important, policy relevant, conclusions. Overall, our findings suggest that the design of monetary policy has significant implications for macroeconomic performance. We conclude with some limitations of the study and discussing some avenues of future research.

In chapter 2, we tried to assess the effect of exchange rate pass through on the consumer price index. One of the limitations of our study is that there are asymmetries in exchange rate pass through. An exchange rate appreciation might not have the same pass through elasticity, compared to a depreciation. Business cycles could exert significant impacts on pass through. For example, Correa and Minella (2010) find the presence of nonlinear mechanisms of pass through from the exchange rate to inflation in Brazil over the period 1995 to 2005. Their findings suggest that short run pass through is higher during periods of faster growth and when exchange rate depreciations are above some threshold value and volatility of the exchange rate is relatively lower. A future improvement of the current study would be to incorporate these factors into our understanding of pass through for the countries studied. Another limitation here relates to the constituents of aggregate CPI. A substantial proportion of the components of the CPI index consist of domestics services (for example, housing costs and expenditure on domestic services). This might, to some extent, account for the lower exchange rate pass through in CPI inflation compared to import price inflation, but possibly not to a large extent. Any future research should take account of this issue.

In chapter 3, we have classified *de facto* monetary policy regimes. The classification has been done on the basis of observable data. There is, sometimes, a lack of transparency regarding the exact targets among countries which actively adopted monetary targets, specifically during the monetary targeting era of the 1970s and 1980s. Often, monetary targets were not as explicit and transparent compared to inflation targets. Another extension of the current research could be with regard to the endogeneity of monetary policy regimes. The literature on the endogeneity of monetary policy is largely concerned with exchange rate regimes, not on other monetary policy regimes like inflation targeting or monetary targeting.

In chapter 4, we have measured the quality and quantity of financial development in terms of banking sector development. Clearly, there are other measures of financial development one can consider, however we tried to restrict our analysis to the banking sectors. Levine and Zervos (1996) find that banks provide different financial services to those of stock markets and both sectors are important for growth in developing countries. A well organized and deeply spread banking sector is a clear indicator of a well-developed financial sector of a country. The banking sector constitutes the largest component of the financial system in most developing countries. For instance, in India, about 49 per cent of external funds for small and medium firms come from banks and term-lending institutions (NSSO, 2008).[86]

Nevertheless, there are distinctions between domestic and foreign banks in terms of their impacts on economic growth. We have not segregated the impacts of domestic banks from foreign banks into our analysis. A study by Detragiache *et al.* (2006) finds evidence that in poor countries, a stronger foreign bank presence has been associated with slower credit growth, accompanied by less access to credit. An article by Winkler (2009) on rapid financial deepening in south-eastern Europe suggests that the impact of foreign banks on financial sector development has been far from uniform. The strategy of fostering financial development, based on strong foreign banks, does not automatically provide a guarantee for financial stability. On the contrary, advocates of foreign banks claim that these banks can achieve better economies of scale and risk diversification then domestic banks. Moreover, foreign banks generally have access to advanced technology, better supervision, regulations and enhanced competition in the domestic financial sector. A natural extension of the current study will certainly be to segregate the analysis on the basis of domestic and foreign banks in developing countries. Another problem, particularly with developing countries is the data limitations. For many developing countries, bank level data needed for conducting valid analyses are not available. The rapid development of databanks will obviously help to reduce such limitations and will certainly pave the way for new and interesting research in the future.

[86] National Sample Survey Organisation

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