

Impact of financial market developments on the monetary transmission mechanism¹

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1. Introduction

The objective of this paper is to determine how the monetary transmission mechanism is affected by financial market developments. The study is motivated by the fact that the Malaysian financial system has undergone tremendous change in the last decade and that the pace of change is only likely to accelerate in the coming decade. Given that monetary policy works through its influence on prices in the financial system, some of these changes could have important implications for the way monetary policy changes are transmitted through the financial system. These changes could have important implications for the effectiveness of monetary policy.

We adopt two approaches in this paper. The first is to trawl the relevant literature and attempt to summarise the key findings regarding the implications of financial developments for monetary policy. Many of these studies are done for the financially developed countries, but by looking at their findings, we can gain important insights into the consequences of both changes that are already occurring in our financial systems, and those that are likely to occur in the future. The second approach used is an empirical study of how some types of financial developments could potentially influence the way in which changes in the policy rate are transmitted to various types of market interest rates.

The paper is organised in three parts. In the next section, we summarise the role of financial markets in the monetary transmission mechanism. In Section 3, we present the key findings from our survey of the literature. Section 4 describes the empirical study and its main findings, and we conclude with some thoughts on what is known about the impact of financial developments on monetary policy.

2. The role of financial markets in the monetary transmission mechanism

Financial markets are central to the conduct of monetary policy, as monetary policy is implemented largely through operations in these markets. The effectiveness of the transmission of monetary policy to the real economy hinges crucially on a set of parameters that are affected by the structure of the financial system; that is, the existence and degree of development of financial markets, and changes in these markets that affect their functioning.³ Although economic theory has recognised this relation and even though this issue has been

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³ Krause and Rioja (2006) empirically analyse how financial development is related to monetary policy for 37 countries. Their results suggest that more developed financial markets significantly contribute towards explaining more efficient policy implementation (controlling for central bank independence, inflation targeting and membership in EMU).

debated in various forums,⁴ empirical studies examining the ramifications of financial market developments for monetary transmission remain scant.

The five main channels in the monetary transmission mechanism literature are the interest rate or money channel, the credit channel, the exchange rate channel, the asset price or wealth channel and the most recent addition to the literature, the expectations channel.

The transmission of monetary policy through the interest rate mechanism has been a standard feature in the economics literature for the last seven decades, as proposed in the basic Keynesian model. This channel operates through its impact on the cost of capital, affecting both businesses' and households' investments and spending decisions. Taylor (1995) takes the position that there are strong interest rate effects on consumer and investment spending, and hence a strong interest rate channel of monetary policy.

The role of credit channels arises from the problem of asymmetric information and costly enforcement of contracts, which creates agency problems in financial markets. Because of this, banks are viewed as playing a special role in the financial system, and hence give rise to the importance of the credit markets in transmitting monetary policy. Two important channels under the credit view are the bank lending channel and the balance sheet channel. The bank lending channel stands on two premises. The first of these is that banks are resource-constrained in that monetary tightening can effectively influence their supply of credit to the markets. The second is that some borrowers are bank-dependent as they cannot easily access financing from the capital markets, possibly because of their size. The balance sheet channel operates through the financial health (or net worth) of borrowers. From the lenders' point of view, lower net worth⁵ of borrowers implies a greater problem in adverse selection and moral hazard and these affect the supply of financing. Based on the borrowers' perspective, a reduction in the value of their financial assets signals the possibility of impending financial distress, which reduces their desire to spend.

With growing openness of an economy, the exchange rate may also play an important role in imparting monetary policy changes through its impact on net exports and aggregate demand. Thus, the exchange rate channel of transmission must also be considered in the case of an open economy. In addition, other asset prices such as equity prices and real estate prices⁶ could potentially play a role in the transmission of monetary policy through the Tobin's Q effect on investments, as well as the wealth effects on consumption.

Parallel to central banks' move of adopting a single interest rate as the policy interest rate to signal monetary policy changes, increasing attention is now also being paid to the expectations channel of monetary policy. This is because changes in official interest rates can influence expectations about the future course of real activity in the economy.

3. Financial market developments and the monetary transmission mechanism

This section of the paper discusses different types of financial market developments, their theoretical underpinnings, and empirical evidence in relation to monetary transmission. Chart 1 provides an overview of some of the main types of developments. Topics that have a red tick mark next to them are the ones that are addressed in this paper.

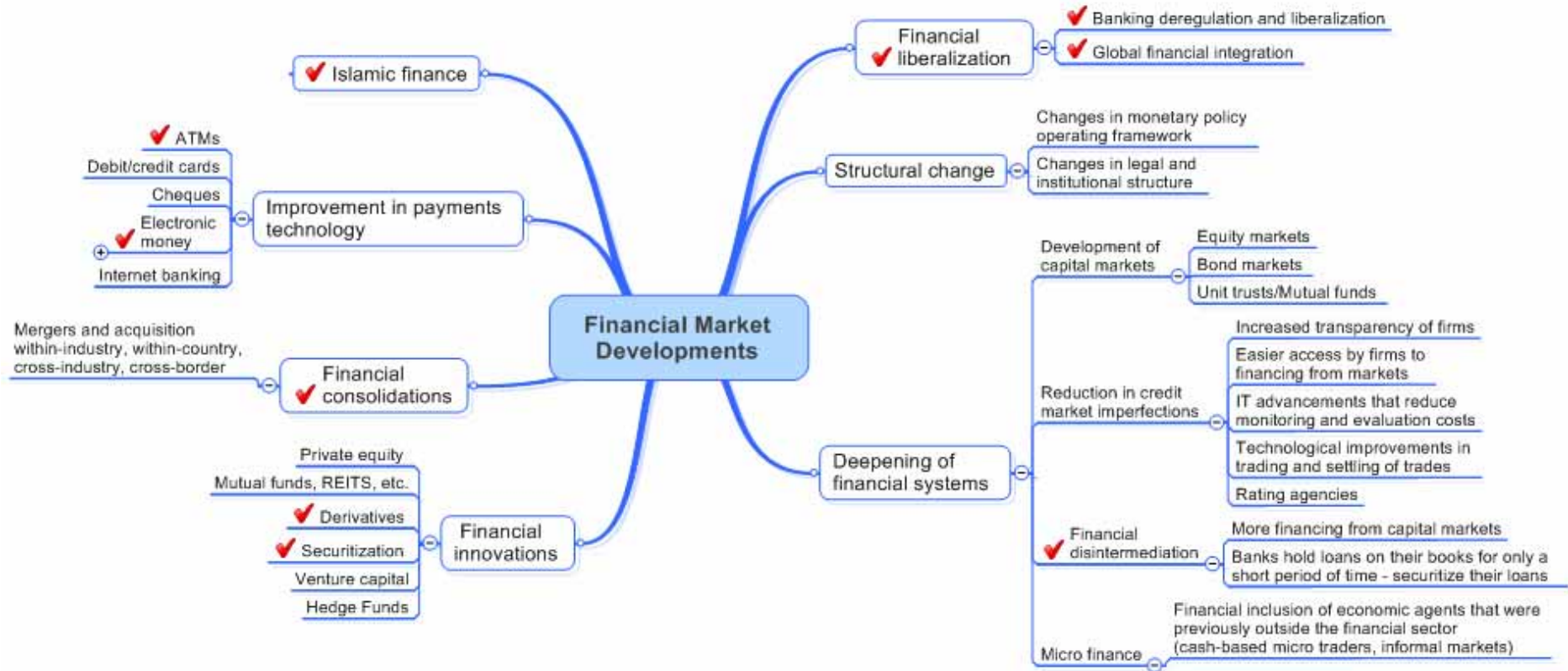
⁴ An example is the conference on "Financial Innovation and Monetary Transmission" held at the Federal Reserve Bank of New York in April 2001.

⁵ An increase in the interest rate reduces the value of collateral and other asset prices of borrowers, thus reducing net worth.

⁶ Meltzer (1995) argues that changes in monetary policy in the 1980s and 1990s in Japan had an important impact on the economy through their effect on land and property values.

Chart 1

Overview of financial market developments



3.1 Financial liberalisation

While there is continued debate on the extent, speed and sequencing of financial liberalisation, there seems to be a consensus that a more liberalised financial system is desirable and leads to greater efficiency of financial intermediation. Consequently, the trend in many Asian economies has been towards increased liberalisation of financial systems in terms of reductions in constraints on price setting as well as on the participation of new players. In line with the increasing openness of Asian economies, over time, their financial systems have also become increasingly linked to the global financial system and are consequently being increasingly influenced by developments in other financial systems.

3.1.1 Interest rate deregulation

The most important aspect of financial liberalisation from the perspective of the transmission of monetary policy is the deregulation of interest rates. In Canada and Germany, interest rate liberalisation took place as early as 1967. The removal of deposit interest rate ceilings in the United States began with the introduction of the Monetary Control Act of 1980. Likewise in Australia, deposit interest rate ceilings were completely abolished in the early 1980s. In the case of the East Asian countries, the process of interest rate liberalisation was started in the 1970s and has continued into the current decade.

In principle, the removal of prescribed interest rates and interest rate ceilings allows policy rates to be transmitted to retail interest rates more quickly and to a larger degree, increasing the role of the interest rate channel. In the case of the United States, for example, Sellon (2002) argues that the impact of monetary policy on spending tended to occur more through credit availability i.e. the credit channel rather than through the interest rate channel during the time when interest rate ceilings were in effect. He shows that spending, particularly in the housing sector, was affected more by reduced credit availability than by higher interest rates prior to the deregulation of interest rates. Based on these arguments, Sellon then hypothesises that the principal consequence of the removal of deposit rate ceilings in the United States is that the interest rate channel is now likely to be a more important part of the monetary transmission mechanism.

Financial liberalisation promoted the emergence of new financial products⁷ and this gave rise to problems of measuring money, creating problems in estimating a stable money demand function. A stable money demand model is essential for the functioning of the interest rate/money channel as it helps to ensure that the pass-through is predictable, stable and efficient. Instability in the money demand models of most countries, plagued with the measurement problems of monetary aggregates, shifted central banks' focus from targeting money supply to targeting a specific interest rate. It is common practice nowadays for the central bank's policy stance to be encapsulated in a policy interest rate and for changes in policy stance to be communicated by changes in the policy rate. This development has led to other questions, such as the extent and speed at which policy rate changes are reflected in retail interest rates in the financial system. We examine exactly this question in the second part of this paper.

Cottarelli and Kourelis (1994) empirically examine the pass-through of money market rates to bank lending rates for 31 industrial and developing countries. They assess whether changes in pass-through can be explained by changes in the financial structure which include, among others, the degree of competition within the banking system as well as between banks and other intermediaries, and the existence of constraints on capital movements. Their results suggest that lending rates in most countries are strongly influenced by several factors: first,

⁷ The impact of financial innovation on monetary transmission is discussed in a later section.

the degree of competition and the existence of any constraints on competition among banks, such as the existence of barriers to entry. They find that very concentrated markets (measured by the market share of the five largest banks) behave like competitive markets as long as they are subject to entry threat. Second, lending rates appear to be less flexible in bank-based banking systems. Third, exchange controls reduce competitive pressures on the banking system and result in greater stickiness in lending rates and finally, the development of markets for securities enhances the flexibility of lending rates.

Financial liberalisation that facilitates greater competition, such as the removal of geographic barriers or product restrictions, will have an impact on the pricing of loans and financial services as well as an effect on how lending rates respond to changes in monetary policy. Studies⁸ undertaken for the Euro Area countries by various authors strongly suggest that greater competition within the banking system, as well as from the capital markets, results in faster pass-through.

3.1.2 Capital account liberalisation

In recent years, increased capital account liberalisation has brought about greater cross-border capital flows. Financial sectors worldwide have not only witnessed greater volatility in exchange rates and liquidity arising from these flows, but have also experienced cross-border financial consolidations and financial market integration.⁹ Greater financial market integration often induces an increase in market competition and this will have an impact on monetary transmission. In this case, de Bondt (2002, 2005) examines the pass-through of changes in the policy rate to bank deposits and lending rates in the Euro Area. Using the Error Correction Model (ECM) and Vector Autoregression (VAR), he finds a quicker retail interest rate pass-through after the introduction of a common monetary policy in 1999. Sander and Kleimeier (2004) also find that financial integration in the Euro Area has produced more competitive markets that improve the pass-through to deposit rates. Similar results are also found by Carlino and DeFina (1998), Heinemann and Schuler (2002), Kwapił and Scharler (2006), Sorensen and Werner (2006) and Chionis and Leon (2005).¹⁰

3.2 Financial disintermediation

Schmidt et al (1997) discuss the theoretical underpinnings of financial intermediation. According to them, based on theories by Townsend (1979), Diamond and Dybvig (1983), Diamond (1984) and others, banking institutions are a special type of intermediary that, under specific conditions, can solve specific information and incentive problems in the relationships between savers and borrowers better than other financial market players. This is the reason for the importance of banks as financial intermediaries, and it thus underscores banking institutions' role in transmitting monetary policy impulses. It also implies that changes in the nature of financial intermediation may have important implications for the operation of the monetary transmission mechanism.

⁸ For example, by Mojon (2000), de Bondt (2002), Sorensen and Werner (2006) and Gropp et al (2007). These studies not only examine the dynamic pass-through between market interest rates and retail rates in the Euro Area as a function of the degree of financial market competition but also analyse a host of other structural differences in the financial systems.

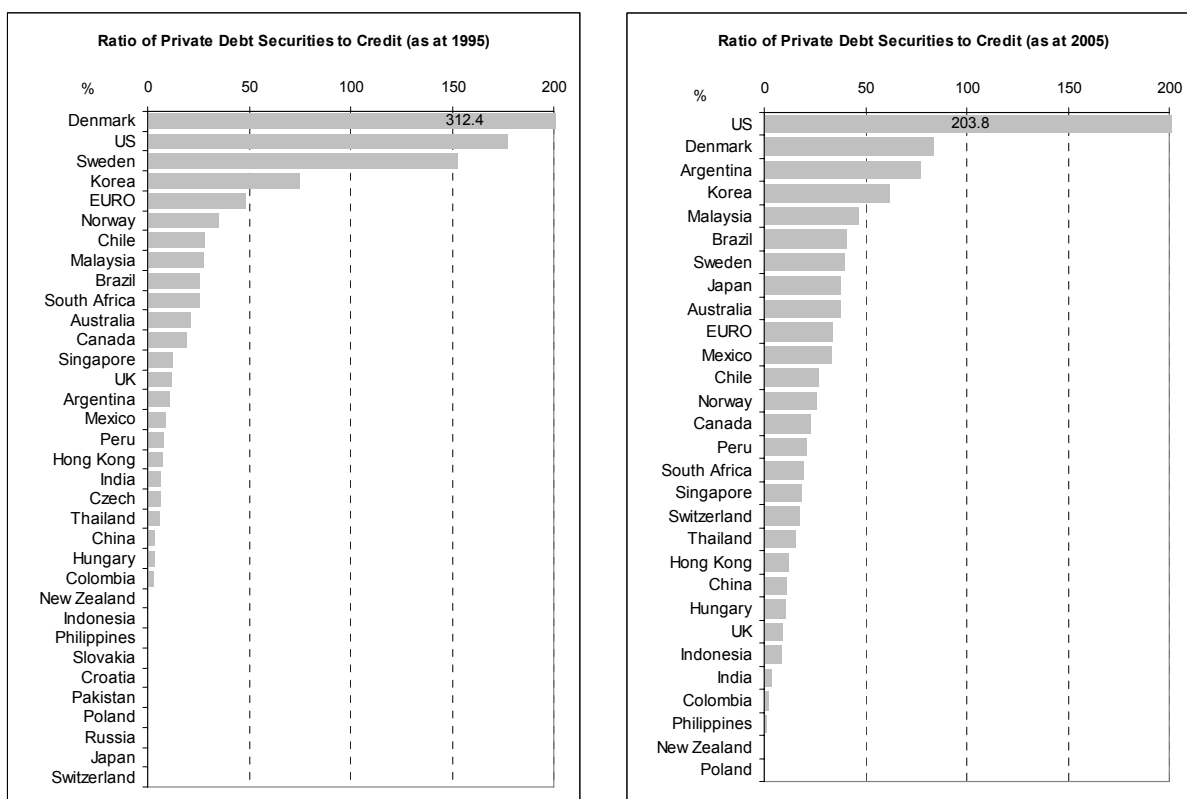
⁹ For discussions on the impact of financial consolidation (cross-border and domestic) and derivatives trading on monetary transmission, see the following sub-section.

¹⁰ Apart from Chionis and Leon (2005), who only analyse pass-through in Greece after EMU, the rest of these studies focus on pass-through for various groups of countries in the Euro Area.

Financial disintermediation implies a reduction in borrowers' dependency on the banking sector, and thus a decline in the role of the bank lending channel. A key development in recent years has been the rapid growth of the capital markets. One important consequence of the growing importance of these markets is that financial intermediation has increasingly shifted outside of the banking system as many borrowers and investors have switched to them from the banking sector. In short, the development of the capital markets has provided households and firms with alternative avenues to invest their savings and obtain their funding through the emergence of a broader range of investment and borrowing instruments, for example equities, various types of bonds and securities, and specialised investment instruments such as mutual funds.

Chart 2 suggests that the share of private debt securities (PDSs) has increased significantly in many countries over the last decade. In essence, there has been a general trend towards bank disintermediation, particularly in the United States and Australia. Nevertheless, there are countries (such as Denmark, Sweden and Canada) where bank loans continue to be an important source of financing.

Chart 2
Ratio of private debt securities to credit



Sources: BIS, IMF International Financial Statistics and authors' own calculations.

It is possible that because access to the capital markets for small firms may be limited, banking institutions will continue to be the main providers of loans to the medium-sized and small enterprises sector. To the extent that this sector remains large in an economy, the bank lending channel may continue to be a potent channel of transmission.

Sellon (2002) hypothesises that, in the case of the United States, changes in lending rates in recent years are less likely to affect large corporations and more likely to influence smaller

businesses and consumers when compared to a few years ago. Morsink and Bayoumi (2001) investigate the role of financial intermediation on monetary transmission in Japan. They find that bank lending continued to exert an important influence on financial intermediation in Japan for the period 1980–98. The authors attribute their results to the lack of alternative sources of borrowing for much of the non-financial private sector because neither the securities market nor lending by government financial institutions provided a significant offset to changes in bank loans. Generally, any development that reduces credit market imperfections, such as increased transparency of firms, rules that allow easier access by firms to financing from capital markets and technological improvements in trading can improve market access and thus potentially reduce the importance of the bank lending channel.

