



CMBF Paper
Asia-Pacific Bond Markets

No. 16

by
David Lynch



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Asia-Pacific Bond Markets

1. Introduction

This paper evaluates the economic contribution of Asia-Pacific bond markets. Government bond markets in the region have great diversity in terms of size, structure and efficiency. Developed countries liberalised their markets in the early 1980s and most developing countries later followed suit, to varying degrees. Corporate bond markets in the region are generally of minor importance, but a widely held view is that they have potential to contribute more to economic development. The analysis here suggests that efficient bond markets improve the performance of the financial sector and the economy in several ways.

First, the bond market permits governments to raise large amounts of finance without resort to captive market controls, that distort interest rate signals. Secondly, yields on government bonds reflect economic and financial conditions and accurately signal the aggregate cost of debt finance. Related to this, the ‘risk free’ status of government bonds and the depth of their secondary market make them a valuable pricing benchmark for corporate bonds and bank loans. Other benefits of efficient government bond markets include low transactions costs for investment and risk management, a broader range of investment and risk management products, greater financial discipline and a means for the monetary authority to implement open market operations.

The paper begins by comparing government bond markets in the region and extracts common patterns of development. Section 3 then rates the pricing efficiency of the markets. Section 4 considers benefits that flow from efficient markets by imposing greater financial discipline, lowering transaction costs and improving the financial infrastructure. A short review of corporate bond markets in the region in section 5. Concluding comments are given in section 6.

2. Characteristics and Growth of Government Bond Markets

2.1 Market Size and Institutional Aspects

The rapid expansion of equity markets in the Asia-Pacific region since the early-1980s has received most attention in finance journals and magazines, but development of government bond markets in the region has also been impressive. Government bond markets in Australia, Japan and New Zealand are vibrant, built upon market orientated reforms in the early 1980s, but other countries only more recently embarked on this path. Government bond markets in Singapore, Malaysia and Taiwan were opened to market forces in the late 1980s to varying degrees. A new market was put in place in Hong Kong in 1990. More recently, Pakistan, India and China implemented more modest reform packages in inert markets. Markets in Thailand and Korea are languid, though moves to develop Korea's market were initiated in mid-1995. Thus, there is now a veritable rainbow of government bond markets in the region in terms of activity and development.¹

Table 1 provides an outline of markets in terms of amount outstanding, secondary market trading activity and existence of ancillary markets for risk management instruments (US Treasury bond and UK gilt markets are included for comparison). The first two are common measures of market size, though their interpretation from a market development perspective are quite different. The amount outstanding is a measure of government finance raised directly through the market. On the other hand, market turnover is a measure of market vibrancy and reflects liquidity management, information absorption and risk management facilities of the market. Advanced government bond markets support active trading in a range of risk management products, from exchange traded futures contracts to more complex products like swaptions in the OTC market.

¹ Appendix 1 provides detailed descriptions of individual country markets, which are the basis of descriptive analysis and comment in the paper.

Therefore, market development is reflected in the sophistication of related products, as well as activity. Success on this front necessarily implies higher levels of trading, investment and risk management skills in the financial community generally.

Data in table 1 are presented in terms of GDP to facilitate cross country comparison. The amount outstanding varies considerably across countries, but it is not possible to distinguish between markets on the basis of economic status, or market development, from these figures. For example, Malaysia and Singapore have the highest stocks of government bonds, which are built upon high compulsory contributions to statutory superannuation schemes that are required to hold a large part of their investments in government bonds. On the other hand, Japan and New Zealand also have relatively high stocks, which are determined more by cumulative net fiscal deficits.

At the other extreme, pursuit of a 'balanced budget' policy in Indonesia prevents establishment of a government bond market there, while the market in Hong Kong exists to improve the financial infrastructure, rather than as a means of raising finance, *per se*. There is an array of markets between the two extremes, with no obvious discriminating factor. Therefore, government resource mobilisation through the market tells little about the status of a market. Funds may not be needed by government (as in Hong Kong), or if funds are needed, bonds can be sold competitively (as in Australia) or institutions can be forced to purchase them (or some part) at given prices (as in China); either way the desired stock is issued and sold.

Table 1. Characteristics of Government Bond Markets in the Asia Pacific Region
(data are presented as a ratio to GDP, except liquidity)

	Year	Physical market			Derivatives turnover			
		Amount Outstanding	Liquidity#	Turnover	Exchange traded		OTC	
					Futures	Options	Forward/ swap	Options & other
Australia								
- Commonwealth	1994	0.16	14.2	2.34	3.48	0.31	0.26	0.13
- State	1994	0.14 ¹	17.1 ¹	2.16	-	-	-	-
Japan								
- Central govt.	1994	0.39	5.2	2.07	2.85	0.26 ¹	0.05 ^{1e}	0.17 ^e
- Other govt.	1994	0.10	0.5	0.05	-	-	-	-
New Zealand								
	1993	0.25	3.0	0.76	0.18	0.01	modest	small
China								
- Treasury bond	1993	0.05	0.5	0.03	0.45 ³	-	-	-
- Other bonds	1993	0.03	0.3	0.01	-	-	-	-
Hong Kong								
- Ex Fund notes	1994	0.01	83.9	0.72	-	-	modest	small
- Ex Fund bills	1994	0.04	119.1	5.04	-	-	-	-
India								
	1993	0.12	0.2 ^e	0.02 ^e	-	-	-	-
Indonesia								
	1994	no market	-	-	-	-	-	-
Korea								
	1994	0.03	minimal	minimal	-	-	negligible	negligible
Malaysia								
	1994	0.35	0.2	0.06	-	-	negligible	negligible
Nepal								
	1993	0.15	0.2	0.03	-	-	-	-
Pakistan								
	1994	0.16	-	0.01 ^e	-	-	-	-
Philippines								
	1994	0.15	2.7	0.41	-	-	-	-
Singapore								
	1993	0.49	1.0	0.51 ²	-	-	small	emerging
Sri Lanka								
	1992	0.18	-	0.00 ^e	-	-	-	-
Taiwan								
	1993	0.11	21.4	2.29	-	-	negligible	negligible
Thailand								
	1994	0.02	-	-	negligible	negligible
<i>Memo:</i>								
USA	1994	0.48	13.1	6.24	1.65	0.48		
UK	1994	0.34	6.3	2.15	0.94	0.15		
# Liquidity equals the turnover divided by the amount outstanding.								
1. 1993 2. excludes repos 3. 1994 - denotes no market/not relevant .. denotes very small or zero								

Notes: Data cover central government debt only, with main exceptions noted. Turnover is measured on one side only. In some countries, notably Japan, reported statistics cover both sides of each transaction. Figures here have been adjusted in these cases. Data sources include - Reserve Bank of Australia *Bulletin*, AFMA *Financial Markets 1994*, Hong Kong Monetary Authority *Annual Report 1993*, DFHI (India) *Annual Report 1993/94*, Bank of Japan *Economic Statistics Monthly*, *Financial Markets and Quarterly Bulletin*, Tokyo Stock Exchange *Fact Book 1993*, Reserve Bank of New Zealand *Bulletin*, Bain and Co., *The New Zealand Bond Market*, Monetary Authority of Singapore, *Annual Reports*, Bank Negara Malaysia, *Annual Reports*, Central Bank of the Philippines, *Annual Report*, Manila International Futures Exchange, *Futures Newsletter*, Central Bank of China, *Financial Statistics Monthly*, Bank of England *Gilts and the Gilt Market Review 1994-95*, US Federal Reserve Bank *Bulletin (various)* and IMF's *International Capital Markets* (September 1994), *Euro money Guide to Bond Markets 1994*, World Bank Bond Review for China and direct correspondence with monetary authorities in most countries, Sydney Futures Exchange and New Zealand Futures Exchange.