For banking institutions, the greater role of capital markets also facilitates the shift from the banks' own traditional interest-based activities, involving mobilising funds through deposits and lending out these funds, towards other fee-based activities. Most importantly, the development of capital markets has provided an alternative source of funding for banks, hence reducing the constraints on the availability of loanable funds. It is therefore possible that the bank lending channel, which stands on the premise of resource-constrained banks, has become less influential. The ramifications of greater financial disintermediation for the credit channel for different countries thus remains an empirical question and may vary considerably from country to country and over time, depending on the depth and breadth of the development of the capital markets as well as the structure of borrowers in the economy, i.e. the composition in terms of small and large firms.

In fact, parallel changes in the profile of the household sector also have implications for the relative importance of different transmission channels. Mojon (2000) examines the balance sheet structure of non-financial agents and how it affects the sensitivity of interest income and payments and of wealth to changes in money market rates and thus their implications for the interest rate channel in Germany, Spain, France and Italy. He finds that varying financial structure is eminent in inducing the differences in the strength of the interest rate channel. A study of the OECD countries by Mylonas et al (2000) shows that there is a shift in financial wealth out of bank deposits into institutions such as mutual funds, pension funds and direct holdings of bonds and equities. The study postulates that the possible implication of such financial disintermediation is that a larger fraction of total wealth may now be more sensitive to market movements in general and vulnerable to abrupt shifts in valuations. If so, these developments raise the potential for monetary policy to affect real variables through the wealth channel.

3.3 Financial innovations

Accompanying the development of the capital markets is the increase in innovations in the financial sector. Tufano (2002) broadly categorises financial innovations into two types, product and process innovations. Product innovation can be illustrated by corporate securities or derivative contracts, while process innovation can be demonstrated by new means of distributing securities, processing transactions or payment system technologies.¹¹

Securitisation and the introduction of derivative instruments have been happening for the last three decades. However, only in recent years have these markets grown in size and become vastly more complex. Securitisation enables the transformation of illiquid financial assets into highly liquid, marketable capital market assets. More specifically, it enables financial institutions to repackage and off-load their loans in the form of bonds, hence making their

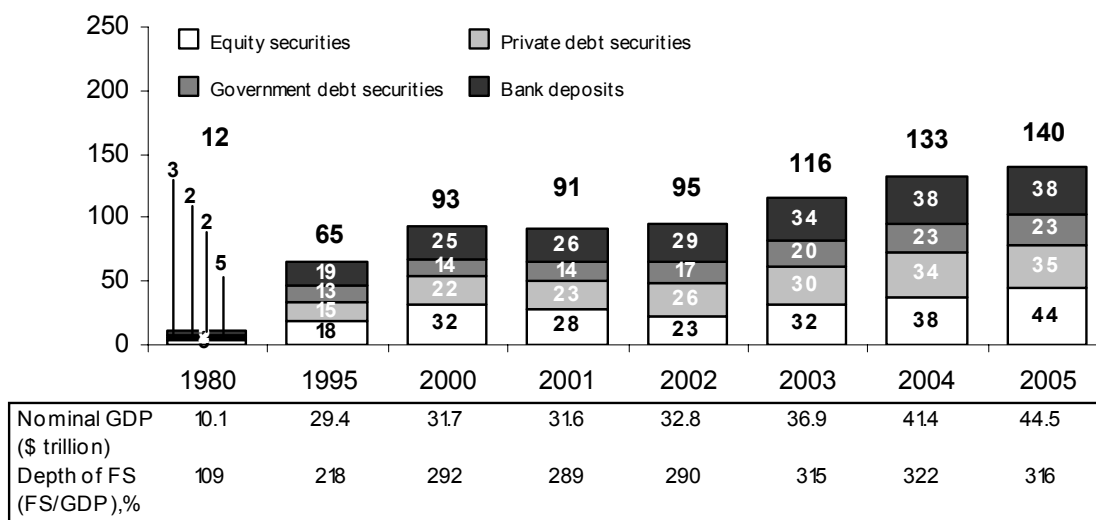
¹¹ The impact of payment system technologies is discussed in a later section.

lending activities less constrained and ultimately more attuned to market conditions. Furthermore, banks' fee-based activities, which include simultaneous securitisation and issuance of bonds, have led the interest rate payable by the non-financial sector to be closely related and sensitive to prevailing market interest rates.

Large-scale usage of derivative instruments has become a central feature of financial markets globally and activity in those instruments has been growing. Derivatives are used for hedging and the transfer of specific risks of an underlying security among economic agents. They can also generate high leverage, thereby raising the volume of transactions and reducing the costs of capital. In addition, derivatives also make it easier to arbitrage between different types of assets, i.e. increasing the substitutability between assets. Based on their study of the OECD countries using data from the BIS, Mylonas et al (2000) show that there is evidence of rapid growth of the mortgage-backed securities (MBS) market and the over-the-counter (OTC) market for interest rate derivatives.

In Chart 3, the growth rates of equity, private debt securities and government debt securities are used as measures of financial innovation while traditional banking is represented by bank deposits. The growth in equities and securities was twice that of bank deposits from 1980 to 1995 (growth of 657 percent over the 15-year period compared to 380 percent growth of bank deposits). The IMF's *World Economic Outlook* in September 2006 also reported significant increases in asset-backed securities (ABSs), banks' non-interest income and bank liabilities vis-à-vis non-bank financial institutions over the recent decade.¹²

Chart 3
Global financial assets
\$ trillion



Source: McKinsey Global Institute Global Financial Stock Database.

¹² Alternative investment vehicles, such as venture capital, are another example of financial innovation. According to Gompers and Lerner (1998) the growth in venture capital has been assisted by the rapid development in financial structures over the last two decades and the increasing importance of institutional investors as suppliers of venture capital financing.

The greater use of derivatives has two important implications for monetary transmission. First, it may improve transmission by extending the impact of changes in policy rates from short-term interest rates to the prices of assets in other markets as derivatives increase asset substitutability across financial markets. Indeed, based on an empirical assessment using data from the United States, Germany and Japan, Cohen (1996) suggests that derivatives accelerate the incorporation of new information into asset prices, thus facilitating greater asset substitutions. Furthermore, interest rate option contracts based on government securities, for example, can be used to protect against a change in the interest rate on a corporate security. This practice increases the link between the government and corporate securities markets, thereby strengthening the relationship between short-term and long-term rates. As such, Mylonas et al (2000) argue that derivative instruments are another reason for the increased sensitivity of asset prices to monetary policy actions, increasing the degree of the pass-through of changes in policy rates to the rates of return on various financial assets.

A second implication of the greater use of derivatives is that it may help create a less abrupt or extreme financial market reaction to monetary policy changes because these instruments are designed to help insulate firms, at least temporarily, from unexpected changes in their revenues and debt-servicing costs. However, this remains a conjecture as the hypothesis is rather difficult to test empirically.

Vroljik (1997) analyses the effect of incorporating the derivatives markets in examining the channels of monetary policy transmission. He argues that theoretically, derivatives trading speeds up transmission to financial asset prices, but changes in transmission to the real economy are ambiguous. Table 1 summarises the theoretical underpinnings of the impact of financial innovations on the various channels of monetary policy transmission as proposed by Vroljik.

However, in his empirical estimation, Vroljik is unable to find statistically strong evidence of the impact of derivatives on the monetary transmission mechanism in the United Kingdom.

On the other hand, Gomez et al (2005) conclude that monetary policy has lost some effectiveness in influencing real variables in the short run, due to the partial dilution of the main monetary transmission channels, i.e. the credit channels, caused by the completion of financial markets that derivative instruments imply. The hypothesis is that, given greater securitisation, the traditional bank lending channel will become less important. However, Gomez et al's argument is based on the assumption that monetary policy operates primarily via the credit markets, and that securitisation has transformed these markets and rendered monetary policy less potent. By estimating a partial equilibrium model of firm investment behaviour, Fender (2000) derives similar conclusions to Gomez et al (2005). In addition, Loutskina and Strahan (2006) and Edwards and Mishkin (1995) also find evidence of the weakening of the bank lending channel with the advent of financial innovations such as derivative instruments and securitisation.

An empirical study by Estrella (2002) finds that securitisation affected the effectiveness of monetary policy in influencing real output in the United States. Specifically, while the sensitivity of mortgage rates is higher with higher securitisation, he finds that sensitivity of output to the federal funds rate declines with higher securitisation. Thus, he suggests that the transmission of policy through the mortgage markets occurs primarily through changes in liquidity and the supply of intermediated credit, hence the credit channel, instead of the interest rate channel.

Table 1

Financial innovations and the monetary transmission mechanism

Channels	Impact of financial innovations
Interest rate channel Overall impact is marginal. Thus, financial innovation does not weaken the interest rate channel.	<i>Substitution effect</i> ↑ IR → Agents substitute saving for borrowing and ↓ Investment Derivatives enable IR (funding cost) to be hedged but future needs of investment cannot be easily hedged. Overall impact on substitution effect is small.
	<i>Income effect</i> ↑ IR → ↑ interest rate sensitive payments & receipts → ↓ spending. Derivatives enable agents to hedge interest rate sensitive payments and receipts exposures → MP has little impact via IR channel, i.e. IR channel weakens. But risk is now being transferred from hedged to unhedged agents, who will have double negative income effect. However, as the unhedged agents have lower marginal propensity to consume, the total income effect is now lower. Overall impact on income effect is ambiguous.
	<i>Wealth effect</i> Derivatives allow hedging on equities and properties. Hedging for equities is more common, but is much more difficult for properties. Overall impact on wealth effect is likely to be small.
Credit channel Overall impact is significant, i.e. the credit channel weakens due to financial innovations.	<i>Bank lending effect (channel)</i> Derivatives allow hedging on long-term lending. Securitisation makes banks less constrained during MP tightening. Overall impact is large, i.e. bank lending channel weakens due to innovations.
	<i>Balance sheet effect (channel)</i> Agents can hedge against declines in net worth due to asset price changes – collateral values unaffected. Overall impact is large, i.e. balance sheet channel weakens due to innovations.
Exchange rate channel Overall impact is to make the ER channel more potent.	<i>Net exports effect</i> ↑ IR → ↑ Inflows → ↑ Nominal ER (appreciate) → ↓ Net exports Nominal ER changes can easily be hedged, but not real ER changes, especially if they are due to changes in relative prices. Overall impact may be little, i.e. exchange rate channel remains potent.
	<i>Interest rate parity effect</i> Increased derivatives usage makes arbitrage trading across currency pairs easier and less expensive, encouraging increased arbitrage activity → ↑ international capital flows following IR changes (due to MP) → ↑ ER changes → ↑ speed at which real import and export prices change → change real economy sooner. Overall impact is that the exchange rate channel becomes more potent.

Source: Authors' summary.

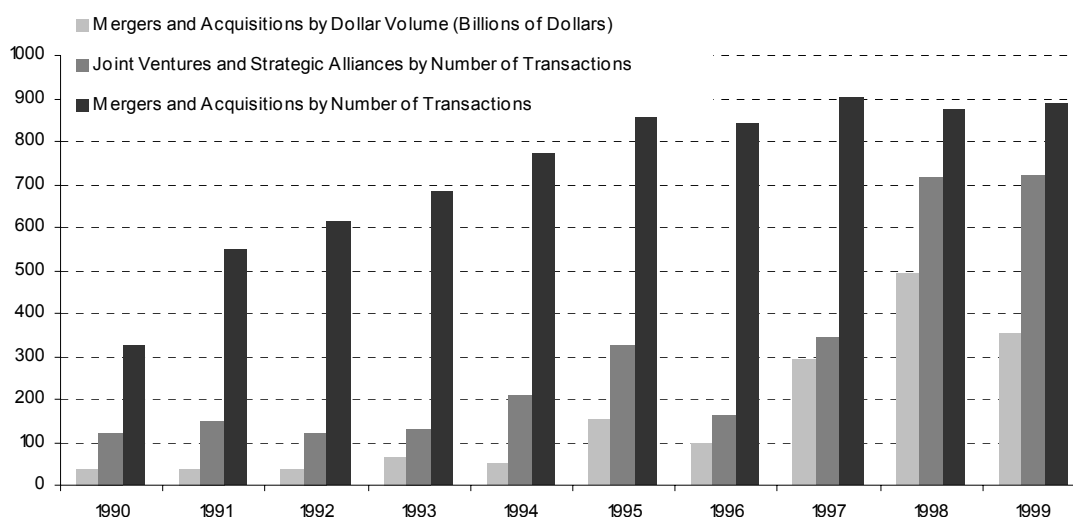
The issue of mortgage securitisation has attracted extensive research because of its implication for monetary transmission via the residential sector.¹³ McCarthy and Peach (2002) assess the possible changes in monetary transmission to this sector as a result of liberalisation of the sector and the introduction of mortgage securitisation. They find that mortgage securities reduce the housing sector's response to monetary policy. Aoki et al (2002) suggest that the link between house prices and consumption in the UK may have changed due to financial innovations such as mortgage equity, based on the financial accelerator model. Their model suggests that, because of the existence of mortgage equity, consumption responds more to monetary changes but housing variables and collateral values tend to respond less. Kuttner and Mosser (2002) provide an excellent summary of some of the studies with regard to financial innovations and monetary transmission.

Overall, the impact of financial innovations on monetary transmission remains contentious. Monetary policy may be powerful through its effect on asset values, which reinforce the direct impact on aggregate demand through the interest rate and wealth channels. However, monetary policy may take longer to have an influence on the economy, as wealth effects take longer to play out. At the same time, financial innovations that lead to the deepening of credit markets by improving the markets' liquidity would produce a market less susceptible to the impact of monetary policy changes through the credit channel.

3.4 Financial consolidations

The 1990s saw a strong wave of financial consolidation in financial sectors across the globe (Chart 4). Recent financial consolidation has been driven mainly by technological factors, deregulation and globalisation, as well as by the responses formulated by policymakers to resolve weaknesses in their financial systems. Greater financial consolidation might change the economic and financial environment in which monetary policy decisions are made, and thus it could also affect policy transmission.

Chart 4
Financial sector consolidation in the 1990s



Source: BIS.

¹³ Certainly, changes in the residential sector are not only driven by financial innovations such as mortgage securitisation and equity. Other factors such as fundamental restructuring and liberalisation of the sector are also playing a significant role in its transformation.

Financial consolidation may lead to a decreasing number of counterparties for monetary operations, thus reducing competition. The degree of pass-through is reduced if liquidity is reduced or volatility is increased in the interbank market due to the lower number of participants. Moreover, financial firms in a less competitive financial sector generally have greater power of discretion in terms of adjusting prices to changes in costs. Empirical studies by Hannan and Berger (1991) and Neumark and Sharpe (1992) support this view, as they find that interest rate rigidity is significantly greater in markets characterised by higher levels of concentration.

However, if financial consolidation led to the creation of large and strong banks, the resulting outcome would differ because larger institutions, often operating in several markets, may promote a faster arbitrage of interest rate changes across markets and assets, hence resulting in an improvement in the degree and speed of pass-through. As shown by Cottarelli and Kourelis (1994), the existence of large and strong banks operating in a competitive environment enhances pass-through. Therefore, the impact of financial consolidation on the pass-through of the policy interest rate to money market and retail interest rates is highly dependent on the competitive environment it creates. If it leads to increased competition, then pass-through is more efficient.

The creation of large and strong banks from the consolidation exercise may dampen the bank lending channel. Large and newly merged banks often have better access to alternative sources of funds because of lower information costs, which implies that their lending activities will be less constrained by monetary policy actions. In addition, if the consolidation process reduces small banks' share in the industry, then the effect of a contractionary monetary policy on the supply of bank loans is likely to be reduced, further weakening the credit channel.

The Group of Ten (2001) undertook a comprehensive study on financial sector consolidation which included the effect of consolidation on monetary policy. The report concludes that financial consolidation imparts negligible effects on monetary policy. The report also recognises the difficulty in assessing the independent impact of consolidation on interest rate pass-through and the relative importance of channels, as in many countries consolidation is accompanied by other financial market changes such as the introduction of new technology, the removal of barriers to entry and improved access to alternative sources of finance. English (2002) provides an excellent summary of the Group of Ten's report.

In the credit channel view of the transmission mechanism, collateral plays a crucial role in the lending process.¹⁴ It is, however, unclear whether consolidation will improve or worsen the asymmetric information problems between lenders and borrowers which underscore the importance of collateral. If larger and well capitalised banks can afford new technologies to assess borrower risk, thereby leading to more efficient evaluation of credit risks, then less collateral will be needed, thus reducing the role of the balance sheet channel in transmitting policy impulses. On the other hand, if a large multinational bank acquires a small local bank, there may be a loss of local knowledge, therefore necessitating greater use of collateral. This enhances the role of the balance sheet channel.

¹⁴ Collateral is not an issue in the conventional interest rate view of the transmission mechanism since enforcement on debt contracts is assumed to be costless. Conversely, if enforcement is costly, then lenders will ask for collateral in order to give loans, and this will result in some borrowers being constrained by the value of the collateral that they can provide. If this is the case, a policy contraction will reduce the value of collateral, and the borrowers that have to provide collateral will not be able to borrow as much.

3.5 Payment instrument technology

Financial markets have undergone rapid technological change over the last two decades, and nowhere is this more obvious than in the emergence of new payment technologies. The existence of Automated Teller Machines (ATMs) and electronic money (e-money) economises holdings of cash, while cheques and debit and credit cards represent alternative and more convenient modes of payment that affect the velocity of money. Arnone and Bandiera (2004) discuss the issues pertaining to electronic money, central banks' operations and monetary policy effectiveness. They conclude that as long as central banks continue to operate and retain control over short-term interest rates and money supply is used only as an information variable, the impact of digital money on monetary transmission is unlikely to be of concern.

The usage of credit cards allows greater consumption smoothing and to some extent boosts spending. To the extent that the pass-through to credit card rates is large and quick, the impact of monetary policy actions on consumption and spending will be significant. On the other hand, as credit cards provide a form of financing, akin to a personal loan, interest rate changes due to monetary policy will have a lesser income effect on households as credit cards can be used to cushion this impact.

Hawkins (2001) postulates that electronic money, finance, broking and trading affect the behaviour of agents in that they encourage greater consumption and investment. For example, the lower transaction costs resulting from the introduction of novel payment technologies may induce small investors to invest directly in the equity markets, thus accentuating the role of the wealth channel in transmitting monetary impulses. With electronic finance, previously constrained firms may be able to access a wider range of potential lenders including those outside the banking system, thus weakening the bank lending channel. Furthermore, the link between real activity and interest rate changes may be severed if hedging against exchange rate and interest rate fluctuations becomes easier and cheaper because of novel technology. Nevertheless, as these developments are relatively recent, there is a dearth of empirical studies examining these issues, and thus the above arguments remain conjectural.

3.6 Islamic finance

In Malaysia at least, the growth of the Islamic financial system could have implications for the conduct of monetary policy. There is evidence of some financial disintermediation from the conventional to the Islamic segment of the financial sector. In principle, the structure of Islamic financing requires the sharing of risks and profits in some pre-agreed ratios, leading to a significantly different method of determining returns within the Islamic financial system. This introduces possible issues regarding the transmission of policy rates to market rates.

It is possible that Islamic loans may be priced higher or lower than their conventional counterparts depending on their structure. Although Islamic deposits are expected to provide a rate of return that is somewhat comparable to conventional deposits, increases in interest rates could result in a lowering of the margins between the rate of return on Islamic loans and the cost of Islamic deposits. Although Islamic banks do utilise their profit equalisation reserves, which are built up to smooth out the fluctuations in their margins by helping them to pay depositors when the rates of return on deposits are rising, the reserves can be depleted if policy rates continue to increase, hence affecting their margins. As a result, to manage this risk, Islamic banks' pricing of loans could be higher than that of their conventional counterparts, although the differential may again be determined by the structure of risk and return sharing, and also constrained by competitive pressures. The implication is that the impact of monetary changes could be magnified or diluted for Islamic financial institutions relative to conventional financial institutions.

A study by Bank Negara Malaysia in 2006 suggests that the pass-through from policy rates to the Islamic money market is fast and sizeable and consistent with those of conventional estimates. In addition, the study finds that profit rates follow conventional money market rates closely, reflecting the evidence of arbitraging between the two markets. As such, as long as there is institutional arbitraging between the two markets, the transmission of monetary policy will be equally effective through the Islamic and conventional financial sectors.

3.7 Summary of main findings

Table 2 attempts to summarise the main findings from the literature survey.

Table 2
Summary of key findings

Financial Market Developments	Consequences on Financial System	Impact on Monetary Transmission Mechanism ¹	Impact on IR Pass-through ²
Financial Liberalisation	Promotes greater competition		
Interest rate deregulation	Leads to more flexible and market-determined interest rates	IRC ↑ BLC ↓	Faster
Capital account liberalisation	Leads to greater financial market integration	Makes foreign interest rates more important – capital flows	Could make domestic monetary policy less effective
Financial Disintermediation			
Development of capital markets	Move away from bank-based financial system	IRC ↑ if non-financial agents hold more interest-sensitive assets in their balance sheets (bonds and equity) BLC ↓; but BLC ↑ if number of smaller firms is large APC ↑ if non-financial agents hold more interest-sensitive assets in their balance sheets	Faster and larger
Financial Innovation			
Securitisation	Banks are less resource-constrained due to ability to securitise their assets	IRC unaffected BLC ↓ BSC ↓ APC ↑	Faster
Derivatives	Allows economic agents to hedge against price changes		

For footnotes, see the end of the table.

Table 2 (cont)
Summary of key findings

Financial Market Developments	Consequences on Financial System	Impact on Monetary Transmission Mechanism ¹	Impact on IR Pass-through ²
Financial Consolidation	Produces higher concentration ratio If accompanied by reduction in barriers to entry – ↑ competition	BLC ↓ BSC ↑ if larger banks have efficient credit risk evaluation (rely less on collateral); but BSC ↓ if a large multinational bank acquires a small local bank and loses the local knowledge, hence requiring greater use of collateral	Faster if consolidation leads to the creation of large and strong banks (promotes faster interest rate arbitrage) Slower if liquidity is reduced due to the smaller number of participants in the interbank market
Payment Instrument Technology	Reduces the use of cash as a mode of transaction (“cashless” society)	IRC ↓ BLC ↓ APC ↑	
Islamic Finance	Generates competition to conventional financial instruments and services	IRC unaffected (expected to weaken) BLC unaffected	Pass-through from policy rate to Islamic money market rate fast and large

¹ Transmission channels are defined as **IRC** = Interest rate/money channel; **BLC** = Bank lending channel; **BSC** = Balance sheet channel; **APC** = Asset price (wealth) channel. ² Interest rate pass-through = transmission of policy interest rate to market interest rates.

Source: Authors' summary.

4. Financial market developments and interest rate pass-through

Interest rate pass-through from the policy rate to retail bank deposit and lending rates along with other short-term paper rates and longer-term bond yields is certainly an important aspect of the monetary transmission mechanism, as it partly determines the effectiveness of monetary policy in affecting aggregate demand and inflation. A faster and stronger pass-through implies that monetary policy is becoming more effective in influencing the cost of funds, while a slower and weaker pass-through would mean that monetary policy is becoming less effective in this regard, and hence might become less effective in influencing aggregate demand.¹⁵

The question that we are trying to answer is whether financial developments have had any discernible impact on the monetary transmission mechanism by changing the interest rate

¹⁵ The final effect on aggregate demand and inflation, however, remains an open question that is not addressed by this paper. The final effect of policy rate changes might become stronger or weaker depending on the changes in the sensitivity of aggregate demand to various market rates as well as the sensitivity of inflation to changes in aggregate demand.

pass-through. We first estimate some interest rate pass-through figures for developed and Asian countries and then provide some assessment of the extent to which financial market developments may account for the differences in the speed and magnitude of this pass-through across these countries.

4.1 Findings of previous studies

One of the first empirical studies on interest rate pass-through was undertaken by Cottarelli and Kourelis (1994). The authors investigated differences in the size of the immediate and long-run pass-through across developed and developing countries, and the factors that would explain the differences in that pass-through. The authors suggest that the differences in pass-through could be due to differences in financial structure. The degrees of competition in the banking system, the extent of money market development, private-public ownership of banking institutions and barriers to foreign competition were among the possible explanations for the differences in interest rate pass-through. The authors also included per capita GDP and interpreted it as a proxy for financial market development, and attributed it as another possible explanation for differences in interest rate pass-through. There was, however, no obvious pattern whereby developed countries with higher per capita GDP had a speedier and stronger pass-through. Borio and Fritz (1995) studied the response of short-term bank lending rates to policy rates among the advanced countries and also found that there were significant differences in the results among countries in terms of the speed of adjustment, but they did not attempt to explain the reason for these differences in pass-through.

Since then, studies of interest rate pass-through have been undertaken by a number of authors. However, most studies have attempted to investigate only the pass-through to retail bank deposit and lending rates, and not the pass-through to short-term paper and long-term bond yields. In addition, the bulk of studies were undertaken for countries in the Euro Area. The main interest of these studies was to analyse the extent of the differences in the speed and magnitude of pass-through across countries in the Euro Area, and to determine if there was uneven transmission of policy rate changes across these countries following the adoption of the single monetary policy. The general findings of these studies were that there were significant differences in the speed and magnitude of pass-through in Euro Area countries, and most authors tended to associate these differences to the differences in the structure of the banking and financial systems. Mojon (2000) provided evidence that the differences in pass-through could be partly explained by differences in the degree of competition in the banking system and disintermediation through the development of the short-term securities market. De Bondt (2002) found a quicker retail interest rate pass-through process since the introduction of the Euro. On the other hand, Sorensen and Werner (2006) attributed the large degree of heterogeneity for both long-term pass-through and the speed of adjustment across Euro Area countries to the differences in the degree of competition in banking sectors across these countries. A more recent study by Gropp et al (2007) has provided further evidence of the importance of differences in competition in the banking system as an explanation for differences in pass-through among Euro Area countries. The authors also provided evidence that greater competition within and between banking systems, as well as the enlargement of bond and stock markets, would lead to speedier pass-through.

As part of their studies, some authors have also included the US as a benchmark country with a market-based financial system as opposed to the bank-based financial system in Euro Area countries. Kwapił and Scharler (2006) reviewed the empirical studies by various authors for the US and Euro Area, and found that the adjustment of retail bank deposit and lending rates was not instantaneous and was relatively smaller in Euro Area countries compared with the US. Only about half of the adjustment took place in the immediate period, and the long-run pass-through was also not complete. In contrast, the US had a high pass-through of almost 75 percent in the immediate period, and a nearly complete pass-through in the long

run. In a non-empirical paper, Sellon (2002) argued that changes in the US financial system over the past three decades have led to faster and larger interest rate pass-through. He pointed out several key developments that could have led to faster and larger pass-through. These include the removal of deposit rate ceilings and other geographical and product line barriers, the trend towards consolidation within and across financial services industries, the emergence and greater role of money market mutual funds and greater transaction volumes with the growth of mortgage-backed securities, and disintermediation from the banking system to the capital market as large corporations have started to meet their funding needs through the capital market. Estrella (2002) examined the impact of mortgage securitisation (as a ratio to total home mortgages) and found that mortgage securitisation increased the size of the pass-through of the fed funds rate to mortgage rates.¹⁶

There appears to be no study so far to investigate the nature of interest rate pass-through in Asian countries, especially in terms of trying to compare the differences between Asian countries as well as between Asian countries and developed countries with more mature financial systems. An exception here is Archer (2006). The author estimated and updated the de Brouwer (1995) estimates of pass-through from money market to lending rates across three different time periods (1990–95, 1995–99 and 2000–05). The study indicated that pass-through was already strong in the 1990s for developed countries, but became stronger and speedier from 2000 onwards. For Asian countries, pass-through was found to be stronger in the Philippines but weaker for Indonesia. No conclusion could be drawn for Malaysia and Thailand due to a breakdown in the estimated relationships for these two countries. The author, however, did not attempt to investigate possible explanations for the differences in interest rate pass-through between developed and Asian countries.

4.2 Empirical methodology

To assess the importance of financial market developments in influencing the pass-through from changes in the policy rate to bank retail rates and other market interest rates, we estimate differences in the nature of interest rate pass-through between developed industrial countries and developing Asian countries. The estimates of interest rate pass-through are then compared with various measures of financial market developments using simple cross-country correlation analysis to gauge the strength of the association between interest rate pass-through and various measures of financial developments.

In undertaking these estimations, we adopt the standard two-step Engle-Granger ECM approach. That is, in the first step, we estimate a long-run relationship between the market rate of interest and the policy rate:

$$i_t = \gamma^* + \beta^* p_t + \varepsilon_t$$

where i is the market rate of interest – retail bank deposit and lending rates, the short-term paper rate (proxied by the treasury bill rate) and the long-term bond rate (proxied by government bond rates) and p is the policy rate or short-term money market rate (as a proxy for the policy rate).

¹⁶ The author, however, found that mortgage securitisation has a negative impact on the effect of policy rate change on the output gap. He attributed this to the fact that mortgage securitisation increased the liquidity and supply of mortgage financing and resulted in a lower impact of interest rates on output.

In the second step, we then estimate the following short-run model incorporating the error correction term, i.e. the lag residual from the above long-run equation:¹⁷

$$\Delta i_t = \gamma + \alpha_1 \Delta i_{t-1} + \alpha_2 \Delta i_{t-2} + \beta_0 \Delta p_t + \beta_1 \Delta p_{t-1} + \beta_2 \Delta p_{t-2} + \delta \bar{\varepsilon}_{t-1} + \eta_t$$

In the above two equations, the immediate impact or pass-through is represented by β_0 and the “speed of adjustment” towards the long-run relationship is represented by δ . The long-run pass-through is represented by β^* . These are the three coefficients that we are interested in for our assessment of the effectiveness of the policy rate in influencing market interest rates.

Most empirical studies by other authors investigating interest rate pass-through have employed the ECM methodology. However, the alternative approach is to model interest rate pass-through based on the expectations hypothesis – that is, to differentiate changes in the policy rate into anticipated and unanticipated policy rate changes as advocated by Kuttner (2001). Kuttner proxied the **anticipated** policy rate change using the difference between the *previous period fed funds futures rate* and the *previous period spot fed funds rate* and the **unanticipated** policy rate change as the difference between the *current period spot fed funds rate* and the *previous period fed funds futures rate*. The author found that short-term paper rates in the US responded almost one-to-one to unanticipated policy rate change but not to anticipated policy rate change. Similar results were found for long-term bond rates although the pass-through from unanticipated policy rate change is less than one-to-one.

While a similar approach would clearly enrich the present study by allowing analysis of the impact of financial developments on the pass-through of anticipated and unanticipated policy rate changes, this approach is not possible for our study due to unavailability of long time series of short-term futures rates for most of the countries in our sample. In addition, overnight or short-term interbank rates were generally volatile in the early part of the sample period and most Asian countries have only recently adopted a monetary policy operating framework that centres on a policy rate.¹⁸

Before discussing our results, a few caveats are in order. First, the above equations presume that aside from the policy rate, there are no other variables that would explain the movement of market interest rates. We had initially included two additional control variables – annual inflation rate and the growth rate of the industrial production index – but we found that these two variables were generally not statistically significant. Second, for most industrialised countries, we have been able to compile data on the actual announced policy rates. However, policy rates were only adopted recently in some countries, especially Asian countries. To the extent that we employ the short-term money market rate as the proxy for the policy rate, it is assumed that there is a very close one-to-one relationship between the money market rate and policy rate. While this is generally the case in recent periods, the conduct of monetary policy in the early 1980s might not have used the same tools as those currently employed by central banks. The level of volatility of money market rates was generally higher in the 1980s compared with the period since the early 1990s. Third, as much as the availability of data permits, efforts have been made to ensure consistency in the

¹⁷ We initially estimated a more general model, i.e. with greater lag length. However, we finally chose to estimate an error correction mechanism with lag 2 as we found that lag 3 and above are generally not significant for most countries.

¹⁸ During our estimations, we have also tried to include lead observations of the policy rate as one of the possible explanatory variables to take into account the possibility that market interest rates react to expected policy rate changes (proxied by lead period policy rate) rather than the current level of the policy rate. However, we do not find the lead policy rate to be a statistically significant explanatory variable.

compilation of interest rate time series, especially those for lending rates.¹⁹ The preferred lending rate is the one associated with the prime rate offered to the best customers on new loans, instead of the average lending rate on outstanding loans.

4.3 Results

On the whole, there is evidence of significant differences in the nature of the pass-through of policy rates to both retail bank deposit and lending rates, as well as to short- and long-term bond rates across both the financially advanced countries and the Asian countries in our sample.²⁰

Table 3 and Charts 5 and 6 summarise the results for the sample:

- In the case of all the interest rates considered here, the pass-through in both the immediate period and the long run is higher in the developed countries than in the Asian countries.
- The speed of adjustment towards the long-run impact is also faster in developed countries, with the cumulative pass-through after three months being almost as high as its long-run level. This is clearly not the case with the Asian countries, which have a slower pace of transmission of policy rate changes to market interest rates.
- The gap between these two groups of countries is wider for immediate pass-through and much smaller in the long run. So while monetary policy changes are transmitted to market rates much more quickly in the developed countries, over the longer term, changes in monetary policy in the Asian economies do filter through to market interest rates to quite a significantly high level.
- Among the developed economies, the UK has the highest and fastest pass-through, while Germany has the lowest.
- Among the Asian economies, pass-through is generally larger and faster in Korea and Malaysia, but much lower and slower for the Philippines, Thailand and Indonesia.
- Among the different types of market rates, pass-through is largest and fastest for short-term paper rates followed by deposit rates. This is true for both groups of countries. However, in the case of the developed economies, lending rates come third and long-term paper rates are last. In the Asian economies, the reverse is true.

Notably, long-run pass-through is less than one, especially among the Asian countries. This is a result not unique to this study, as studies by other authors have also found interest rate pass-through to be incomplete. This is a puzzle, as it appears to indicate that a permanent one percent decline in policy rates would not be accompanied by an equivalent permanent fall in market interest rates.

There are a few possible reasons why this might be the case. First, during the earlier part of the sample period (1987–2006), many of the Asian countries still had some form of interest rate controls that could have made deposit and lending rates not fully responsive to changes in policy rates. Second, in the aftermath of the Asian financial crisis, despite the decline in policy rates, banks may not have significantly lowered their lending rates to compensate for the increased risks of defaults, or even to rebuild their eroded capital base. A third reason could be the fact that unlike their more developed counterparts, the Asian economies are characterised by a situation of surplus liquidity which, if not fully sterilised, could lead to discrepancies between market rates and policy rates.

¹⁹ Appendix III gives detailed sources of data and plots policy rates, deposit and lending rates, and short-term paper and long-term bond rates for the advanced and Asian countries used in the estimations.

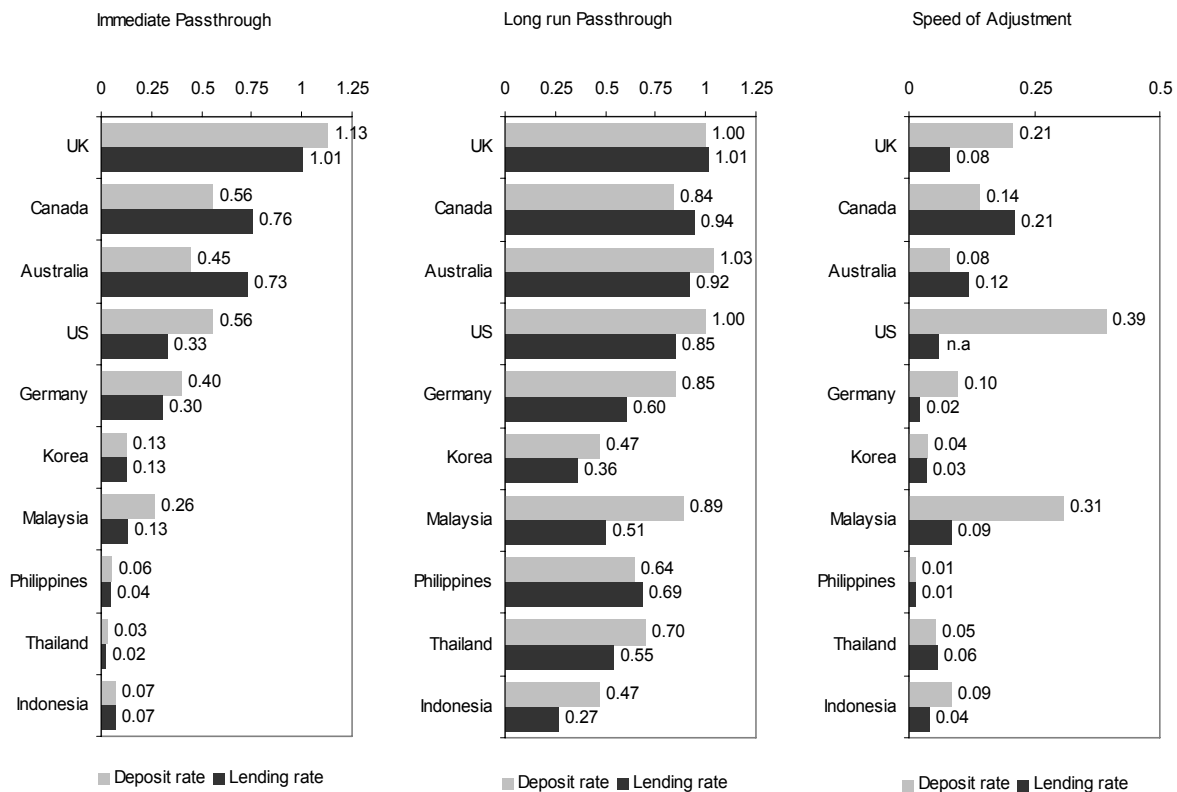
²⁰ We term the UK, Australia, Canada, the US and Germany as the financially advanced countries and Korea, Malaysia, the Philippines, Thailand and Indonesia as the Asian countries.