Market turnover data are more discriminating than stock data. Countries that have 'free' market regimes - Australia, Japan, New Zealand, Hong Kong and Taiwan - have by far the largest turnover. Yields in Malaysia and Singapore have been market determined since the late 1980s, but there are still significant captive market elements that limit the supply of tradeable stock and inhibit active trading.² Singapore is in an intermediate position, with Malaysia some way behind.³ Secondary market trading in other countries, that have more restrictive regimes, or have only more immediately undergone market reform, is an even smaller fraction of that in developed country markets. Discussion of figure 1 below further illustrates these points.

Active derivatives markets based on domestic government bonds exist only in Australia, Japan and New Zealand. Derivatives emanate from active physical markets, but once established both interact providing continuous market prices, additional liquidity and lower transaction costs. Futures trading easily exceeds that on the physical market in Australia and Japan. Sizeable OTC derivatives markets exist only in Australia and Japan, though *ad hoc* transactions occur in most countries. A treasury bond futures contract was introduced in China in late 1992, but was only traded actively from late-1994 to early-1995, when fraudulent trading undermined the market. Given China's phase of economic and financial development, the market is little short of a casino.

² The Philippines also suffers from this to some extent, given high bank reserve requirements. A quite successful Treasury bill market and some investor resistance to long term debt stemming from previous macroeconomic disturbances and sovereign debt rescheduling are other factors.

³ This statement allows for repos, which are excluded from table 1 figures for Singapore and Malaysia due to data constraints

2.2 Patterns of Development

Government bond markets are influenced by the historical development of the underlying economy (especially budgetary policy) and the rest of the financial sector. By its nature, political influences help shape it. Partly because of this, and partly in spite of this, several points in common emerge from a review of the individual bond markets. In summary, these are;

- Controlled yields stifle secondary market trading,
- Portfolio constraints on financial institutions (that is, captive market arrangements) likewise inhibit trading,
- As the foregoing implies, establishment of market related yields and curtailment of captive markets constraints stimulate secondary market trading,
- Introduction of market makers, rationalisation of issues to ensure continuity of deep, liquid benchmark lines of stock and establishment of efficient registry, clearing and settlement systems are required to sustain a continuous market,
- An active market for repurchase agreement (repos) based on government bonds can exist along side stagnant secondary market outright bond trading,
- Only deep physical markets, with large outright bond trading, support active markets for interest rate derivatives products,
- Small markets in OTC derivatives exist along side active government bond markets and large exchange traded bond futures markets.

Motivation for reform has varied but the ultimate aim is to lift economic performance. A desire to reduce government influence on the economy and improve internal and external competitiveness prompted market liberalisation in Australia and New Zealand. This was part of a package of economic and financial reforms. Japanese reform followed domestic and international pressure to liberalise its markets and open up its economy. Taiwan's need to mobilise resources to finance the government's National Development Plan, while also pursuing financial liberalisation, was the turn-

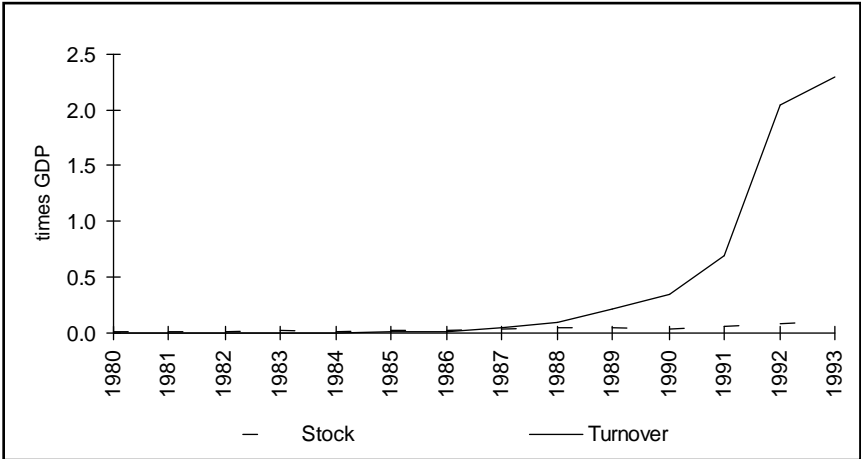
ing point for market development there. Similarly, a temporary need to finance capital projects initially helped stimulate market development in Hong Kong, though the market's role in developing financial sector infrastructure is now the only relevant factor. The latter is an important objective of market development in Singapore and Malaysia too. Markets in Pakistan and India are being reformed as part of economic deregulation packages.

Figure 1 illustrates representative country temporal experiences (the scale differs across countries). Only central government bonds are covered in figure 1, though in some cases sizeable markets exist for 'other' government bonds, as shown on table 1. Singapore and, especially, Taiwan demonstrate that market development can be rapid, once liberalisation measures are implemented; see examples 1 and 2. Turnover literally 'took-off' after implementation of major reforms in 1987 and 1990, respectively. Singapore's market later stabilised at a much lower level and is small relative to developed markets, though it is still much larger than most developing markets.⁴ Over 90% of turnover in Taiwan's bond market is in the form of repos, as is a high proportion of turnover in Singapore's bond market.

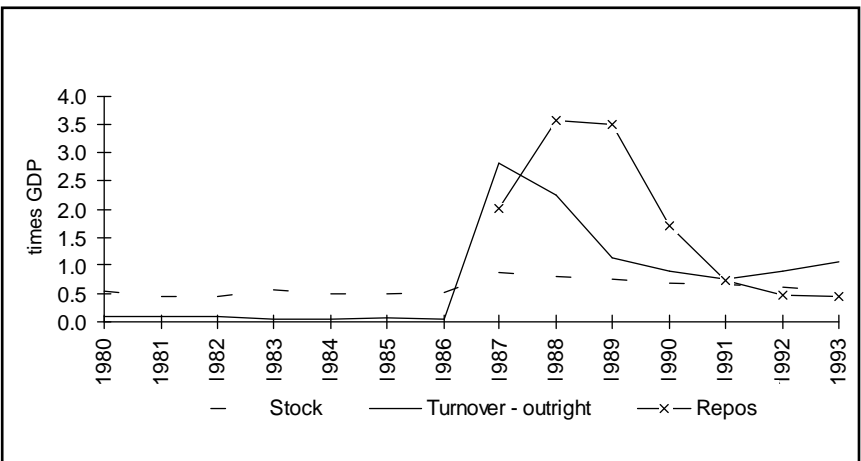
⁴ Singapore turnover data (example 2) cover both Treasury bills and government bond transactions. However, the pattern over time reflects the broad trend to government bond turnover. Government outright turnover (that is, excluding repos) was evenly split between Treasury bills and bonds in 1993.