Table 3
Summary of estimation results

		Deposit Rate	Lending Rate	Short-term Paper	Long-term Paper
Developed Countries	Immediate Pass-through	0.40–1.13	0.30–1.01	0.43–1.16	0.15–0.60
	After 3 months	0.78–1.10	0.57–0.99	0.85–1.02	0.19–0.56
	Long-run Pass-through	0.84–1.03	0.60–1.01	0.88–1.00	0.65–0.83
Asian Countries	Immediate Pass-through	0.03–0.26	0.02–0.13	0.10–0.45	0.01–0.19
	After 3 months	0.10–0.72	0.15–0.40	0.20–0.67	0.05–0.37
	Long-run Pass-through	0.47–0.89	0.27–0.69	0.72–0.82	0.37–0.72

Chart 5

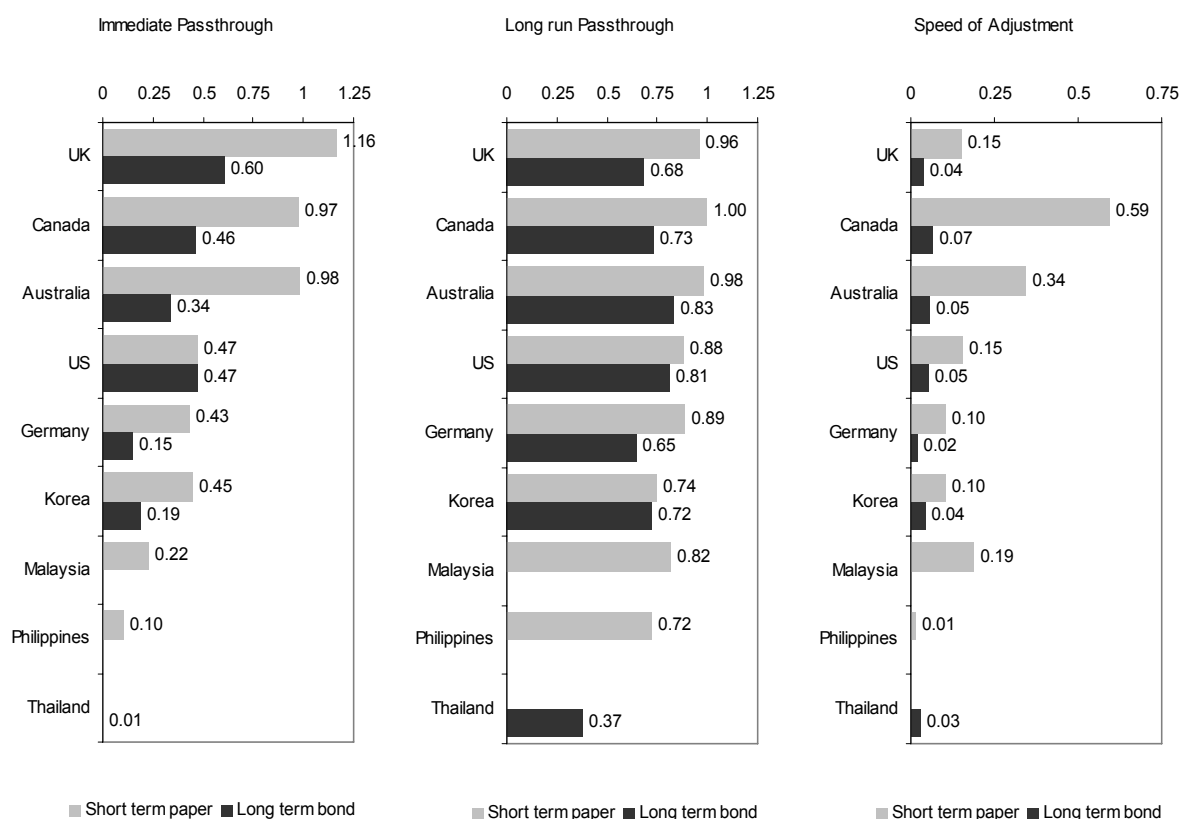
Estimated immediate and long-run pass-through and speed of adjustment of deposit and lending rates



Source: Authors' estimates.

Chart 6

**Estimated immediate and long-run pass-through
and speed of adjustment of short-term and long-term bond rates**



Source: Authors' estimates.

The incomplete pass-through could also reflect the state of development of the financial systems in these countries. A lack of alternative sources of financing as well as the significant presence of relationship banking may have made it difficult for bank customers to switch banks and thereby allowed the pricing of bank loans to be less sensitive to changes in policy rates. Similarly, banks might be able to continue offering lower deposit rates to customers if the customers do not have alternative saving instruments or when competition for deposits among banks is limited. From a broader perspective, the differences in the nature of interest rate pass-through across the developed and Asian countries must certainly reflect differences in the nature of the financial markets. The degree of competition within the banking system, as well as with non-bank financial institutions, and the size and composition of financial systems could have an important impact on the speed and size of interest rate pass-through. We provide some results on this in the following pages.

In looking at explanations for the differences in pass-through between the two groups of countries, particularly in the immediate period, one factor could be differences in the level of competition. Interest rate liberalisation and free competition among banks was a feature of financial systems in the developed economies during the sample period used for this study.²¹

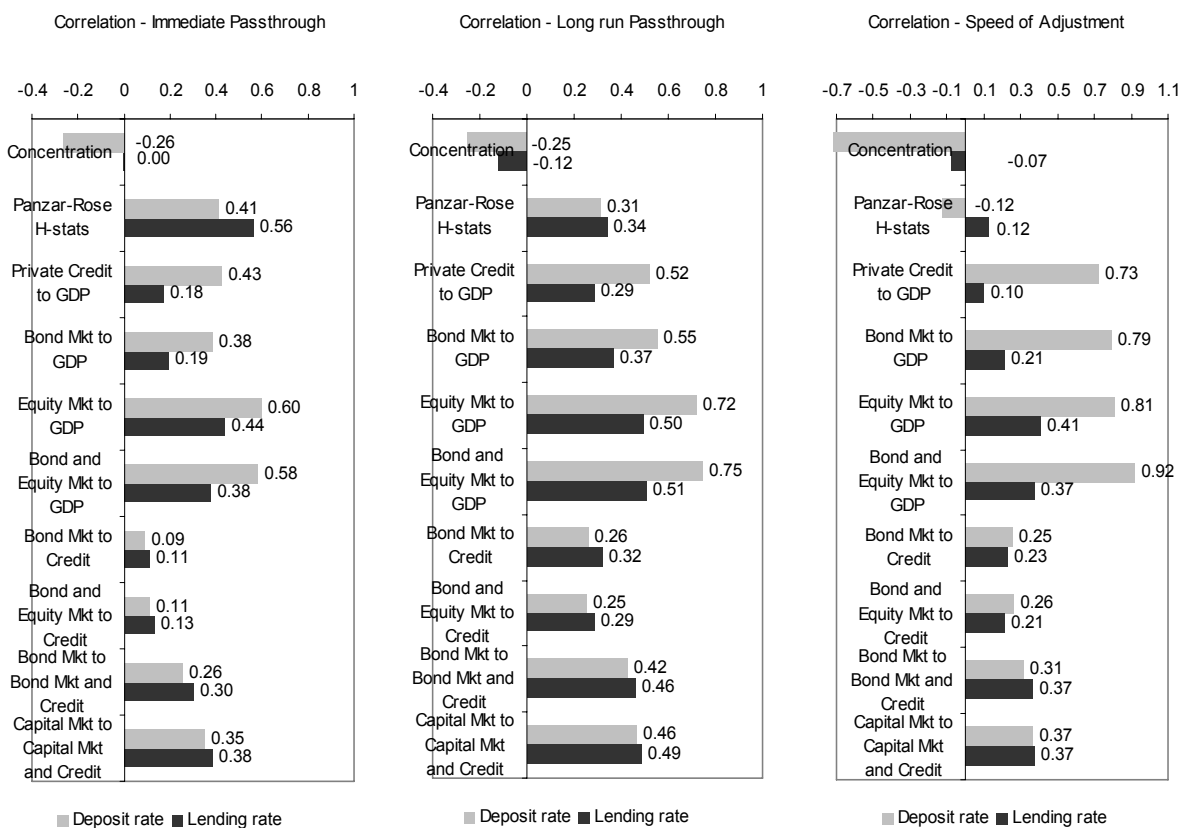
²¹ Monetary reforms were introduced in the UK in 1981–82 which involved the removal of the so-called Corset (special deposit requirement that was actively employed to control the expansion of the monetary base) and the establishment of a system of market-determined interest rates. In the US, regulation-Q and the inter-state

This was not the case with the Asian economies. Many undertook sustained interest rate liberalisation starting only in the mid 1990s.

One of the standard measures of the degree of market competition is the concentration ratio (CR_k), where k is the number of institutions. Based on CR_3 , there appear to be some differences between the degrees of market concentration of the financially developed and Asian countries (Table 4). There appears to be a negative correlation between interest rate pass-through and banking concentration (Chart 7), suggesting higher banking concentration does reduce interest rate pass-through. However, the size of correlation is relatively small.

Chart 7

Correlation between pass-through to deposit and lending rates and measures of competitiveness and financial market developments



Source: Authors' estimates.

branching restriction were removed in the early 1980s. Australia began to remove ceilings on lending rates as early as 1972 and had removed them completely by 1986.

Table 4

**Measures of competitiveness, size
and composition of financial market**

	Competitiveness		Size of Financial Market ¹				Composition of Financial Market			
	Con- centra- tion ¹	Panzar- Rosse H-stats ²	Private Credit to GDP	Bond Mkt to GDP	Equity Mkt to GDP	Bond and Equity Mkt to GDP	Bond Mkt to Credit	Bond and Equity Mkt to Credit	Bond Mkt to Bond Mkt and Credit	Capital Mkt to Capital Mkt and Credit
UK	0.50	0.84	1.26	0.48	1.43	1.91	0.38	0.28	1.51	0.60
Canada	0.56	0.60	0.97	0.81	0.91	1.72	0.84	0.46	1.78	0.64
Australia	0.64	0.98	0.81	0.48	0.88	1.36	0.59	0.37	1.68	0.63
US	0.30	0.52	1.87	1.46	1.24	2.71	0.78	0.44	1.45	0.59
Germany	0.68	0.69	1.10	0.81	0.42	1.23	0.74	0.42	1.12	0.53
Korea	0.49	0.68	1.21	0.55	0.43	0.99	0.46	0.31	0.82	0.45
Malaysia	0.47	0.66	1.29	0.79	1.77	2.56	0.62	0.38	1.99	0.67
Philippines	0.64	0.70	0.41	0.33	0.50	0.83	0.80	0.45	2.04	0.67
Thailand	0.53	0.35	1.20	0.23	0.53	0.77	0.19	0.16	0.64	0.39
Indonesia	0.61	0.66	0.33	0.16	0.25	0.41	0.48	0.32	1.22	0.55

¹ Data on concentration and various measures of size of financial market are from Beck et al (1999). Composition of financial market data are derived through ratios using data on financial market size. All data represent average values for 1994–2005. ² Panzar-Rosse H-stats are taken from Claessens and Laeven (2004), except for Korea (Bikker and Haaf (2002)) and Thailand (Laeven (2005)).

The other – and often preferred – measure of market competition is the Panzar-Rosse H-statistic, which measures the degree of monopolistic structure of the market by assessing the impact of factor input prices on revenue.²² Based on Panzar-Rosse H-statistics, banking systems in the financially advanced countries seem to be more competitive than in Asian countries. The correlations with the policy rate pass-through to deposit and lending rates are also positive, suggesting that pass-through is higher and faster in countries with greater competition.

The other factor that could also influence the degree of interest rate pass-through is the size of financial markets. The presence of alternative channels of intermediation – namely bond and equity markets – offers opportunity for both savers and borrowers to access savings and financing instruments directly from the markets. Savers in this environment, through mutual and hedge funds as well as pension and insurance funds, would gain access to alternative investment instruments that would enable them to possibly earn higher returns on their savings. Banking institutions would then need to compete for their deposits by offering competitive deposit rates. This would lead to greater sensitivity of deposit rates to underlying market interest rates and policy rates. Likewise, corporations would also gain access to alternative ways of raising financing. Banking institutions would therefore need to offer credit to borrowers at more competitive lending rates. The greater the size of bond and equity

²² A number of authors have computed cross-country Panzar-Rosse H-statistics as part of their studies on banking market structure to understand factors determining bank competitiveness, growth and development. The computed H-statistics, however, differ across studies. In general, most empirical studies tend to suggest competition is higher in financially advanced countries compared to developing countries. See for example Bikker and Haaf (2002), Claessens and Laeven (2004) and Laeven (2005).

markets, the greater is the breadth and depth of these markets. Indeed, the size of the correlations between pass-through from the policy rate to retail rates and various measures of the size of financial markets are positive, and particularly strong for deposit rates.

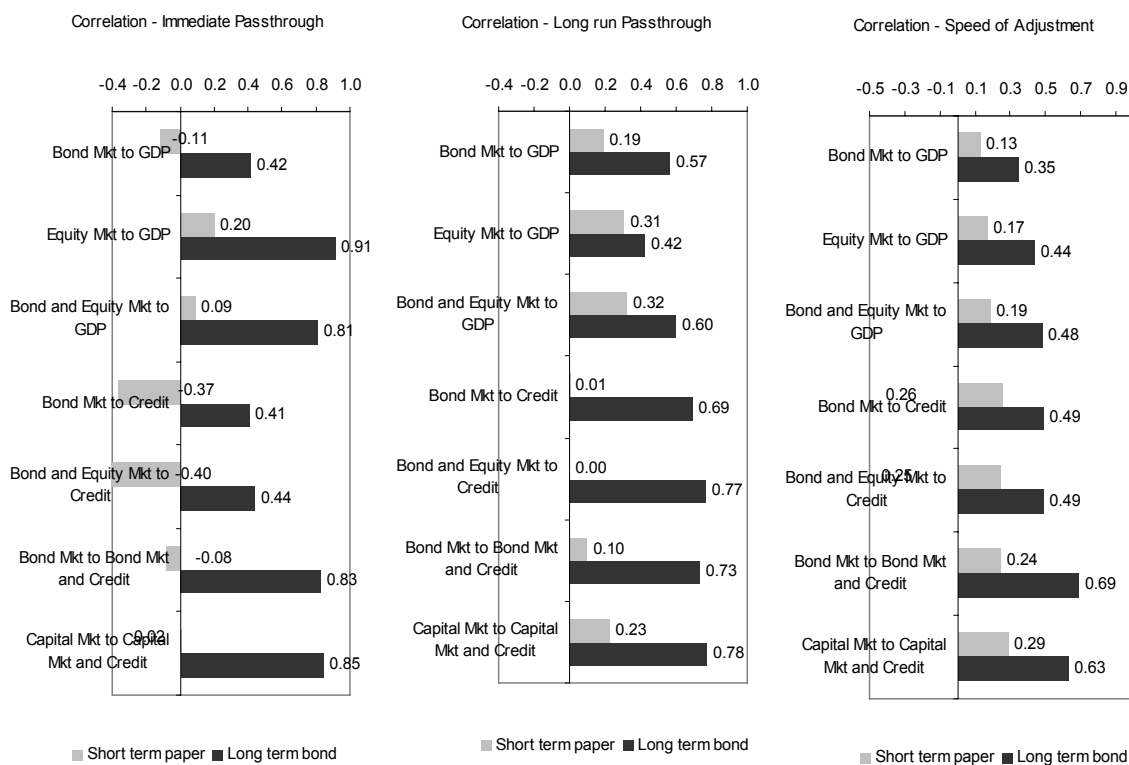
The other aspect that ought to also influence the degree of interest rate pass-through would be the composition of financial markets – the relative share between traditional bank lending and capital market activity. Correlations between interest rate pass-through to deposit and lending rates and the various measures of the composition of financial markets are also positive although the degree of correlation is somewhat lower compared with correlations involving the size of financial market.

On the whole, the evidence suggests that the degree of pass-through from policy rates to both deposit and lending rates appears to positively correlate with the degree of competitiveness and the size and composition of financial markets. That is, countries with a greater degree of market competition, larger financial markets and a higher share of bond and equity markets relative to credit markets should experience stronger and faster policy rate pass-through to both deposit and lending rates.

In Chart 8, we present the results of the correlation between pass-through to short-term and long-term bond rates, and measures of financial developments. The correlation analysis reveals differences in the interactions between the degree of pass-through for short-term paper rates and long-term bond rates. There appear to be only weak positive or negative correlations between the pass-through to short-term paper rates and the various measures of the size and composition of financial markets. Only the size of bond and equity markets appears to matter for pass-through to short-term paper rates and then only for long-run pass-through and not for immediate pass-through. There appear to be other important factors that determine the nature of pass-through to short-term paper rates. This might reflect differences in the micro-structure of the short-term paper market, such as the tendering and auctioning practices.

Chart 8

Correlation between pass-through to short-term and long-term bond rates and measures of competitiveness and financial market developments



Source: Authors' estimates.

In contrast, the degree of pass-through to long-term bond rates is strongly and positively correlated with measures of the size and composition of the financial market. The size of the correlations seems to indicate that the size of bond and equity markets has an important influence on the size of immediate and long-run pass-through, as well as the speed of adjustment of long-term bond rates.

4.4 Rolling regression

When looking at the entire period, we cannot exclude the possibility that some structural change or changes in the policy framework could have fundamentally affected the nature of interest rate pass-through over time, especially for the Asian countries. In order to investigate this possibility, we estimated a rolling regression with a 10-year window using data from 1980–2006. Appendix II plots the rolling regression results for the immediate and long-run pass-through and the speed of adjustment of market rates to policy rate changes for the 10 countries in our sample.

The rolling regression results for the financially advanced countries indicate that, for deposit and lending rates, the nature of interest rate pass-through has changed for some countries. The degree of immediate pass-through was already high in the UK and Canada in the early 1990s. Pass-through in the UK is almost complete in the immediate period, while in Canada it is also nearly complete. Meanwhile, the size of immediate pass-through in the US and Australia shows an increasing trend over the last 16 years, although the size of immediate pass-through to deposit rates in Australia seems to have declined slightly in the recent period. Thus, the ability of monetary policy to influence the cost of borrowing from the banking system in the US and Australia appears to have become stronger. On the other hand, immediate pass-through in Germany appears to have declined for the lending rate, while remaining relatively stable for the deposit rate. Thus, the monetary policy impact to borrowers in Germany appears to be weakening.

For the Asian countries, the size of immediate pass-through as well as long-run pass-through appears to have increased, especially since the financial crisis in 1998 for Korea and to some extent for Malaysia. However, there seems to be little change for Thailand, Indonesia and the Philippines.

The results for short-term paper rates, however, are mixed. In the US, immediate pass-through to short-term paper rates is getting stronger, but this is declining in Germany (similar to deposit rate trends). However, for long-term bond rates, the rolling regression indicates that there are signs that the immediate pass-through to long-term bond rates has been weakening in recent periods for financially advanced countries. Thus, it appears that policy rate transmission to the long-term bond market has weakened for most financially advanced countries.

One of the possible reasons for lower immediate pass-through to long-term bond rates that is often suggested is that, with large free flow of capital, there is a strong correlation between long-term bond rates across countries. To investigate this possibility we re-estimated the rolling regression by including either US or UK long-term bond rates in the short-run equation (and either US or UK or Canada for US and UK). The estimation result is shown in Chart 9. The evidence seems to suggest that while there are some changes in size of immediate pass-through – a smaller size of immediate pass-through in all countries, except the UK – the size of the immediate pass-through still shows a declining trend over the rolling window. Thus, while the strong correlation between long-term rates across countries seems to reduce the size of immediate pass-through, the evidence still suggests a decline in immediate pass-through in recent periods.

Chart 9

Rolling regression result for interest rate pass-through to long-term bond rates

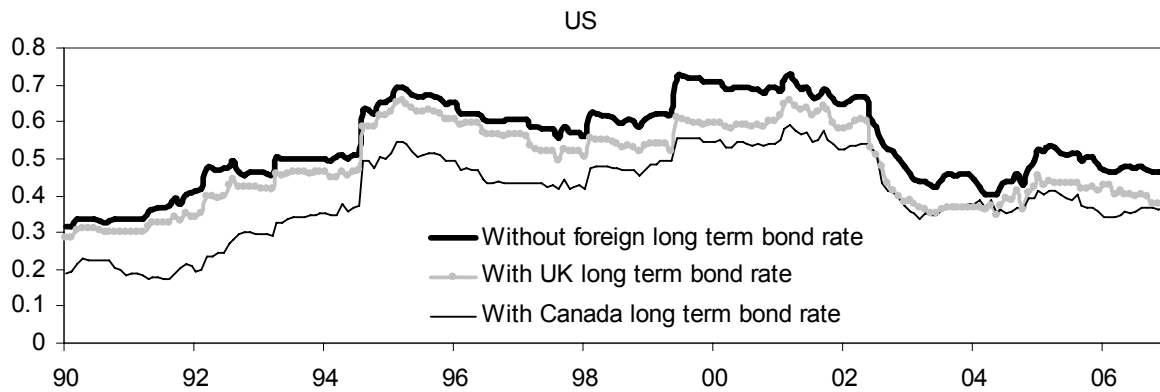
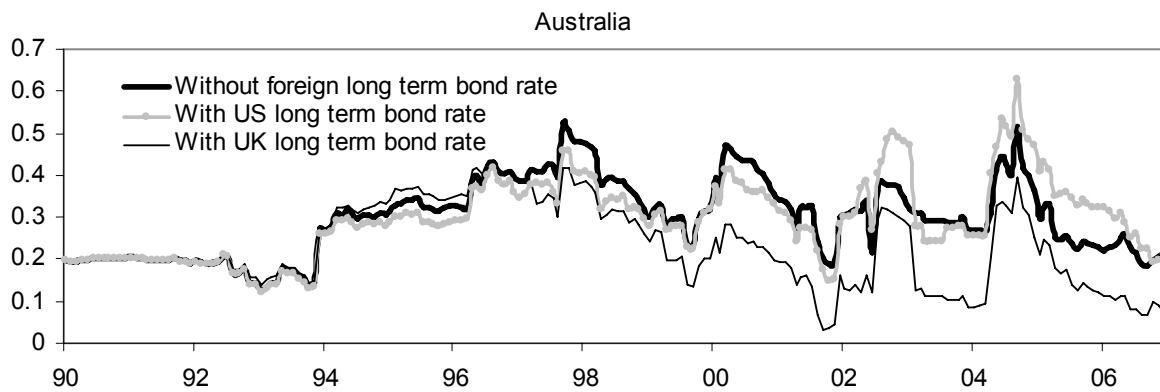
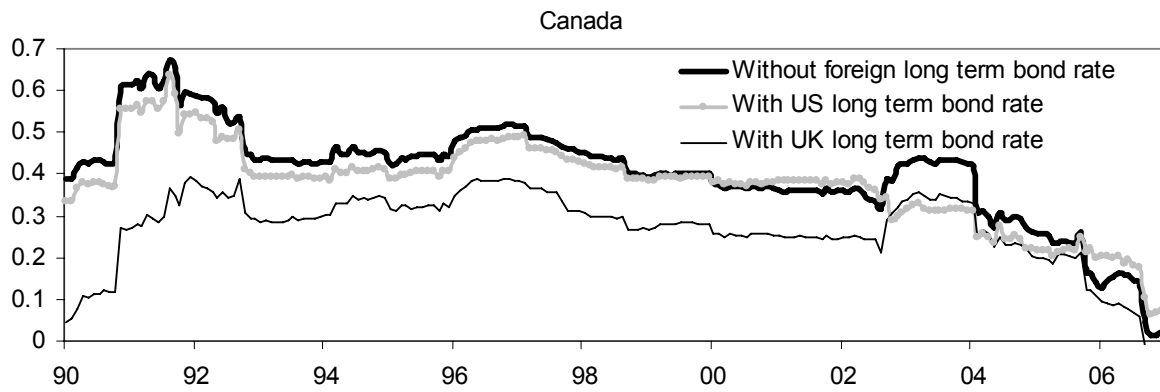
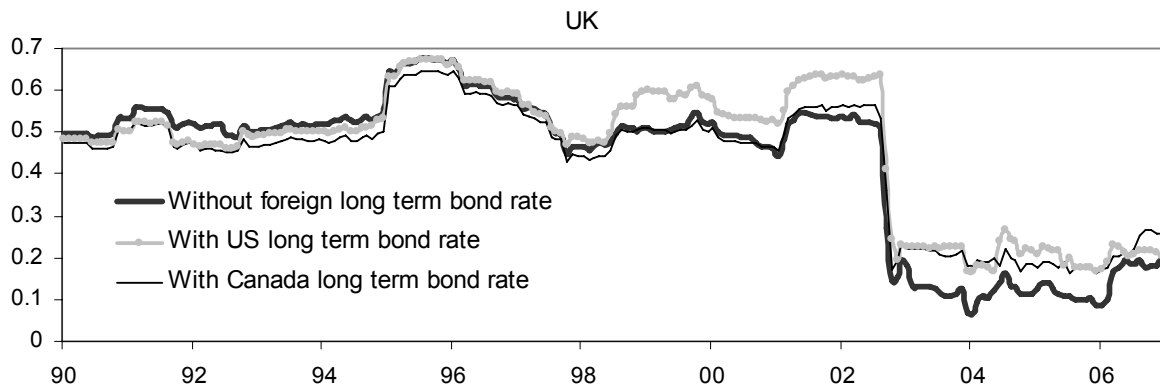
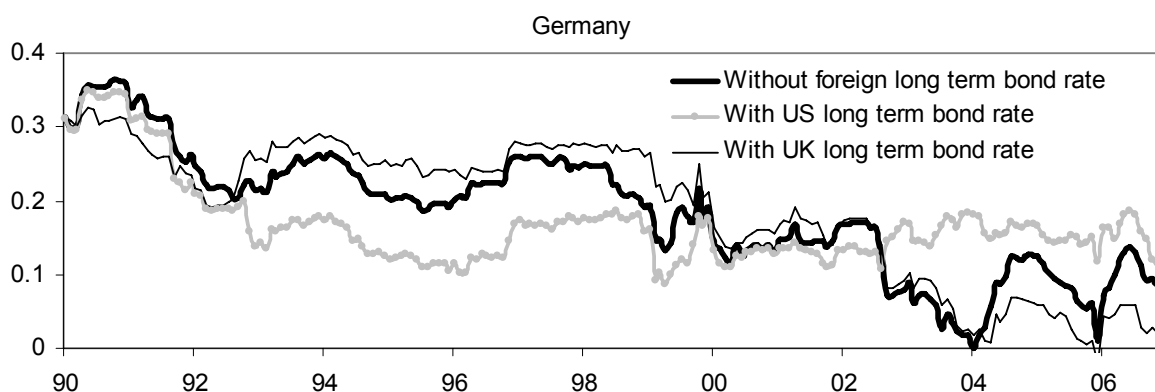


Chart 9 (cont)

Rolling regression result for interest rate pass-through to long-term bond rates



Source: Authors' estimates.

The other possible explanation that is often put forward is lower inflation expectations, with the success of many central banks in bringing down and anchoring inflation at lower levels since the mid 1990s. In an environment of stable and constant inflation expectations, responses to policy rate changes would be partial as increases or decreases in policy rates would be viewed as temporary and likely to revert back to average or normal levels. In other words, the size of immediate pass-through would be smaller than that under an environment of unstable inflation expectations. It is difficult, if not impossible, however, to directly test this hypothesis. Nonetheless, careful observation of the rolling regression results reveals that the “structural break” tends to occur in 2002. This coincides with the lapse of the year 1991 and 1992 in the rolling window. This seems to suggest that the size of the immediate pass-through is somehow being influenced by the level of inflation experienced during the period. The generally much lower and more stable inflation experienced by most advanced countries since the mid 1990s seems a probable and good explanation for the reduced size of the immediate pass-through effect to the long-term bond rate here.

4.5 Summary of empirical findings

Overall, the empirical findings suggest that interest rate pass-through in the financially developed countries is stronger – in terms of higher immediate and long-run pass-through as well as faster speed of adjustments – compared with that in the Asian countries. In other words, countries with more developed financial markets – in terms of higher levels of bank competitiveness and breadth and depth of bond and equity markets – will tend to have stronger interest rate pass-through. In addition, market-based financial systems also tend to be associated with stronger interest rate pass-through compared with bank-based financial systems.

Meanwhile, the rolling regression results suggest that the degree of interest rate pass-through to deposit and lending rates, and to some extent short-term paper rates, has also become stronger for a number of countries, notably the US and Australia among the financially developed countries, as well as Malaysia and Korea among the Asian countries. The nature of pass-through for other countries appears to remain unchanged. In Germany, however, the interest rate pass-through to retail bank rates and short-term paper rates appears to have declined in recent periods.

5. Conclusions

The effectiveness of monetary policy in affecting economic activity and inflation depends on the state of the financial system, and various financial developments can potentially change the way monetary policy is transmitted through the financial system. From our literature survey, we can conclude that most aspects of financial market developments tend to strengthen the interest rate channel. Only the advancement of payments technology, which enables consumption smoothing, weakens the importance of the interest rate channel. With respect to the bank lending channel, almost all aspects of financial market developments weaken the impact of monetary policy through this channel. However, having a large proportion of smaller firms in an economy with a relatively high dependence on bank financing may strengthen the role of this channel in transmitting monetary policy. As for the balance sheet channel, financial market developments appear to have a mixed impact. Meanwhile, the asset price or wealth effect channel strengthens with greater financial market development. In the case of interest rate pass-through, it can be concluded that financial market developments lead to faster and larger pass-through.

The findings of our empirical studies with respect to interest rate pass-through are in line with other studies. Financial market developments, in general, lead to stronger interest rate pass-through – in terms of both higher immediate and long-run pass-through and faster speed of adjustments. Our study on Asian countries together with developed countries suggests that Asian countries, which have a lower degree of financial market development compared with the financially advanced countries, also have lower interest rate pass-through. Looking ahead, therefore, our empirical findings together with other earlier studies suggest that interest rate pass-through will become much stronger in the near future with the current trend of changes and developments in the Asian financial landscapes. That is, the effectiveness of monetary policy in Asian countries is likely to increase in the future, at least in terms of its influence on cost of funds.

Appendix I: Estimation results of study

Estimation results – interest rate pass-through to deposit rate

1987–2006

	Long-run			Short-run							
	γ^*	β^*	Adj R ²	γ	α_1	α_2	β_0	β_1	β_2	δ	Adj R ²
UK	0.04 (0.03)	1.00 (0.00)	1.00	0.00 (0.01)	-0.17 (0.07)	-0.20 (0.06)	1.13 (0.03)	0.16 (0.08)	0.10 (0.06)	-0.21 (0.06)	0.87
Canada	-1.33 (0.06)	0.84 (0.01)	0.98	-0.01 (0.01)	-0.23 (0.06)	0.04 (0.06)	0.56 (0.03)	0.20 (0.05)	0.11 (0.05)	-0.14 (0.04)	0.61
Australia	-1.43 (0.09)	1.03 (0.01)	0.97	-0.01 (0.02)	0.13 (0.06)	-0.07 (0.06)	0.45 (0.06)	0.10 (0.07)	0.10 (0.07)	-0.08 (0.03)	0.40
US	0.15 (0.03)	1.00 (0.01)	0.99	0.00 (0.01)	0.17 (0.07)	0.05 (0.06)	0.56 (0.05)	0.16 (0.07)	0.00 (0.06)	-0.39 (0.06)	0.57
Germany	0.03 (0.02)	0.85 (0.00)	0.99	0.00 (0.01)	0.04 (0.07)	-0.04 (0.05)	0.40 (0.03)	0.29 (0.04)	0.07 (0.04)	-0.10 (0.04)	0.68
Korea	3.62 (0.20)	0.47 (0.02)	0.72	-0.01 (0.02)	0.24 (0.07)	0.05 (0.06)	0.13 (0.02)	0.07 (0.02)	0.04 (0.02)	-0.04 (0.01)	0.44
Malaysia	0.76 (0.09)	0.89 (0.02)	0.92	-0.01 (0.02)	0.31 (0.06)	0.04 (0.06)	0.26 (0.03)	-0.07 (0.04)	-0.08 (0.03)	-0.31 (0.04)	0.42
Philippines	-1.29 (0.93)	0.64 (0.07)	0.24	-0.03 (0.06)	-0.12 (0.07)	-0.04 (0.06)	0.06 (0.02)	0.02 (0.02)	0.02 (0.02)	-0.01 (0.01)	0.04
Thailand	2.50 (0.25)	0.70 (0.03)	0.70	-0.02 (0.03)	0.11 (0.06)	-0.03 (0.06)	0.03 (0.02)	0.08 (0.02)	0.06 (0.02)	-0.05 (0.02)	0.20
Indonesia	9.67 (0.46)	0.47 (0.02)	0.64	-0.01 (0.08)	0.18 (0.06)	0.17 (0.05)	0.07 (0.02)	0.05 (0.02)	0.09 (0.02)	-0.90 (0.02)	0.42

Source: Authors' estimates.

**Estimation results –
interest rate pass-through to lending rate**

1987–2006

	Long-run			Short-run							
	γ^*	β^*	Adj R ²	γ	α_1	α_2	β_0	β_1	β_2	δ	Adj R ²
UK	0.04 (0.01)	1.01 (0.00)	1.00	0.00 (0.00)	-0.10 (0.07)	-0.21 (0.06)	1.01 (0.01)	0.09 (0.07)	0.21 (0.06)	-0.08 (0.03)	0.99
Canada	1.65 (0.04)	0.94 (0.01)	0.99	0.00 (0.01)	-0.14 (0.07)	-0.04 (0.06)	0.76 (0.03)	0.20 (0.07)	0.05 (0.06)	-0.21 (0.05)	0.74
Australia	4.03 (0.05)	0.92 (0.01)	0.99	0.00 (0.01)	-0.04 (0.06)	0.01 (0.06)	0.73 (0.04)	0.01 (0.06)	0.02 (0.06)	-0.12 (0.03)	0.73
US	3.48 (0.07)	0.85 (0.01)	0.95	0.01 (0.01)	-0.03 (0.06)	0.00 (0.05)	0.33 (0.04)	0.42 (0.04)	0.12 (0.05)	-0.06 (0.02)	0.65
Germany	7.33 (0.11)	0.60 (0.02)	0.78	0.01 (0.01)	0.04 (0.06)	-0.08 (0.06)	0.30 (0.04)	0.15 (0.04)	0.12 (0.04)	-0.02 (0.01)	0.44
Korea	5.60 (0.22)	0.36 (0.02)	0.57	-0.01 (0.02)	0.19 (0.07)	0.01 (0.07)	0.13 (0.02)	0.02 (0.02)	0.02 (0.02)	-0.03 (0.01)	0.29
Malaysia	5.18 (0.12)	0.51 (0.02)	0.68	-0.01 (0.01)	0.06 (0.06)	0.19 (0.06)	0.13 (0.02)	0.10 (0.03)	0.04 (0.02)	-0.09 (0.02)	0.32
Philippines	2.11 (1.03)	0.69 (0.08)	0.23	-0.03 (0.07)	-0.13 (0.07)	0.03 (0.06)	0.04 (0.02)	0.08 (0.02)	0.02 (0.02)	-0.01 (0.01)	0.07
Thailand	6.80 (0.19)	0.55 (0.02)	0.70	-0.01 (0.02)	0.20 (0.06)	0.13 (0.06)	0.02 (0.01)	0.01 (0.01)	0.02 (0.01)	-0.06 (0.01)	0.26
Indonesia	16.42 (0.30)	0.27 (0.01)	0.58	-0.01 (0.04)	0.13 (0.06)	0.26 (0.06)	0.07 (0.01)	0.04 (0.01)	0.01 (0.01)	-0.04 (0.01)	0.45

Source: Authors' estimates.