Figure 1 Evolution of Selected Asia-Pacific Government Bond Markets

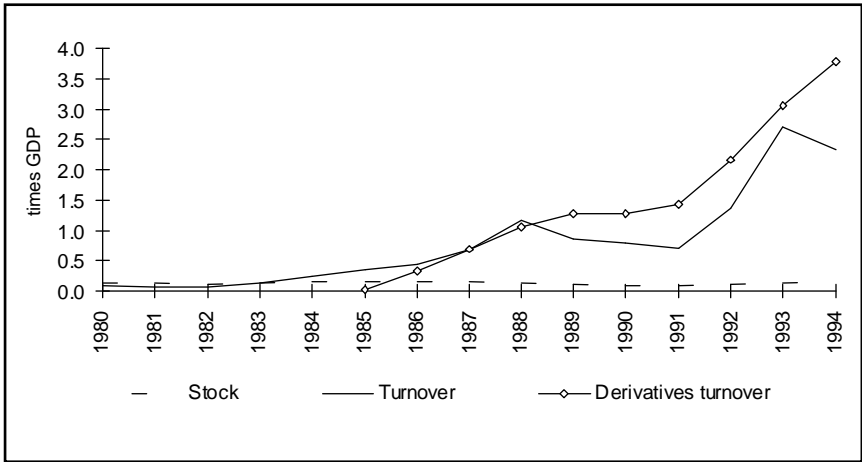
Example 1. Taiwan's Government Bond Market.



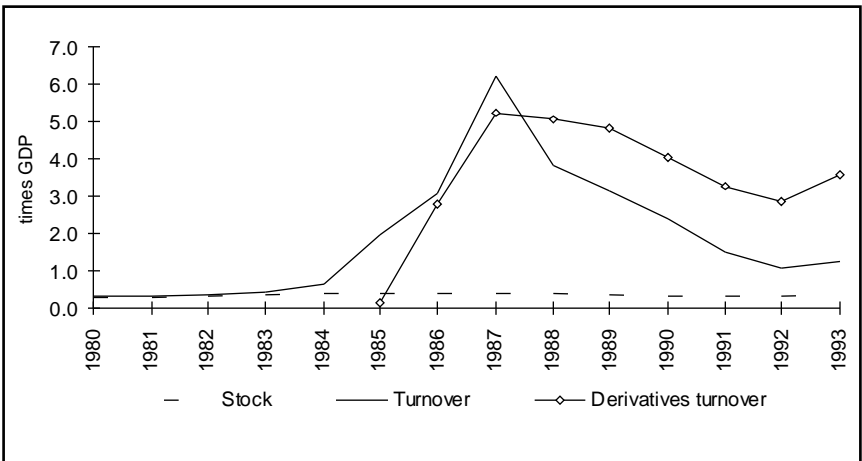
Example 2. Singapore's Government Securities (Bond and Treasury bill) market



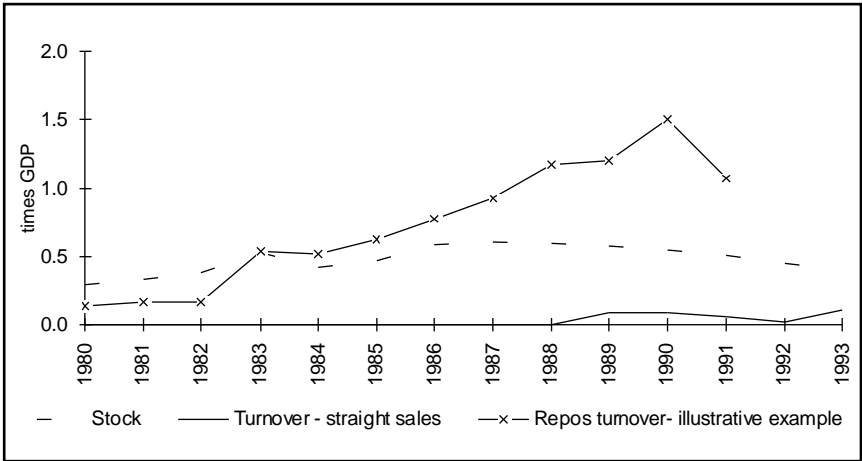
Example 3. Australia's Government Bond Market



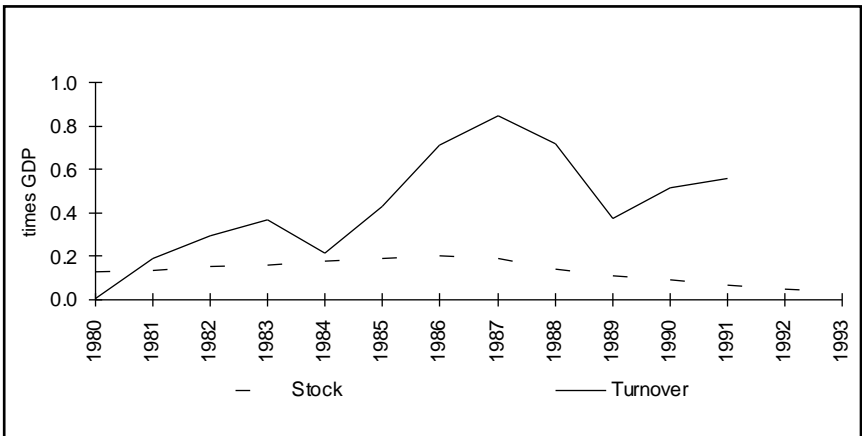
Example 4. Japan's Government Bond Market.



Example 5. Malaysia's Government Bond Market



Example 6. Thailand's Government Bond Market



Note: Turnover figures in charts include repurchase agreements, except where they are explicitly graphed. Repos are about 40% of physical turnover in Australia, but are marginal in Japan, where *gensaki* are based mainly on Treasury and Finance bills. In examples 3 and 4, derivatives comprise exchange traded futures and options.

Australia and Japan, shown as examples 3 and 4, experienced similar periods of rapid growth in turnover after liberalisation and other market development measures. Repos accounted for about 45% of reported turnover in Australia in 1994.⁵ Only a tiny fraction of long term bond sales in Japan are in the form of repos (or 'gensaki'). These examples also illustrate the importance of derivatives in advanced markets. The sum of notional turnover of exchange traded futures and options easily exceeds that on the physical market. Trading in futures and options expands very rapidly once they are introduced. There are no exchange traded contracts based on other bonds.

In Malaysia, outright sales in the secondary market for government bonds picked up after reform in 1987 but are still tiny compared to developed markets. A significant captive market, including a statutory superannuation fund that holds 60% of the stock, is undoubtedly a part of the problem. Repos have a much higher turnover (example 5 contains an illustrative estimate, based on the amount outstanding at the end of each year, as turnover data are not published).⁶ Thailand's market is also illiquid, with no substantive effort made to reform it by end-1994. A repo market exists, in which the Bank of Thailand is the effective intermediary for all parties and uses the market for open market operations. The decline in the amount outstanding of government bonds inhibits further development of the market.

⁵ Data provided by the Authorised Money Market Dealers Association on their members transactions suggest that repo trading is greater than that implied by data here, which are collected on a survey basis.

⁶ The 'illustrative repo turnover' is calculated assuming that the weighted average repo has one week to maturity and one third of repos are based on government bonds. The assumptions seem reasonable but their accuracy cannot be assessed. Bank Negara made repo stock data available to 1990, for the ADB (1993) study, which is used in calculations here.

Table 2. Government Bond Yields in Real Terms

<i>Country</i>	<i>Period</i>		<i>Average Annual Yield</i>	
	Pre-reform	Post-reform	Pre-reform	Post-reform
Australia	1970-82	1982-93	0.1	5.6
Japan	1971-82	1983-93	-0.1	0.9
New Zealand	1965-83	1984-93	-1.7	4.9
China	1981-92	-	2.5	-
Hong Kong	-	1990-94	-	na
India	1964-84	-	-1.6	-
Korea	1975-92	-	6.2	-
Malaysia	1970-87	1988-93	1.7	na
Pakistan	1964-92	-	-0.7	-
Philippines	1980-90	-	-	1.0
Singapore	-	1987-93	na	2.0
Sri Lanka	1985-92	-	1.6	-
Taiwan	-	1989-94	na	4.8
Thailand	1980-93	-	5.1	-

Note: Based on quarterly data. Pakistan, Taiwan, India and the Philippines figures are based on annual data. Taiwan's yield is an issue rate for five year bonds (sourced in the Central Bank of China's *Financial Statistics Monthly*) and includes two years prior to the introduction of auctions and, thus, crosses regimes to some extent. Philippine data are based on secondary market rates for 'other' government securities, which includes some short term paper (see Central Bank of the Philippines, *Annual Report*, table 3.2).