**Estimation results –
interest rate pass-through to short-term paper rate**

1987–2006

	Long-run			Short-run							
	γ^*	β^*	Adj R ²	γ	α_1	α_2	β_0	β_1	β_2	δ	Adj R ²
UK	0.03 (0.04)	0.96 (0.00)	0.99	0.00 (0.01)	-0.23 (0.07)	-0.16 (0.07)	1.16 (0.04)	0.09 (0.08)	0.09 (0.06)	-0.15 (0.05)	0.82
Canada	-0.27 (0.03)	1.00 (0.00)	0.99	0.00 (0.01)	-0.35 (0.10)	-0.13 (0.07)	0.97 (0.04)	0.26 (0.09)	0.17 (0.07)	-0.59 (0.12)	0.74
Australia	0.05 (0.07)	0.98 (0.01)	0.99	0.00 (0.02)	-0.11 (0.11)	-0.11 (0.09)	0.98 (0.10)	0.25 (0.11)	0.10 (0.08)	-0.34 (0.10)	0.46
US	0.24 (0.04)	0.88 (0.01)	0.99	0.00 (0.01)	0.07 (0.07)	-0.19 (0.07)	0.47 (0.04)	0.20 (0.05)	0.18 (0.05)	-0.15 (0.04)	0.55
Germany	0.27 (0.06)	0.89 (0.01)	0.96	0.00 (0.01)	0.03 (0.07)	0.06 (0.06)	0.43 (0.07)	0.35 (0.07)	0.05 (0.07)	-0.10 (0.03)	0.29
Korea	3.74 (0.24)	0.74 (0.02)	0.82	-0.03 (0.05)	0.05 (0.07)	-0.09 (0.07)	0.45 (0.05)	-0.04 (0.06)	0.01 (0.05)	-0.10 (0.03)	0.31
Malaysia	0.67 (0.10)	0.82 (0.02)	0.89	0.00 (0.02)	0.31 (0.06)	-0.10 (0.06)	0.22 (0.04)	0.08 (0.04)	0.01 (0.04)	-0.19 (0.04)	0.26
Philippines	-0.03 (1.05)	0.72 (0.08)	0.24	-0.02 (0.08)	0.06 (0.07)	-0.14 (0.06)	0.10 (0.02)	0.08 (0.02)	0.01 (0.02)	-0.01 (0.01)	0.13
Thailand ¹											
Indonesia ¹											

¹ Data not available.

Source: Authors' estimates.

**Estimation results –
interest rate pass-through to long-term bond rate**

1987–2006

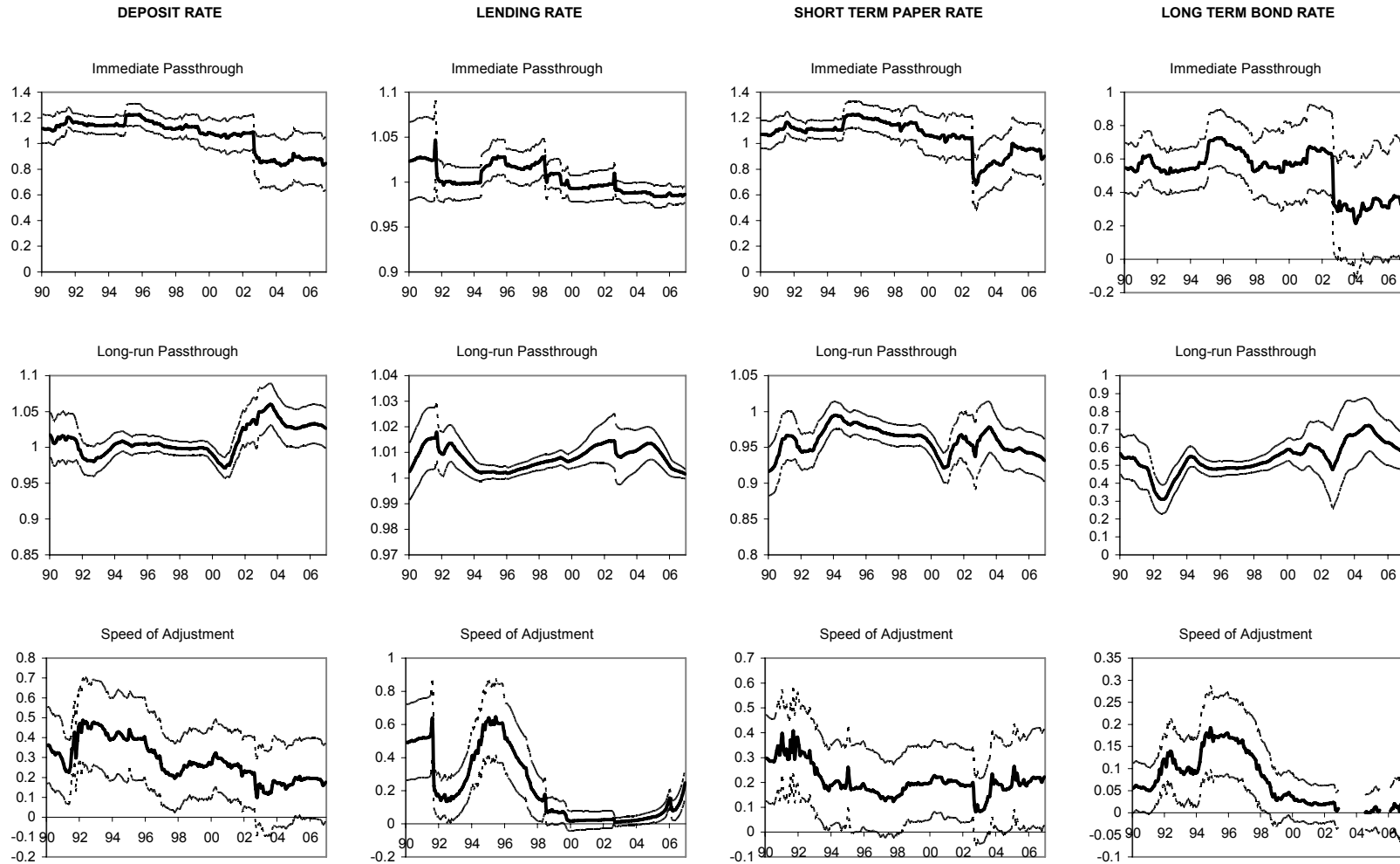
	Long-run			Short-run							
	γ^*	β^*	Adj R ²	γ	α_1	α_2	β_0	β_1	β_2	δ	Adj R ²
UK	2.22 (0.15)	0.68 (0.02)	0.84	-0.01 (0.02)	0.30 (0.07)	-0.04 (0.06)	0.60 (0.07)	-0.40 (0.08)	-0.03 (0.07)	-0.04 (0.02)	0.36
Canada	2.16 (0.12)	0.73 (0.02)	0.88	-0.01 (0.02)	0.00 (0.07)	-0.04 (0.07)	0.46 (0.05)	-0.09 (0.06)	0.02 (0.06)	-0.07 (0.03)	0.23
Australia	1.55 (0.14)	0.83 (0.02)	0.91	-0.02 (0.03)	-0.05 (0.07)	0.01 (0.07)	0.34 (0.12)	0.03 (0.12)	-0.02 (0.10)	-0.05 (0.03)	0.03
US	1.66 (0.11)	0.81 (0.02)	0.87	0.00 (0.02)	0.36 (0.07)	-0.20 (0.07)	0.47 (0.07)	-0.03 (0.07)	-0.02 (0.07)	-0.05 (0.03)	0.28
Germany	2.66 (0.11)	0.65 (0.02)	0.78	-0.01 (0.01)	0.30 (0.07)	-0.02 (0.07)	0.15 (0.07)	0.03 (0.07)	-0.06 (0.06)	-0.02 (0.02)	0.09
Korea	3.61 (0.24)	0.72 (0.02)	0.81	-0.02 (0.03)	0.13 (0.06)	-0.12 (0.06)	0.19 (0.03)	0.05 (0.03)	0.06 (0.03)	-0.04 (0.02)	0.22
Malaysia ¹											
Philippines ¹											
Thailand	5.63 (0.19)	0.37 (0.02)	0.54	-0.01 (0.02)	0.15 (0.07)	-0.03 (0.07)	0.01 (0.01)	0.00 (0.01)	0.00 (0.01)	-0.03 (0.01)	0.02
Indonesia ¹											

¹ Data not available.

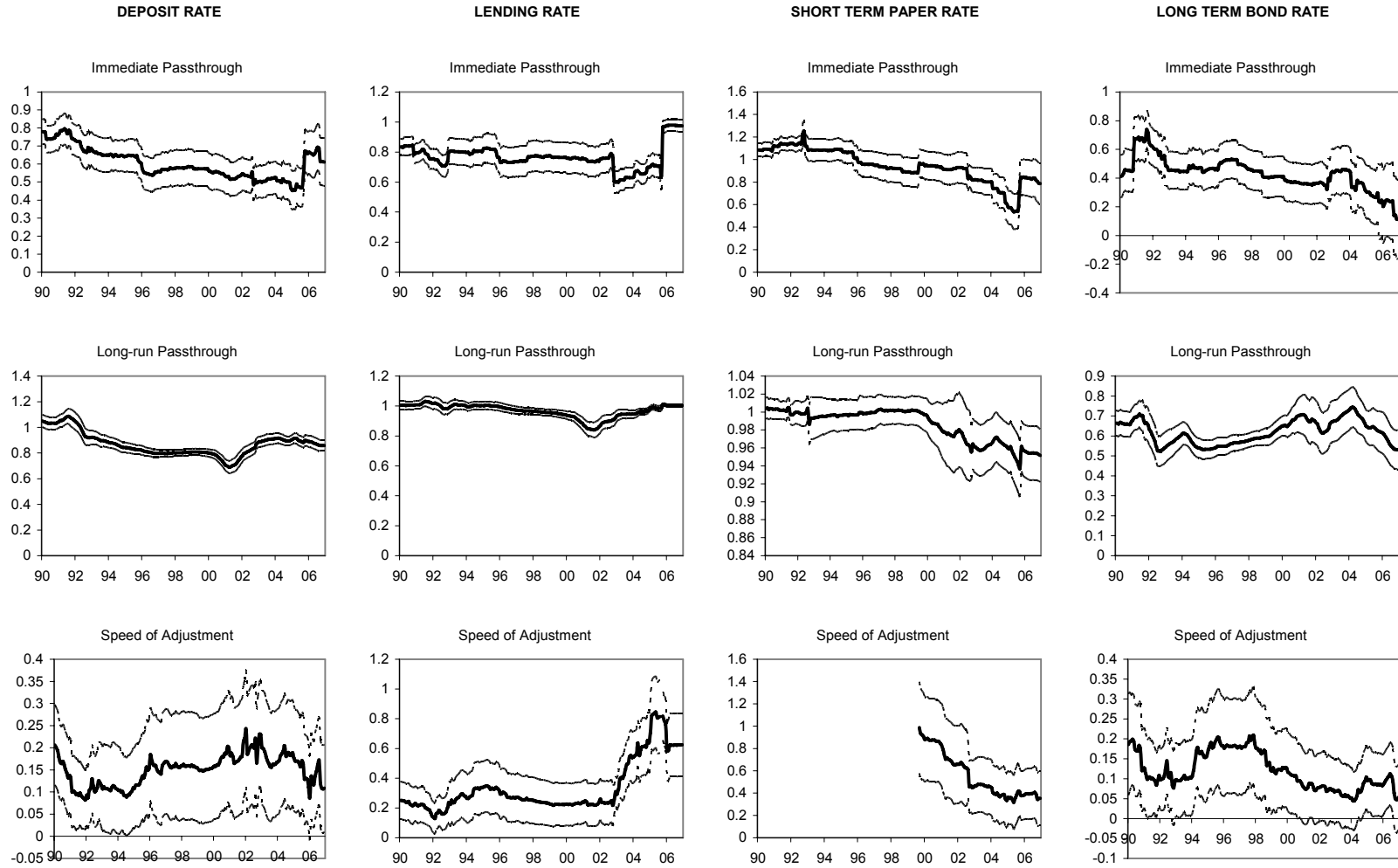
Source: Authors' estimates.