3. Pricing Efficiency in the Government Bond Market

3.1 Yield Levels and Flexibility

Yields in efficient government bond markets rapidly absorb new information and adapt to changing economic and market conditions. In contrast, yields in controlled markets are usually rigid, insensitive to market conditions and too low to fully compensate savers for inflation. The benchmark pricing role of government bonds exacerbates the problem. On the face of it, low yields may relieve budgetary pressures by providing cheap finance, but resulting allocative inefficiencies have grave economic consequences that ultimately contract the government revenue base. Table 2 presents government bond real yields for Asia-Pacific countries, separated into two periods; before and after implementation of market liberalisation reforms.

Table 3. Volatility of Nominal Government Bond Yields

		yield level (%)		volatility (%)	scaled volatility
		1.	2.		(2/1)x1000
Australia	- pre-reform	9.3	0.11		12
	- post-reform	12.2	0.37		30
Japan	- pre-reform	7.9	0.19		23
	- post-reform	5.7	0.24		42
New Zealand	- pre-reform	8.1	0.12		14
	- post-reform	12.6	0.47		37
Korea	- pre-reform	17.2	0.50		29
Malaysia	- pre-reform	6.1	0.02		3
Pakistan	- pre-reform	9.7	0.10		9
Singapore	- post-reform	4.7	0.04		9
Sri Lanka	- pre-reform	13.4	0.13		10
Thailand	- pre-reform	10.8	0.17		16
<i>Memo:</i>					
USA	- 1980-93	9.5	0.29		30
UK	- 1980-93	10.9	0.32		30
Germany	- 1980-93	7.7	0.20		26

Note: Volatility is measured as the average of the absolute change in monthly bond yields. Pre-reform and post-reform dates correspond to those on table 2. Quarterly figures for New Zealand, Singapore and Thailand are adjusted to provide comparable data.

Real yields are calculated by adjusting nominal yields to take account of current inflation. There is probably a term structure to inflation expectations, but this can only be observed if the term structure of real interest rates is known, which it is not. The problem is alleviated by calculating yields on an annual average basis over several years. In some instances, the official level of inflation understates the true rate, which naturally leads to an overestimate of real yields; for example, there is doubt on the accuracy of real yields for China in table 2.⁷ The obvious difficulty is that no alternative price index exists from which to calculate the true rate of inflation.

Table 3 contrasts nominal yield volatility across countries and between controlled and liberalised markets, in countries that have undertaken meaningful bond market reform. Bond yield volatility in the USA, UK and Germany are shown for comparison. Volatility is measured by the average absolute monthly change, which is a simple but adequate measure. A scaled measure is provided to take account of yield levels.

Nominal bond yield volatility in Australia rose sharply post-reform by both measures, despite a fall in the level and variability of inflation. New Zealand experienced a similar increase, though inflation volatility rose moderately. Japan's low bond yields, produced low volatility, which has not altered much between the 1970s and 1980s.⁸ Singapore similarly benefits from low inflation. Sri Lanka and Pakistan had stable nominal yields for long periods, followed by significant one off shifts in yield levels.

⁷ For example, see *Asia Wall Street Journal* article, syndicated to the *Australian Financial Review*, 25 January 1995. This asserts that the baskets of goods used to calculate the consumer price index in many Asian countries are adjusted too infrequently, with the result that actual inflation is understated. It also draws attention to a political desire to understate inflation in some cases.

⁸ Mid-1982 is the date selected to separate Japanese data into pre- and post-reform periods, because it reflects important changes to dealing regulations that permitted banks to more actively trade government bonds and signifies the time from which market turnover began to rise dramatically. Selection of a reform date for Japan is contentious, as reform was a gradual process from the mid-1970s to the mid-1980s (see Takagi, 1987, for a concise description). Results for Japan must be interpreted in this light.

The level of bond yields in Malaysia changed little in the pre-reform period. Korea is a notable exception for regulated markets, with a high volatility that in part reflects occasional high inflation. In sum, it appears that nominal yields are more volatile in de-regulated markets than in controlled markets, but the extent of the rise depends on the yield levels, inflation and the extent to which the authorities adjusted yields in the pre-reform period.

Several features emerge from analysis of data reported in tables 2 and 3;

- Average real bond yields are positive in all post-reform markets but are low or negative in most pre-reform markets,
- Nominal yield volatility rises as markets are liberalised and their sensitivity to changing economic conditions increases,
- Nominal yields change in larger, discrete movements in tightly controlled markets,
- Yields rise at the time of market liberalisation.

3.2 Empirical Tests of Yield Efficiency

Korea's and Thailand's government bond markets demonstrate that, while controlled markets suffer defects, such as inadequate liquidity, they can be managed in a flexible manner to provide positive real yields, even if inflation is high and variable. However, this does not mean that the markets are entirely efficient in absorbing market information. One approach to measure the information content of bond yields is to test the term structure of interest rates as a predictor of economic growth.⁹ This is a guide to the markets' capacity to absorb growth expectations (to the extent that growth expectations are correct, *ex post*). The term structure established in liberalised bond markets will be a better predictor than that imposed in controlled markets, if higher yield volatility in liberalised markets represents greater sensitivity to evolving economic conditions, rather than being the outcome of speculative trading.¹⁰

⁹ The term structure is the difference between short term interest rates and bond yields.

¹⁰ Efficient operation of the market assists information absorption; Takagi (1987) shows that lower transactions costs in Japan's bond market, following deregulation, increased arbitrage trading and generated a term structure that better reflected economic expectations.

Nominal bond yields in efficient markets are determined largely by expectations on future economic growth and inflation, so the analysis can be extended to test the information content of the term structure of interest rates on future inflation. A positive relationship is expected, with a rise in bond yields predicting a rise in inflation, *ceteris paribus*.

3.2.1 Economic Growth and the Term Structure of Interest Rates

Many studies examine the relationship between the term structure of interest rates and indicators of economic activity in developed countries. Recent examples include Stock and Watson (1989) and Estrella and Hardouvelis (1991) for the USA, Lowe (1992) and Karfakis and Moschos (1995) for Australia, and Plosser and Rouwenhorst (1994) and Hu (1993) for a range of industrial countries. The substance of their findings is that the differential between short term and long term interest rates is a useful predictor of economic growth; that is, the bond and money markets absorb expectations about future economic conditions in their pricing. Expectations are not always correct and markets may not fully capture them, so an imperfect relationship is observed. When bond or money markets are tightly controlled, prices lose much of their information content. Poor information content of yields indicates an informationally inefficient market.

The relationship between the term structure of interest rates and economic growth is formally derived by several researchers. For example, Hu (1993) uses an inter-temporal equilibrium model of an infinite horizon, single commodity economy to derive the relationship. Economic growth is driven by underlying productivity shocks, that evolve according to predictable drift and diffusion processes and can be represented by the stochastic integral given by equation (1). Consumers can invest in zero coupon bonds that repay one unit of output at maturity, at time T . Therefore, the return to bond investors is dependent upon economic growth and can be represented by equation (2).

$$(1) \quad Y_t = Y_0 + \int_0^t \mu_y(Y,X,s) + \int_0^t \sigma_y(Y,X,s)dB_s,$$

where B is standard Brownian motion.