Appendix II: Rolling regression result

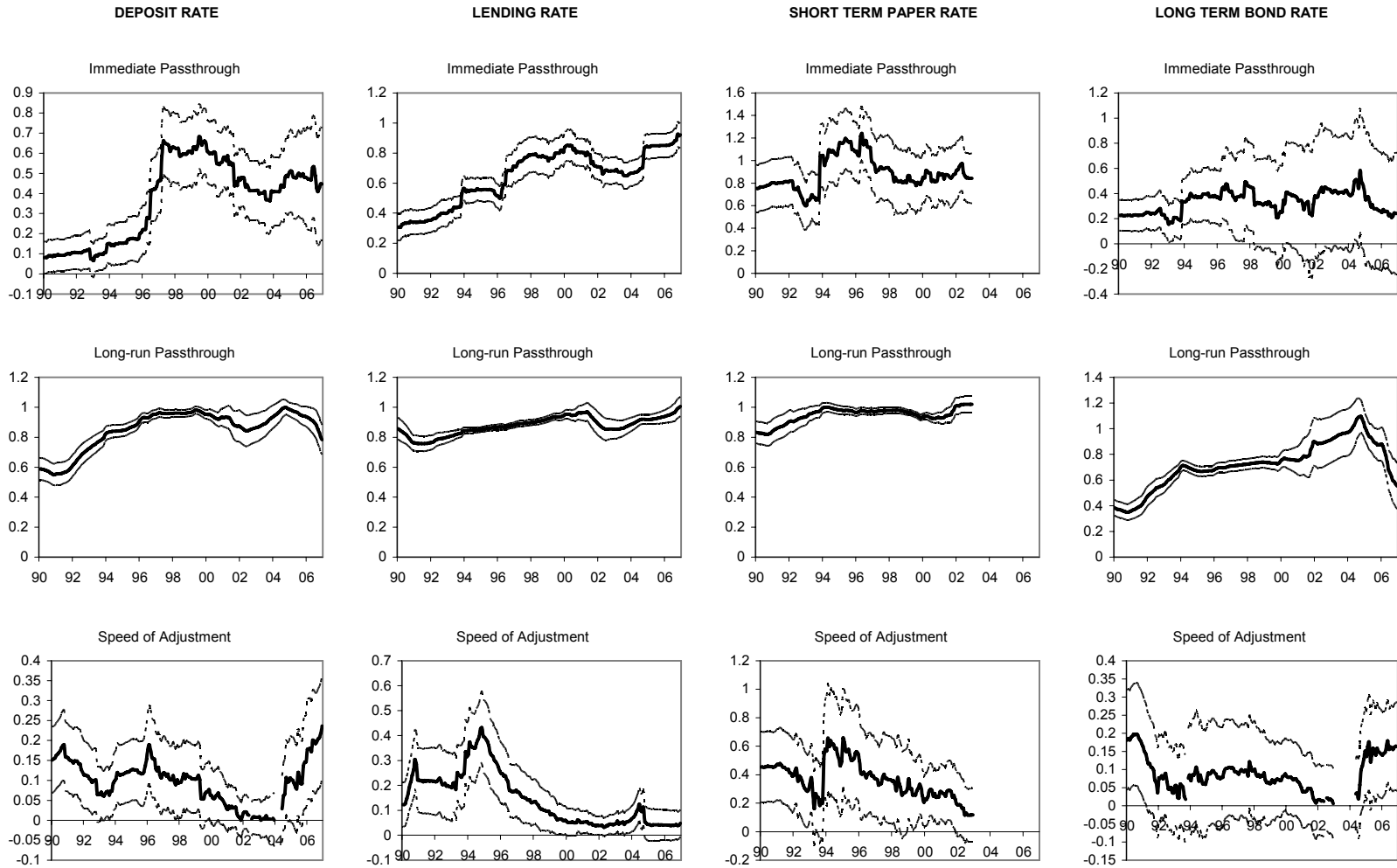
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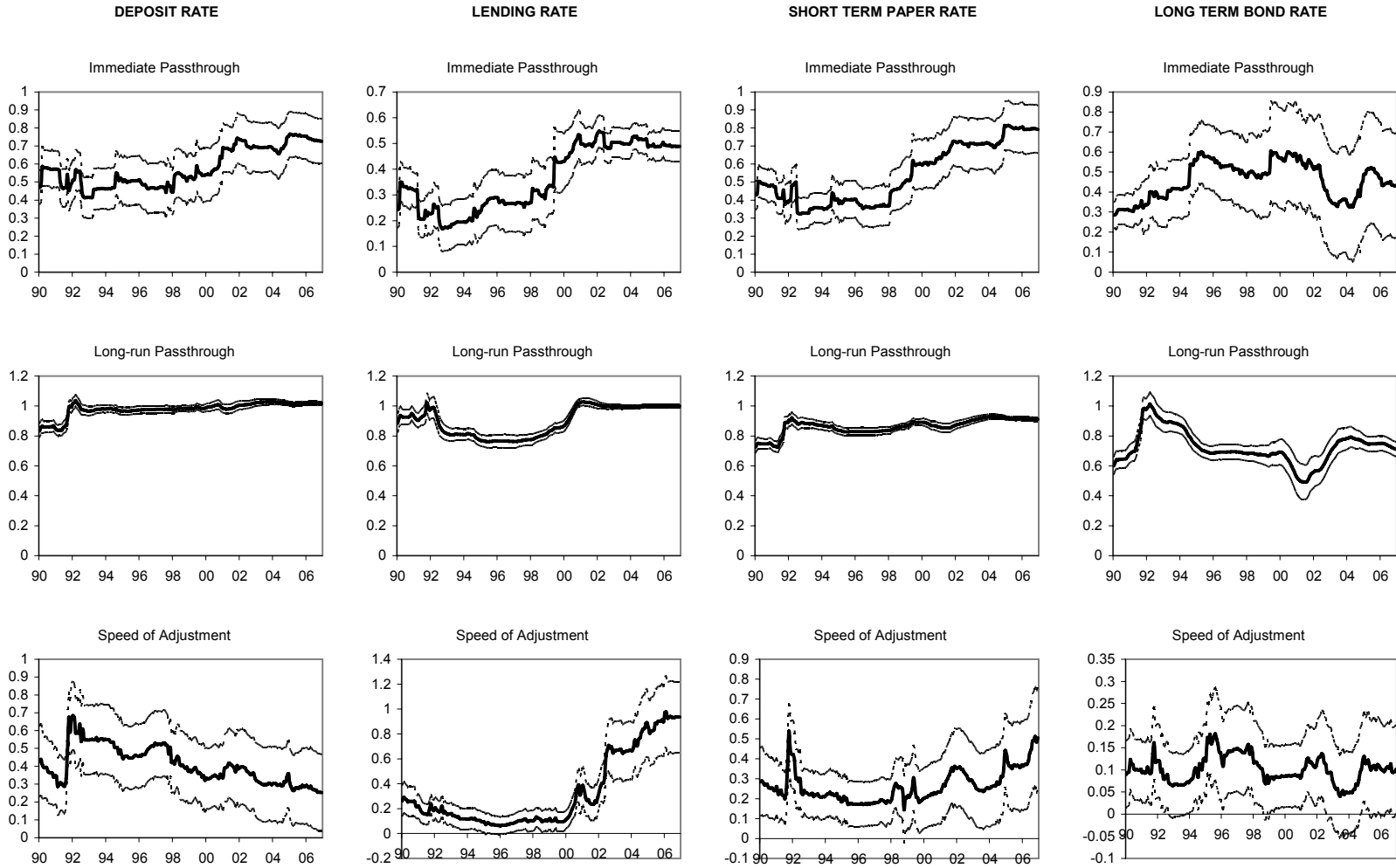
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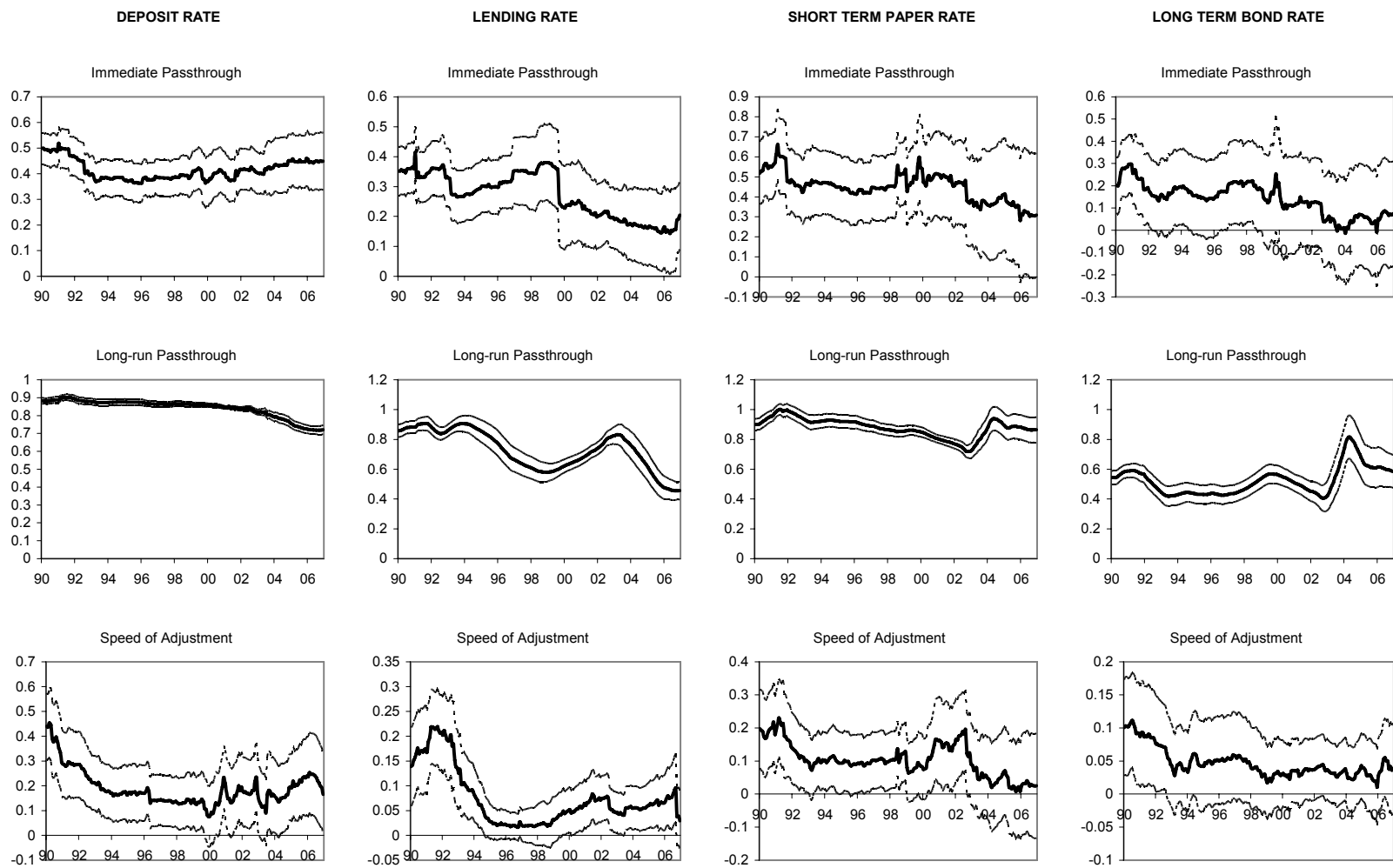
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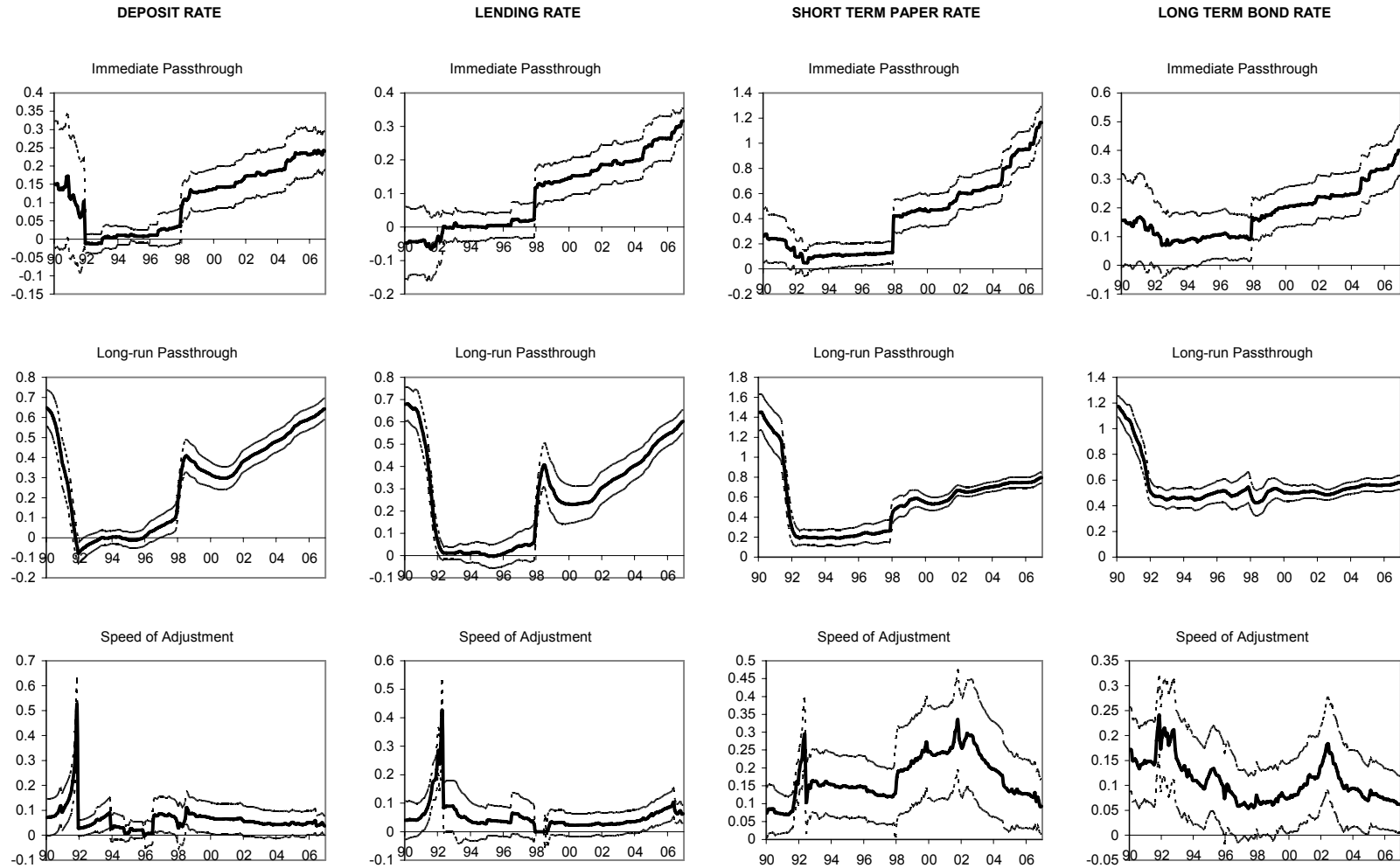
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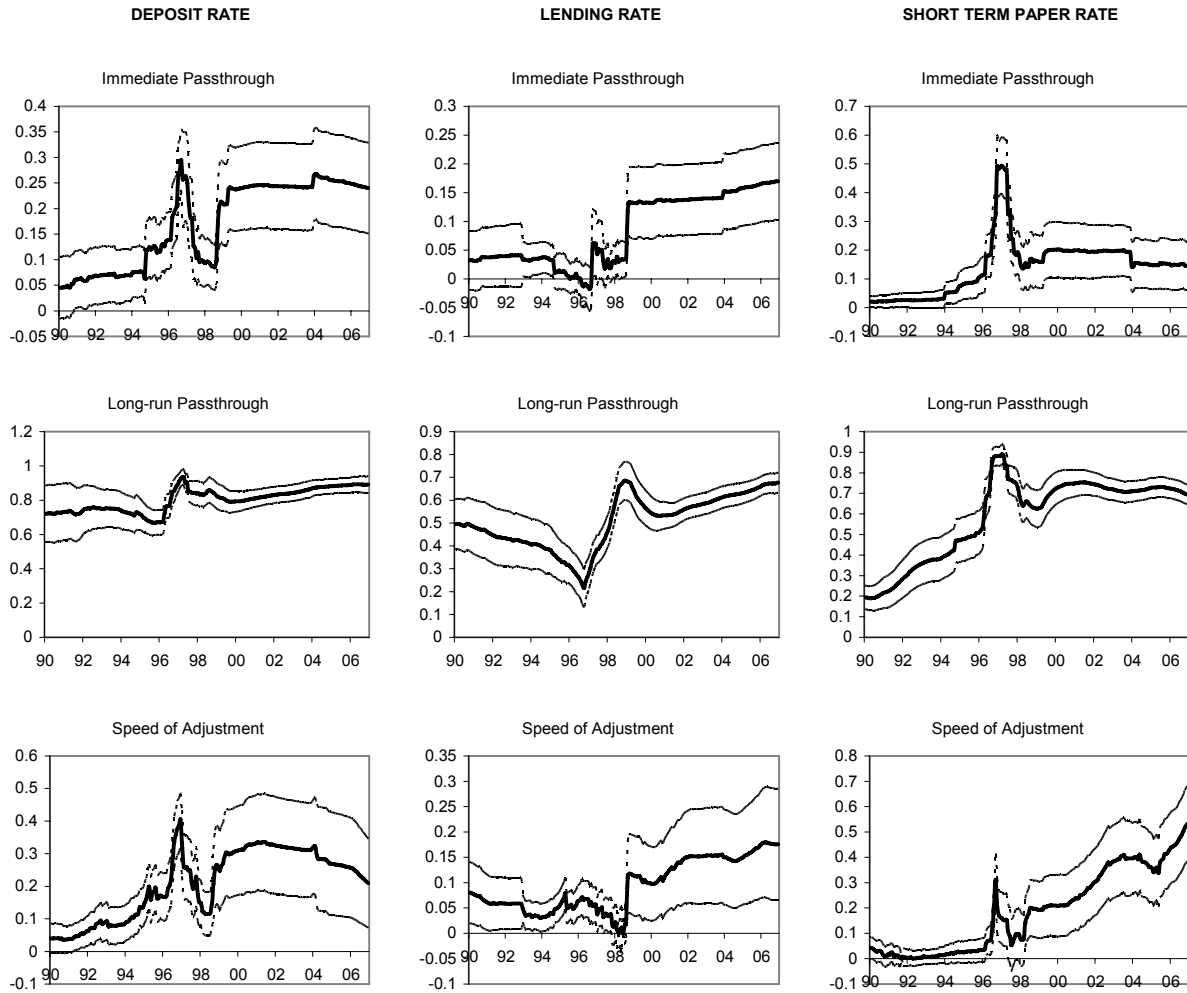
Germany