Y_0 - Initial aggregate output.

Y_t - Aggregate output at period t

μ - Drift in output (or expected economic growth).

σ - Output diffusion process (or expected variance of economic growth).

$$(2) \quad dP = \mu_p dt + \sigma_p dB.$$

dP - Change in value of bond (inverse of yield change).

In this framework, current bond prices are dependent on anticipated economic growth and the differential between short term and long term interest rates embodies economic growth expectations. Assuming constant variance, the term structure will be upward sloping if economic growth is expected to pick up and downward sloping if a decline in growth is expected. The model is intuitively appealing, despite its restrictiveness.

Other researchers offer formal models, like Lowe (1992), and heuristic models, like Harvey (1993), that examine the link between the term structure of interest rates and economic growth in a similar manner. Table 4 provides summary evidence on the link between economic growth and the term structure for a range of Asia-Pacific economies (limited by data availability), both pre-reform and post-reform. Quarterly data are used in a prediction model, given by equation (4).

$$(4) \quad \Delta \text{GDP}_{t-(t+1)} = a_0 + a_1 * (Y_d - I_d)_t + e_t$$

$\text{GDP}_{t-(t+1)}$ - Growth in GDP between t and t+1.
 $(Y_d - I_d)_t$ - Difference between long term interest rates, or bond yields, (Y_d), and short term interest rates (I_d); the current term structure.

The relationship between the current term structure and future economic growth is estimated over two time horizons, by using economic growth one year forward and three years forward.¹¹ Economic growth is measured by the percentage change in real GDP over one year and three years, respectively, in equations for Australia, Japan, Korea and Singapore. The level of manufacturing output is used as a measure of economic growth for New Zealand and Pakistan, in the absence of quarterly GDP data. Appendix 3 presents details of the regressions summarised on table 4.

Table 4. The Term Structure: Its Information Content for Economic Growth

Equation: $\Delta GDP_{t(t+1)} = a_0 + a_1*(Y_d - I_d)_t + e_t$									
Growth horizon:	a ₁ Coefficient value				Equation adjusted R ²				
	pre-reform		post-reform		pre-reform		post-reform		
	1 year	3 year	1 year	3 year	1 year	3 year	1 year	3 year	
Australia	0	0	0.39	0.25	0.00	-0.01	0.16	0.19	
Japan	0.45	0	0.90	0	0.10	-0.01	0.12	0.00	
Korea	0	-0.53	n ap	n ap	0.04	0.31	n ap	n ap	
New Zealand	0	-0.92	0	0	0.02	0.19	0.00	-0.04	
Pakistan	0	-0.96	n ap	n ap	-0.02	0.11	n ap	n ap	
Singapore	na	na	0	0.94	na	na	0.02	0.32	

Note: Ordinary least squares regression (OLS), quarterly data. Coefficient estimates that are not significantly different from zero at the 10% level are presented as zero to improve clarity of exposition (two sided Newey West, 1989, autocorrelation adjusted t-test, with six and 14 lags for one year and three year horizons, respectively).

Information content is measured by the adjusted R². The term structure has negligible predictive power in pre-reform Australia, but has modest explanatory power and coefficients are positively signed after deregulation of the bond market for both growth horizons.

¹¹ The term structure is represented by the difference between long term government bond yields and short term money market rates, usually an interbank rate or a treasury bill rate. Treasury bill/note rates are used for Australia, New Zealand, Singapore and Sri Lanka (additional regressions for Australia and Singapore using money market interest rates provide similar results). See appendix 2 for data sources for government bond yields and money market interest rates.

In Japan, the term structure has significant explanatory power over the one year time horizon, in both the pre- and post-reform periods, but no link is reported over the three year growth horizon. Regression estimates for post-reform Singapore provide positive coefficients with significant explanatory power.

Korea has a controlled regime but, nevertheless, has a significant relationship between the term structure and economic growth, with good explanatory power. However, the term structure coefficient is negatively signed; the opposite to that predicted by theory. This phenomenon is also reported for the three year horizon in pre-reform New Zealand and Pakistan. Further analysis of New Zealand data identifies a significant positive link between the term structure and one year economic growth since the 1987 recession.

The cause of the observed negative relationship prior to market liberalisation is difficult to pin down.¹² It may result from a combination of rigidities in the financial system, a lack of potency of monetary policy, or long lags in its effects. For example, monetary tightening to stem strong economic growth could push up short term interest rates, while long term interest rates remain inflexible. The normal positive term structure is then reduced, but growth proceeds until monetary policy takes hold, giving rise to the observed relationship. Development of a theoretical framework to explain a negative relationship is beyond the scope of this paper.

The term structure on international markets may indicate future domestic economic growth in open economies and can be especially useful if the domestic bond market is controlled. Test results with this data-set find that the international term structure has information content for all economies (see appendix 3). Notably, a positive relationship with economic growth is found for Korea and post-reform New Zealand.

¹² The negative relationship could reflect deficiencies in data, but this is unlikely because of the systematic nature of the relationship.

The results can be summarised;

- Liberalised bond markets conform with theoretical priors and provide an interest rate term structure that has a positive relationship with economic growth,
- In some cases, the term structure in controlled markets has a *negative* relationship with future economic growth, against prior expectations of no relationship.

3.2.2 Inflation and the Term Structure of Interest Rates

The analysis so far ignores inflation, though nominal bond yields in efficient markets embody inflation expectations. Movements in the term structure may reflect new information on real economic growth prospects or revised inflation expectations. In view of this, equation (5) is estimated to test for inflation information content.

$$(5) \quad \Delta INF_{t-(t+1)} = a_0 + a_1*(Y_d - I_d)_t + e_t$$

$\Delta INF_{t-(t+1)}$ - Change in the inflation rate between t and t+1.
 $(Y_d - I_d)_t$ - Current term structure, as in equation (4).

Table 5 reports the results of this model, applied to the data-set here. Wider country coverage than in table 5 is possible, because sub-annual inflation data are more readily available than GDP data. The term structure here has considerable predictive power for inflation in most countries. Liberalised markets in New Zealand and Australia (for the long horizon) have significant information content, in contrast to pre-reform markets. It is notable that Thailand and Korea also record significant predictive power, which accords with findings for other price efficiency measures reported above. The results suggest that liberalised markets, or those controlled in a flexible manner with a view to maintaining positive real yields, have greater predictive power for inflation.

Table 5. The Term Structure: Its Information Content for Inflation

Equation: $\Delta INF_{t+j} = a_0 + a_1*(Y_d - I_d)_{t-j}$

Inflation horizon:	a ₁ Coefficient value				Equation adjusted R ²			
	pre-reform		post-reform		pre-reform		post-reform	
	1 year	3 year	1 year	3 year	1 year	3 year	1 year	3 year
Australia	0	0	0	0.86	-0.01	-0.00	-0.02	0.29
Japan	1.67	2.54	0.78	0	0.27	0.20	0.42	-0.01
Korea	1.17	1.29	n ap	n ap	0.41	0.12	n ap	n ap
Malaysia	0	0	n ap	n ap	-0.01	-0.01	n ap	n ap
New Zealand	0	0	1.56	1.98	-0.02	-0.02	0.43	0.57
Pakistan	0	0	n ap	n ap	0.00	-0.02	n ap	n ap
Singapore	na	na	0	0	na	na	-0.03	0.00
Sri Lanka	0	1.60	n ap	n ap	-0.03	0.22	n ap	n ap
Thailand	0.51	1.12	n ap	n ap	0.39	0.59	n ap	n ap

See notes to table 5. Detailed regression results are given in appendix 3.

Finally, note that expected inflation was added to equation (4) and expected real interest rates were added to equation (5) as explanatory variables, to take account of the fact that nominal bond yields are jointly determined by real interest rate and inflation expectations. The results strongly support the above analysis and so are not reported.

3.2.3 Pricing Efficiency - Summary

Indicators of pricing efficiency demonstrate that liberalised government bond markets do better at emitting price signals with rational economic content, especially yields that compensate for inflation. They are also more flexible and better able to absorb economic information and expectations, as reflected in the information content of the yield curve. However, it is noteworthy that controlled markets in Thailand and Korea perform quite well on important fronts, most notably in establishment of positive real yields. This suggests that bond markets can be liberalised on a gradual basis; first, by establishing positive real yields and later by introduction of market organisation and trading mechanisms that further improve pricing accuracy.

Finally, a problem in researching emerging bond markets is the absence of reliable data for some countries. For example, historical secondary market yield data are not available for Malaysia, or Taiwan. This is a problem, because rapid and extensive diffusion of price information is an important input to effective price signalling by the market and good information dissemination mechanisms are a vital input to developing inert markets.

4. Three Outstanding Issues

4.1 Market Discipline

An important benefit from financial market development is the discipline imposed by markets on their participants. Borrowers must pay a fair return to investors and are penalised if they deviate from sensible financial policies, initially by higher borrowing costs and eventually by exclusion from the market and liquidation of assets if remedial action is not taken. Market discipline is a form of investor protection based on sanction. A useful description is given by Lane (1993);

“Market discipline means that financial markets provide signals that lead borrowers to behave in a manner consistent with their solvency”.

Discipline is vital to successful financial markets and economic benefits that flow from them. The central role of government in the economy makes disciplined policy making by it an important input to economic growth. Captive market and other regulations reduce (if not eliminate) government’s sensitivity to market discipline and prevent the market from signalling the true cost of capital in the economy.

Government borrowing on international capital markets is automatically subject to market discipline, but domestic lenders cannot unilaterally apply this control. The government must agree to be disciplined by the market, which occurs when regulated yields and captive market conditions are removed.¹³ The government retains the right to re-introduce a regulated system, but in practice, this is difficult because the consequent transfer of financial resources is paralleled by a shifting of power in society.

¹³ Domestic economic agents hold some degree of power by the threat of capital flight. Once the capital is gone, so is the threat, but the inducement of repatriation takes its place.

This moves beyond the strict bounds of economics, as only in a democracy is government controlled by the community that it represents.¹⁴ Nevertheless, some basic tenets about the discipline of the market on government can be stated.

Market sanctions, in the form of higher debt servicing costs and possibly restricted market access, are imposed on governments that embark on irresponsible economic policies. These feed into the economy through benchmarking and other relationships. Two important consequences follow. First, the government must either increase taxes, cut expenditure, or increase borrowing to pay the higher debt servicing cost. The first two are not politically palatable and the latter exacerbates the problem. Secondly, political pressure on the government from voters paying higher mortgage and business loan interest rates intensify pressure on it to rectify policy. This creates a healthy tension between the government and the markets, which opens out and improves the quality of economic debate. More critical and better informed evaluation of government spending, tax raising and financial management generally leads to better economic policy making and an improved economic performance.¹⁵ The policy credibility premium offered by the market is a strong incentive for good government to maintain responsible policies.

There are several qualifications to these arguments. First, the market is not always right, but the better the quality of information made available to it, the better it performs.¹⁶

¹⁴ It is not beyond the realms of political economy. The interaction between political and economic forces is complex and helps shape the pattern of economic development. A short piece on the subject here would not do justice to the issues involved, so its analysis is left to future researchers.

¹⁵ A professional, sophisticated and sufficiently independent financial community is needed to evaluate policy. Open access to relevant information, of acceptable quality, is an essential input. Credit rating agencies assist in this regard, as international ratings are factored into the domestic market and their importance rises when exchange controls are removed.

¹⁶ Natural uncertainty, outside of the probabilistic domain, means that *ex post* signals are not always correct but the nature of this uncertainty cannot be overcome by market.

An advantage of the government bond market, in this respect, is its low level of information asymmetry, because information on economic conditions and policy considerations that drive the market is widely available. Foreign investment in government bond markets gives rise to a second qualification. Foreign capital flows can be volatile and act as a conduit for currency speculation.¹⁷ Ordinarily foreign investors increase market discipline, but there have been occasions when external capital flows have seriously disrupted markets.

Evaluation of government bond markets in the region from a disciplinary perspective is subjective. Tightly controlled bond market regimes are not subject to market discipline; the Pakistan and Indian government bond markets up to the early 1990s are examples of this. China's attempts to liberalise its market through voluntary primary market auctions were toppled by high inflation in 1993 and 1994, that pushed up borrowing costs. Small markets in Hong Kong, Korea and Taiwan reflect solid fiscal discipline, achieved independently of the market. In Singapore, the government dominates the markets, because of a strong fiscal position and required bond purchases by the state superannuation fund (CPF). Similar captive market elements inhibit the market's influence in Malaysia. Japan, New Zealand and Australia have open markets that operate in a manner that imposes the type of discipline described above to varying degrees. The traditional strong role of the Ministry of Finance in Japan, dampens the market's influence, while substantial foreign investment in New Zealand's markets accentuates sensitivity to macroeconomic developments. Australia provides a good example of the economic and political interactions that determine a market's influence through its judgments, expressed in price movements.¹⁸

¹⁷ For example, in an effort to stem currency speculation, Malaysia banned the sale of long term fixed rate instruments (and short term securities) to non-residents for a period in 1993/94.

¹⁸ Macfarlane (1995) provides a short but cogent account of the role of financial markets in acting as a counterweight to sectional interest groups (and policy laxity driven by the politics of the situation) in Australia; "... markets play a useful role in helping countries put in place sustainable macro-economic policies in the face of some quite powerful forces pushing in the opposite direction".

Liberalised government bond markets are not a panacea for poor policy making. The payment of a penalty for high borrowing may not halt a government's imprudence, especially if an election is in the offing. Further, experience in Singapore and elsewhere demonstrates that solid government policy making can take place in the absence of bond market discipline (partly because other financial markets, especially the foreign exchange market, also provide discipline on government policy).

4.2 Transactions Costs

Low transactions costs make government bonds a useful tool for liquidity management (usually by repo trading) and investment management. Advanced markets rely on a market making system, in which the bid-offer spread is the sole transaction cost. Brokers can exist along side the market but usually only capture a small part of the business. Less developed markets rely more on brokers, but are still OTC, with nominal amounts traded on stock exchanges. Table 6 provides a guide to bid-offer spreads on government bond markets in the region.

The spreads illustrate the large difference in trading costs between developed and inert markets. Liquidity and transactions costs are jointly determined, so markets with high liquidity have low transactions costs. Australia and Japan report the lowest spreads for government bonds and are accompanied by derivatives markets, the most active of which trade-off even narrower margins. Spreads decline as markets develop and trading increases. For example, government bond spreads in Singapore were 50 basis points (bps), or more, prior to reform but are now a fraction of that. Similarly, spreads on government bonds in Hong Kong fell from 20 bps at the time of their introduction, to around 5 bps by early 1995. Liquidity and investment management costs in the markets have fallen commensurably and are a fraction of costs in inactive markets, like Thailand's. Taiwan's government bond market lacked consistent liquidity in 1994, so although spreads were generally low, they blew out on occasions.