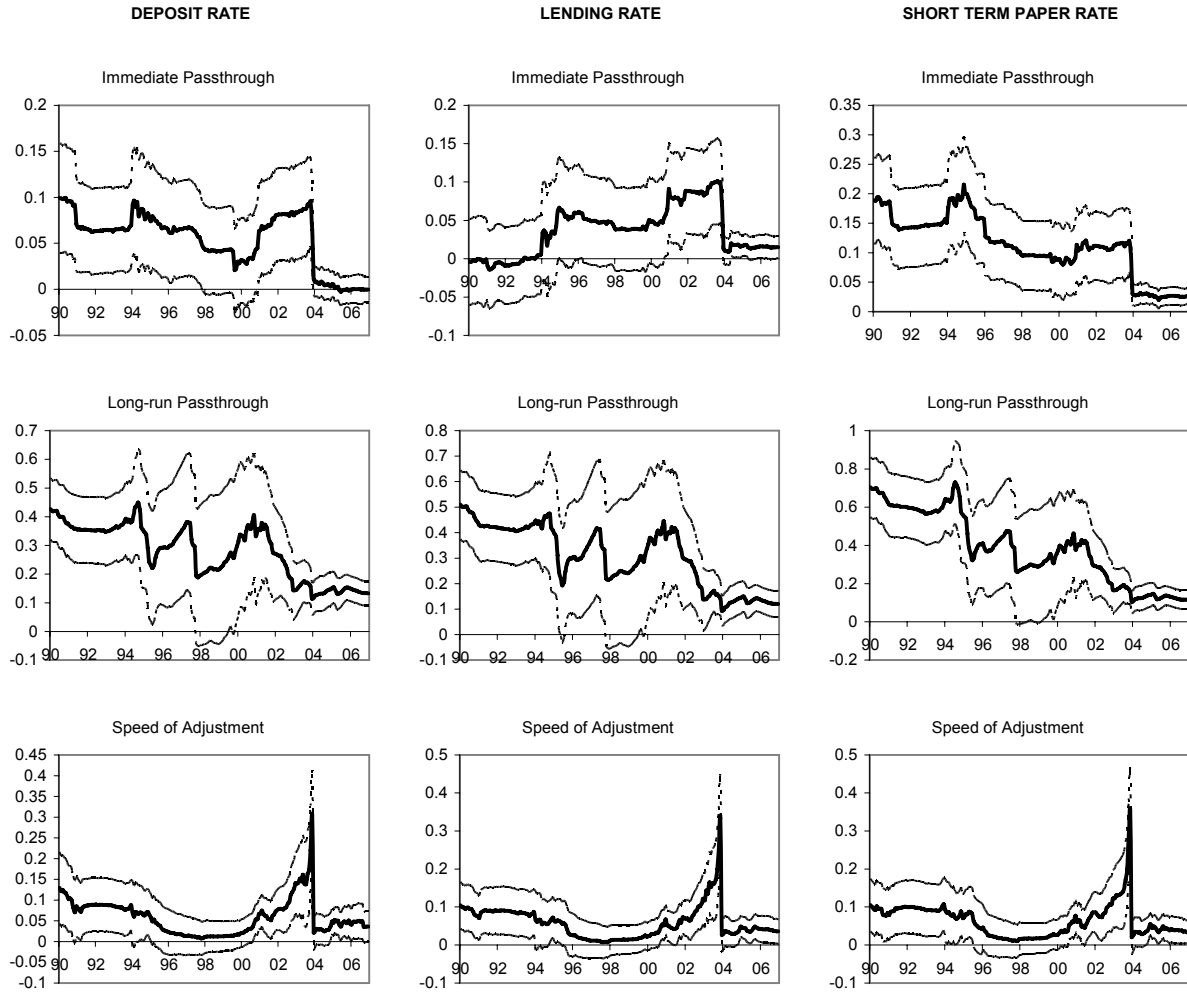
Korea



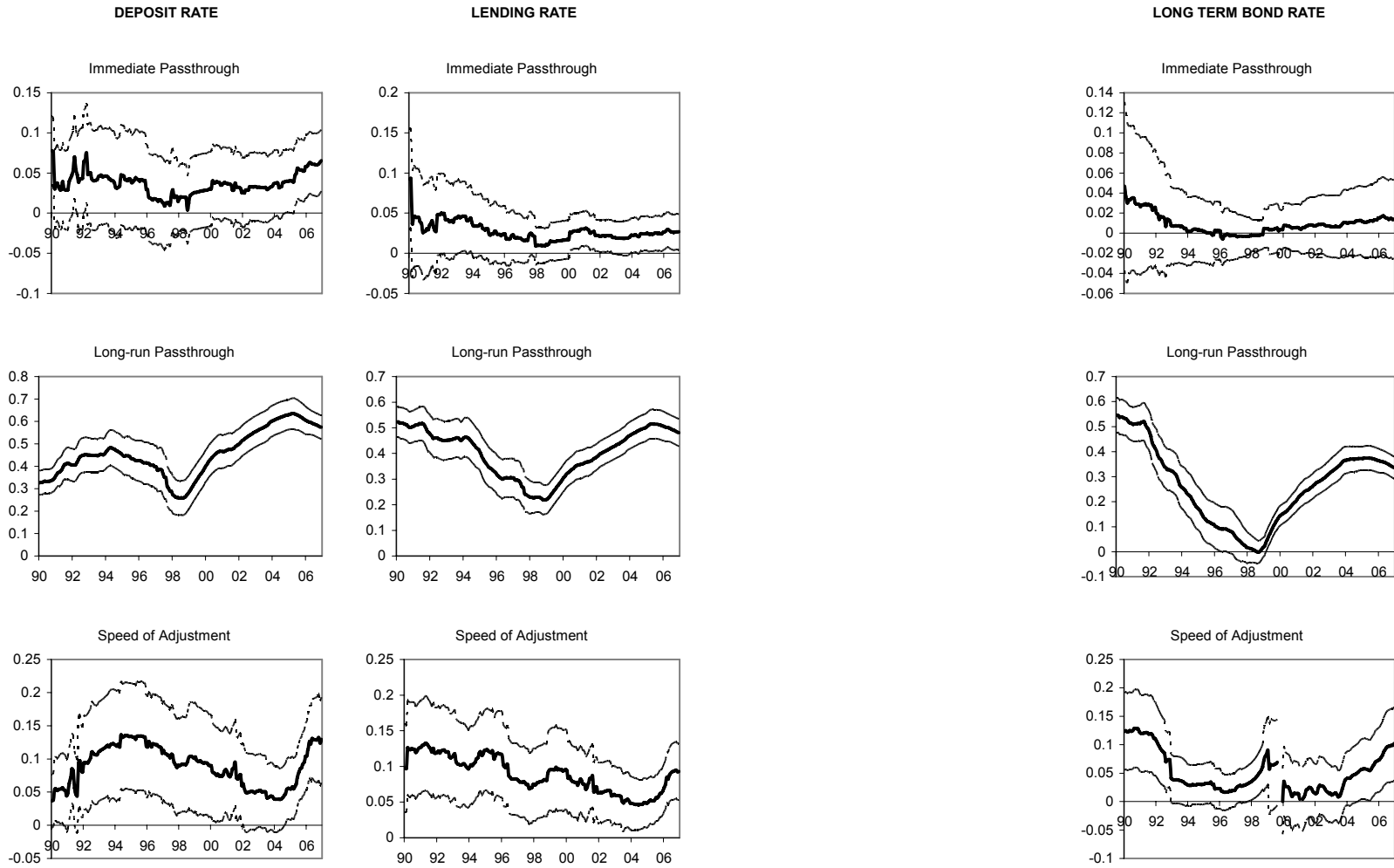
Malaysia



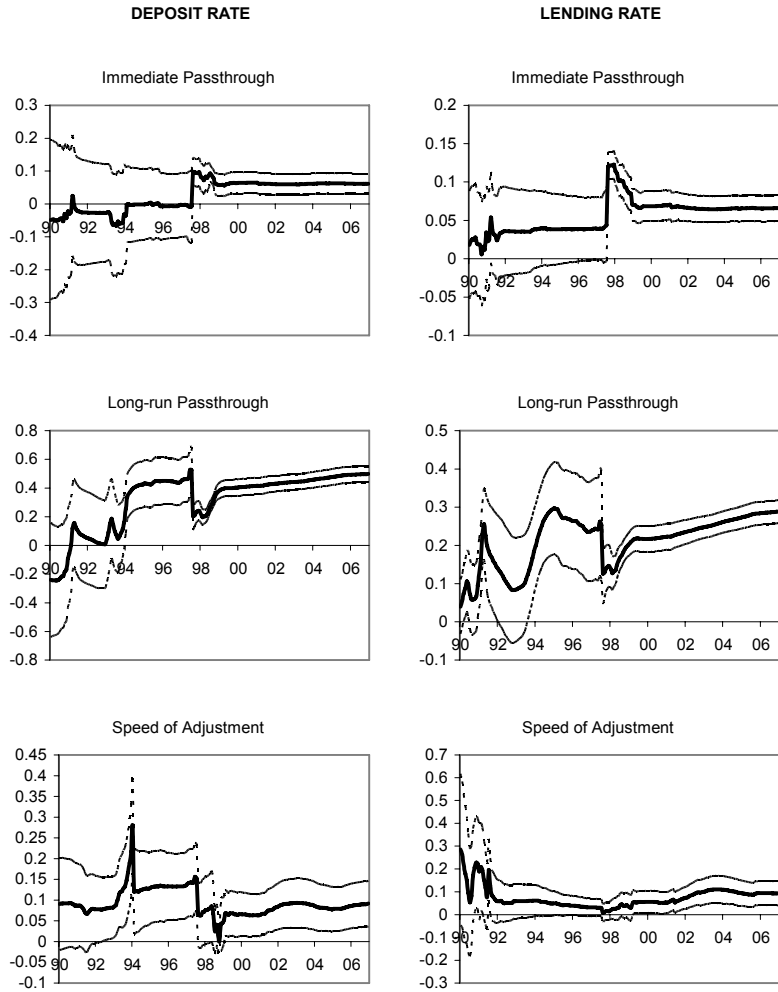
Philippines



Thailand



Indonesia



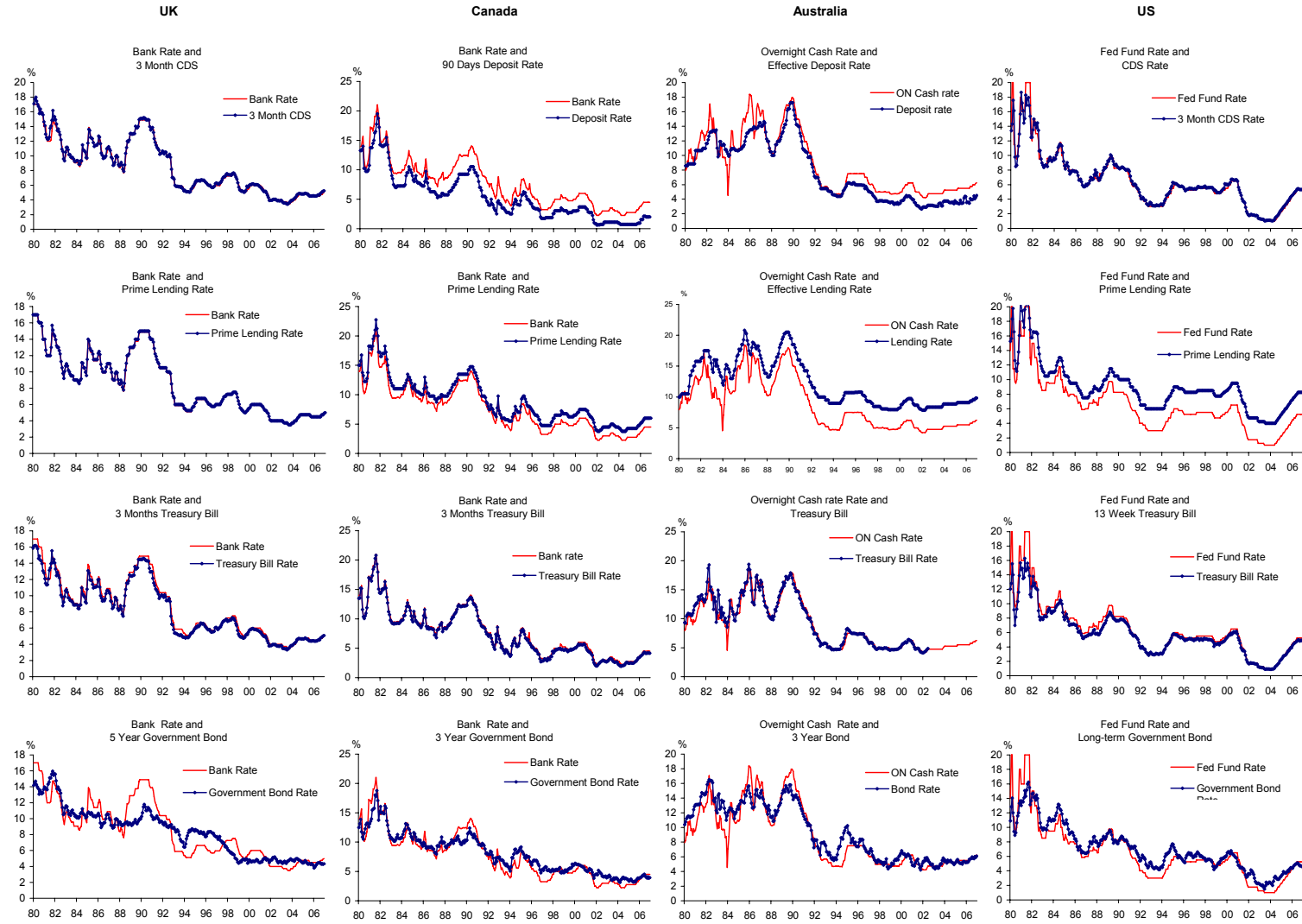
Appendix III: Sources and plots of data

Country	Data	Description	Source
UK	Bank rate	Monthly average Bank official rate.	Bank of England
	CDS	Three-month certificate of deposit rate.	Bank of England
	Prime lending rate	Monthly average of base rate of four banks.	Bank of England
	Treasury bill rate	Tender rate at which 91-day bills are allotted.	IFS
	Government bond rate	Theoretical gross redemption bond yields computed from bonds issued at par with five years to maturity.	IFS
Canada	Bank rate	Rate at which the Bank of Canada is prepared to respond to requests of chartered banks for temporary advances and enter into purchase and resale agreements with money market dealers.	IFS
	Deposit rate	Rate offered by chartered banks on 90-day deposits in national currency.	IFS
	Prime lending rate	Rate charged on large business loans to their most creditworthy customers.	IFS
	Treasury bill rate	Weighted average of the yields on successful bids for three-month bills.	IFS
	Government bond rate	Average yield to maturity of government bonds with original maturity of three-five years.	IFS
Australia	Overnight Cash Rate	Weighted average rate of the interest rates at which banks have borrowed and lent exchange settlement funds during the day.	IFS
	Deposit rate	Average rate offered by major banks on three-month fixed deposits of 10,000 Australian dollars.	IFS
	Lending rate	Maximum rate charged by banks on loans to small and large businesses.	IFS
	Treasury bill rate	Weighted average yield on 13-week treasury notes allotted at last tender of month. Beginning in January 1995, estimated closing yield in the secondary market on 13-week treasury notes.	IFS
	Government bond rate	Yield on two-year Treasury bonds. Beginning in June 1981, assessed secondary market yield on two-year non-rebate bonds. Beginning in June 1992, assessed secondary market yield on three-year non-rebate bonds.	IFS

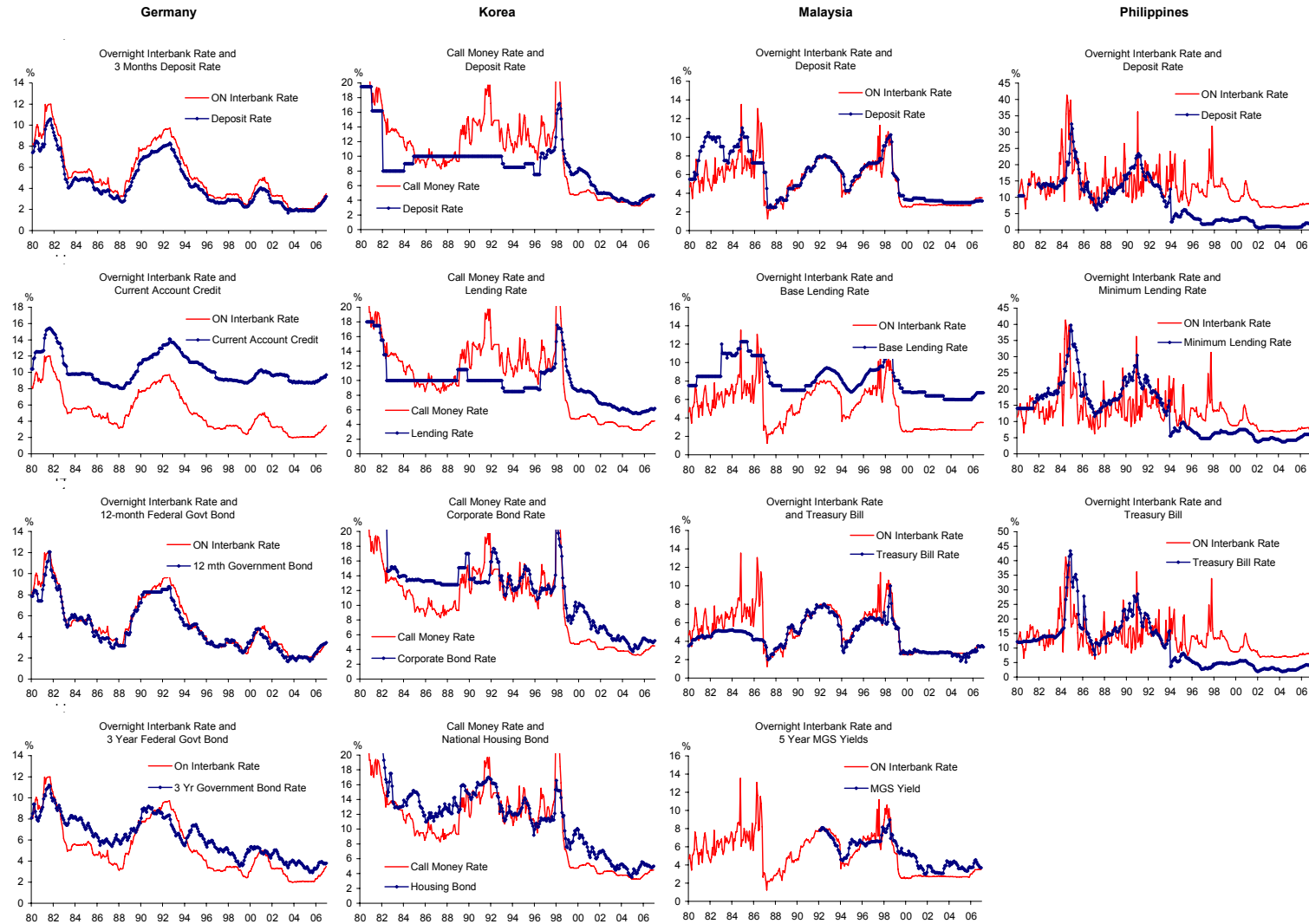
Country	Data	Description	Source
US	Fed funds rate	Fed funds target rate.	Federal Reserve Board
	CDS	Average of dealer offering rates on nationally traded certificates of deposit.	IFS
	Prime lending rate	Average base rate charged by 23 banks on short-term business loans.	IFS
	Treasury bill rate	Weighted average yield on multiple-price auctions of 13-week treasury bills. Beginning on 28 October 1998, data are stop yields from uniform-price auctions.	IFS
	Government bond rate	Yield on actively traded treasury issues adjusted to three-year constant maturities.	IFS
Germany	Overnight interbank rate	Period averages of 10 daily average quotations for overnight credit.	IFS
	Deposit rate	Rate on three-month deposits in denominations of less than one million marks. From January 2003, rates on household deposits up to two years.	IFS
	Current account credit rate	Rate on current account credit in denominations of less than one million marks. From January 2003, rates on household loans up to one year.	IFS
	Short-term paper rate	Rate on 12-month Federal debt register claims.	IFS
	Government bond rate	Average yields on all bonds issued by the Federal Government with remaining maturity of more than three years, weighted by the amount of individual bonds in circulation.	IFS
Korea	Call money rate	Average daily rate on call money, weighted by the volume of transactions.	IFS
	Deposit rate	Average, weighted by the amount of deposits for periods of one year or more but less than two years at nationwide commercial banks.	IFS
	Lending rate	Minimum rate charged to general enterprises by deposit money banks on loans of general funds for up to one year. From July 1996, the rate is an average, weighted by new loans extended during the period by nationwide commercial banks.	IFS
	Corporate bond rate	Through January 1992, yields on 91-day bills issued by enterprises without collateral. Beginning February 1992, data refer to corporate bond rate.	IFS
	National housing bond rate	Arithmetic average of yields, by maturity, on Type 1 National Housing Bonds.	IFS

Country	Data	Description	Source
Malaysia	Overnight interbank rate	Weighted average overnight interbank rate.	IFS
	Deposit rate	Average rate offered by commercial banks on three-month time deposits to the private sector in national currency.	IFS
	Base lending rate	Average base lending rate offered by commercial banks.	Bank Negara Malaysia
	Treasury bill rate	Average discount rate on three-month treasury bills.	IFS
	Government bond rate	Market yield to maturity on five-year government bonds.	IFS
Philippines	Overnight interbank rate	Weighted average rate on overnight loans between commercial banks, thrift banks, savings banks, and non-bank financial institutions with quasi-banking functions to cover reserve deficiencies.	IFS
	Deposit rate	Weighted average rate offered by commercial banks on 61- to 90-day time deposits in national currency.	IFS
	Lending rate	Weighted average rate charged by commercial banks on loans in national currency.	IFS
	Treasury bill rate	Weighted average rate on 91-day treasury bills denominated in national currency.	IFS
Thailand	Overnight interbank rate	Rate on loans between commercial banks. Beginning in January 1989, daily average of commercial banks' overnight rates for interbank lending.	IFS
	Deposit rate	Maximum rate offered by commercial banks on three- to six-month savings deposits.	IFS
	Minimum lending rate	Minimum rate charged by commercial banks on loans to prime customers.	IFS
	Government bond rate	Maximum coupon rate on bonds allotted to banks and other financial institutions in Thailand.	IFS
Indonesia	One-day interbank rate	Rate on one-day loans between commercial banks.	IFS
	Deposit rate	Average rate offered by commercial banks on six-month time deposits. Beginning in January 1990, weighted average rate offered by commercial banks on three-month time deposits in national currency.	IFS
	Average lending rate	Weighted average rate charged by commercial banks on loans to the private sector for working capital in national currency.	IFS

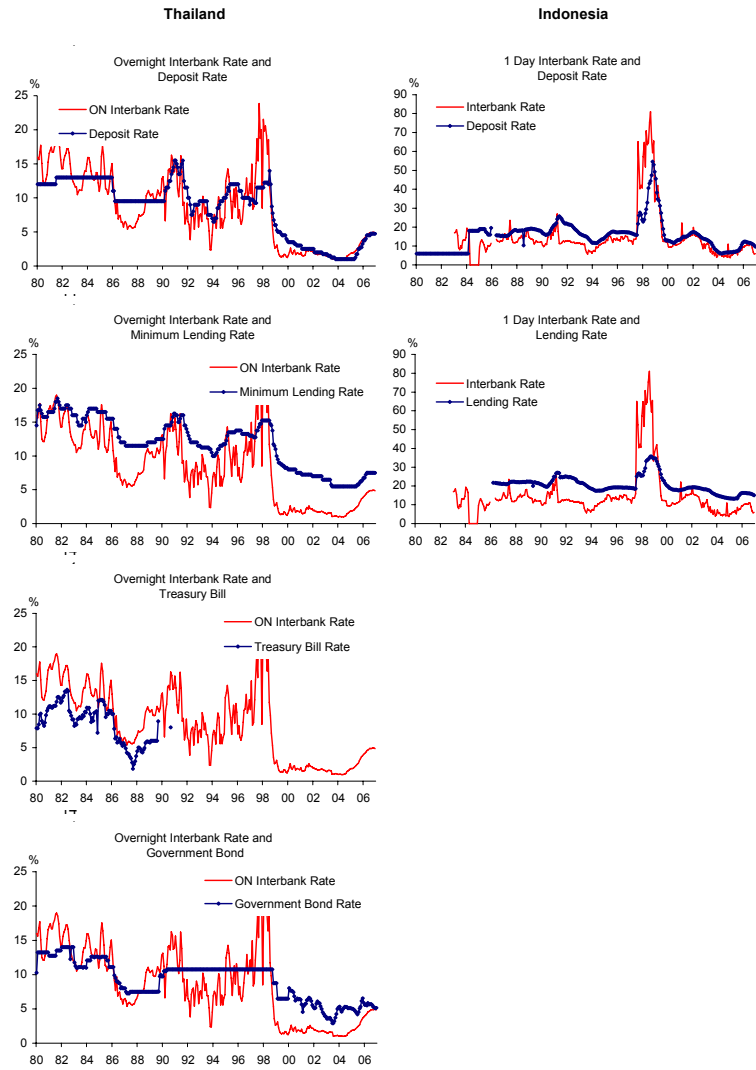
Plots of data



Source: Authors' estimates.



Source: Authors' estimates.



Source: Authors' estimates.

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