Table 6. Illustrative Spreads on Government and Corporate Bond Markets

	Government bonds				Corporate bonds	
	Pre-reform		Post-reform		spread	year
	spread	year	spread	year		
Australia	25	1975	3	1994	5	1994
Japan	13	1980	2	1994	-	-
New Zealand	na	-	3-5	1994	5	1994
Hong Kong	20	1991	5-10	1994	50	1994
India	25	1993	-	1993	100	1993
Indonesia	-	-	-	-	150 ⁺	1994
Korea	nq	1993	-	-	na	na
Malaysia	na	-	10-25	1994	25-50	1994
Pakistan	na	1993	-	-	na	1993
Singapore	50 ⁺	1986	5	1994	na	1994
Sri Lanka	nq	1993	-	-	nq	1993
Taiwan	25 ⁺	1991	3-5	1994	nq	1993
Thailand	nq	1993	-	-	75 ⁺	1995

na denotes not available nq denotes no quote given - denotes no material market

Notes: Quotes are for benchmark stock. Spreads for Australia, Singapore and Hong Kong were given by experienced market traders. Quotes for Japan are from Takagi (1987) and Reuters. Spreads for New Zealand are from Bain & Co., *The New Zealand Bond Market*, spreads for Thailand are from *The Bangkok Post*, 15 March 1995, Spreads for Malaysia are from JP Morgan, *Investment Brief*, 4 November 1994. Others are from a survey conducted through Central Banks in 1993. The corporate bond spread for Indonesia is from PT Sigma Batara (direct communication).

Spreads on corporate bonds are higher than spreads on government bonds, because the market lacks depth. However, Takagi (1987) shows that increased activity and lower spreads in benchmark markets lower transaction costs in ancillary markets (though not to the level in the former). Therefore, an external benefit of an efficient government bond market is lower transaction costs on corporate bond markets.

On a related matter, experience in Australia and elsewhere shows that rationalisation of the market (deep lines of benchmark stock, standardisation of issues etc) significantly lowers the issue and servicing cost of debt, as well as lowering subsequent trading costs.¹⁹

¹⁹ The re-organisation of NSW T-Corp debt in Australia in the late 1980s is a good example of this.

Benchmark government bond yields often trade at 20 bps, and sometimes much more, below yields on off-the-run stocks, with significant savings for government.

4.3 Infrastructure Links.

Government bond markets are an important part of the financial infrastructure. They provide 'risk free' prices that benchmark for corporate bonds and are an input to derivatives pricing (including foreign exchange and equity derivatives). The market is also used to hedge open derivatives positions and serves as a means to implement open market operations. In the Asia-Pacific region, only markets in Australia, New Zealand and Japan adequately fulfill these roles. The markets in Hong Kong and, to a lesser extent, Singapore have made significant progress on these fronts in recent years. Their contribution to infrastructure is more important than their more direct role of raising finance and development of a fixed interest culture is seen an enhancement to their status as an international financial centre. In other countries, the bond market has some value as means for central banks to manage the liquidity of the banking system, but is of limited value for price benchmarking.

It should be noted that infrastructure links extend to other areas, like ancillary hardware. For example, the Central Moneymarkets Unit is operated by the Hong Kong Monetary Authority to provide custodial and clearing services for government securities. In December 1993, it was extended to cover private debt securities. In Australia, the order of development was reversed; the Austraclear system, founded by major banks to facilitate clearing and settlement of bank bills and other private paper, later had an automatic clearing system for government paper (RITS) built on as a module of it.

5. Corporate Bonds

Markets for corporate bonds (domestic currency bonds issued by local non-bank enterprises) are much smaller than either government bond or equity markets in most Asia-Pacific economies. There are several reasons for this. In developed countries, investor demand for fixed interest securities is met most efficiently in the government bond market. Corporate bonds carry significant credit risk, have lower liquidity, higher transactions costs, less standardisation and information asymmetry is greater. Scale and credit risk factors exclude small companies from the market and large companies often have access to international capital markets that provide a wider range of financing options which, allied with tax arbitrage, provide powerful competition for local markets. Other harmful factors apply in highly regulated financial sectors, including company access to cheap/rationed bank credit, legal uncertainty and regulatory constraints.

Table 7 provide an overview of the region's corporate bond markets. Bonds issued by public sector enterprises, like a Telecom corporation, are included and constitute the bulk of most markets. Thus, the amount of bonds issued by private sector companies is very small. There are a couple of exceptions. Korea has a relatively large primary corporate bond market, but most are bank guaranteed and secondary trading is minimal. Japan has a sizeable market for industrial and other (mainly local government and government guaranteed) bonds.²⁰ Secondary market trading is small, even where significant primary markets are established. Markets for bank debentures are shown separately for comparison, where they are significant and data are available.

²⁰ Greater competition and less regulation reduced the cost of raising funds in the corporate bond market in Japan. The underwriting and trust fees for corporate bond issues fell from 1.8% and 0.3% in 1980, respectively, to 0.5% and 0.1-0.17% in 1993. This provides some order of magnitude to potential benefits from reform, even in reasonably well developed markets.

Table 7. Characteristics of Corporate Bond Markets in the Asia Pacific Region

(data are presented as a ratio to GDP; x/GDP)

	Year	Amount Outstanding	Annual Turnover	Liquidity
Australia				
- Asset backed securities.	1993/1994	0.014	0.013	1.0(e)
- Other bonds/debentures	1994	-	0.068	na
Japan				
- Industrial	1994	0.048	0.010	0.219
- Other	1994	0.059	0.006	0.102
- Bank debentures	1994	0.164	0.056	0.341
New Zealand				
	1993	0.050	small	low
China				
- Enterprise bonds	1993	0.027	0.007	0.243
- Financial bonds	1993	0.006	0.001	0.237
Hong Kong				
- Resident	1991	0.005	small	low
- Non-resident	1991	0.003	small	low
- NCDs (long)	1991	0.036	0.030	0.825
Singapore				
	1992	0.120 ^e	small	low
Korea				
- Corporate	1991	0.151	0.085	0.57
- Bank debentures	1991	0.050	na	na
Malaysia				
- Cagamas	1992	0.060	0.048 ⁽¹⁹⁹⁴⁾	0.021
- Other	1992	0.041	0.019	0.046
Taiwan				
- Corporate	1993	0.010	0.000	0.044
- Bank debentures	1993	0.015	0.000	0.000
Thailand				
	1991	0.014	0.001	0.039
Indonesia				
	1993	0.017	0.001	0.040
Philippines				
	1992	Almost non-existent		-
India				
	1991	0.025	small	low
Pakistan				
	1991	No market permitted		

Notes: See table 1 for principal data sources. Note that the stock of corporate bonds outstanding in Singapore is estimated by the sum of the previous five years of issues of S\$ bonds and loan stock listed on the Stock Exchange of Singapore and unlisted bonds.

Efforts are ongoing to develop corporate bond markets as a source of company finance in most countries. Credit rating agencies have been established in Malaysia, Thailand, Indonesia and India, amongst others, to help overcome information asymmetry. Other infrastructure problems, like legal uncertainty and inadequate trading and settlement systems, are being addressed.

6. Concluding Comments

Efficient government bond markets play an important economic role by financing budget deficits, without resort to captive market arrangements. Market determined bond yields compensate savers fairly and signal the true economic cost of long term capital, both of which can lift economic performance. From a political economy perspective, continual critical evaluation of government economic policy by the bond market (in conjunction with other financial markets) can improve the quality of policy and be of significant economic benefit. The market is an important element of financial sector infrastructure and contributes through the provision of market determined benchmark yields for other financial products, by offering low transactions costs for liquidity and risk management and by developing fixed interest skills in the financial community. Monetary authorities use the market to conduct open market operations, which is important in liberalised financial sectors.

Few Asia-Pacific bond markets are sufficiently well developed to provide all of these services, though most have made significant progress in recent years. For example, in the early 1990s, India and Pakistan introduced market determined primary market yields; a key reform. More active trading should follow once appropriate trading mechanisms are developed. Introduction of related derivatives products must be at a more cautious pace (as in Singapore) given the need for a solid legal and regulatory framework and deep, stable physical market to support them. Experience in developed countries in the region suggests that the corporate bond market has modest potential.

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Appendix 1.

Development of Government Bond Markets - Country Details

Australia

The market for Commonwealth treasury bonds is the largest bond market in Australia. A large and active State government bond market stands alongside this.

- Commonwealth government bonds.

Treasury bonds are the Commonwealth government's main domestic debt instrument, used to finance its accumulated fiscal deficits. A large secondary market has developed over the past decade, stimulated by a range of factors. In the early 1980s, secondary market trading of Treasury bonds was minimal; less than A\$50 million per day on average. However, market turnover increased strongly after 1984, doubling in less than a year, and peaked in 1988, when average daily turnover was A\$1.5 billion. A paucity of new issues on the primary market depressed trading for a period, but turnover picked up sharply to a new high in 1992, as issues increased and reduced fears of a stock shortage, and trading was assisted by the introduction of the Reserve Bank Information and Transfer System (RITS). Annual turnover in the year to end-June 1994 was equivalent to 2.3 times GDP and the liquidity (turnover to stock) ratio rose from 0.5 to 14.2. The jump in market activity since the early 1980s reflected a number of factors, including market reform and the Reserve Bank efforts to deepen the market and improve its efficiency.

The seeds for market development were sown in 1982, when the bond tendering system was introduced. It established market determined primary market yields and improved the technical operation of the markets for investors. Also, the decision to reduce required holdings by banks and insur-

ance companies contributed to market development.²¹ Establishment of a Reporting Bond Dealer (consultative) group at the beginning of 1985 from the largest dealers improved information flows²². Improvements in bond debt management techniques, including a shortening of maturities and better focussed issues, helped market efficiency. For example, bond issues ensure sufficient ‘hot stocks’ are available to maintain liquidity, which also meets the needs of the bond futures market. The latter has underpinned development of the bond market, by providing an effective means of hedging. Against this background, institutions’ willingness to trade in Treasury bonds increased markedly. Non-residents are also active participants in the market. The market is an important conduit for the Reserve Bank to implement monetary policy through open market operations.

Annual Commonwealth treasury bond tenders are highly correlated with the size of the fiscal deficit/surplus and the amount of debt maturing. Consequently, the stock outstanding fell in fiscal surplus years from 1987 to 1991 but increased with a return to deficit financing. At mid-1994, the amount outstanding was A\$70 billion (16% of GDP). Taking into account cyclical variation, the trend movement has not been substantial over the past decade.

Around 45% of market transactions are undertaken on a repurchase basis. The market supports large derivatives markets, both exchange traded and OTC. Treasury bond futures were first listed on the Sydney Futures Exchange in 1985 and options on these contracts were introduced in 1986. Their combined nominal turnover was over one and a half times that of the physical market in 1993/94. OTC derivatives (including complex products like caps and collars) are much less important in volume terms, but are a key addition to product range, that facilitate sophisticated risk management and financing arrangements.

²¹ For example, the “30/20” rule was removed in September 1984.

²² This group was disbanded in 1992, having fulfilled its market development role.

Transactions costs on the government bond markets are low; 'hot' stocks typically trade at a spread of 2-3 bps. The market is almost exclusively OTC and market makers earn a spread, with no direct charges. The tendering system and related factors, like strong market communications systems, have helped refine market pricing efficiency; on average Treasury bond issues took place at an average margin of only one basis point above the secondary market yield in 1993/94 and the average range of tenders accepted was three basis points (both half the levels recorded in 1991/92).

- Semi-government bonds

State government instrumentalities and utilities (including Telecom) issue 'semi-government' bonds. Issues are generally made through closed dealer panels. Panel members are frequently required to make a market in the stock, to support market liquidity. Development of the semi-government bond market has been similar to the Commonwealth government bond market, but more recent in origin.

The stock of semi-government bonds outstanding increased steadily since 1989. The proportion of actively traded or 'hot' stocks has increased more rapidly than this, reflecting efforts to develop the market. Secondary market transactions increased steeply from well under A\$1 billion per day in 1988 to A\$4 billion per day in 1991, a level which it has stabilised at. Secondary market development benefited from establishment of state central borrowing authorities to handle the borrowing of state agencies and local government authorities, within each state, on centralised and better ordered basis. This unified fragmented markets for individual instrumentality and utility issues; all states have adopted this approach. Marketing of securities was upgraded and liquidity features of semi-government stock improved as authorities, like the NSW Treasury Corporation, issued a small number of benchmark stocks of varying maturities. Advantage was taken of the falling stock of Commonwealth bonds in the late 1980s to expand the market for semi-government bonds. State bonds are heterogeneous, differentiated by individual state credit ratings; so the various state bonds are not

perfect substitutes for each other and futures contracts based on the bonds have failed, because of this lack of standardisation.

China²³

Trading in State bonds dominated the securities market in China in the early 1990s. The secondary market was not established until 1988, when trading of bonds issued in 1985 and 1986 was permitted. The key to market development was a fortuitous outcome of bureaucracy, rather than careful planning. In 1990, Treasury bonds paid a higher interest rate (coupon) than comparable bank deposits, for the first time and their relatively attractiveness led to development of active trading. This situation arose because a large number of certificates printed in 1988-89 (when rates on bonds were raised to 14%) continued to be issued in 1990 (after inflation had fallen from over 20% to under 5%). State bonds outstanding at end 1991 amounted to Yuan50 bn (3% of GDP) and gross issues over the following three years were Yuan172 bn. Treasury bonds recorded a peak turnover of Yuan34 bn (2% of GDP) in 1991; this declined to only Yuan10 bn in 1993.

State bonds are issued by the Ministry of Finance to both institutions and individuals. The first legislation covering State bonds was enacted in 1981, when mandatory allocations were made. There are two coupon rates, with the higher paid to individuals and the lower to institutions. The primary market was entirely captive until 1991, with allocation decisions made sequentially from central to provincial levels. A limited number of voluntary placements, underwritten by dealer syndicates, were introduced from 1991, but the Ministry of Finance had to revert to mandatory allocation, because primary market yields were uncompetitive. A new system is being put in place, in which the Ministry of Finance is the sole issuer and the PBC places the bonds amongst a national syndicate of primary dealers. The dealers are required to maintain market liquidity, but it remains to be seen if the arrangement is successful.

²³ I am grateful to Jian Guo Li and Jiannan Zhang of the People's Bank of China for useful material.

In 1993, transactions costs on the official market was 50 bps, but effective spreads were much higher on unofficial markets (300 *plus* bps), reflecting infrastructure weakness, market segmentation and regionalisation, amongst other things.

Until 1992 bond prices varied considerably between cities²⁴, but technical development of the market through the securities exchanges and other bodies, like the Securities Trading Automatic Quotations System that links the exchanges, concentrated trading and largely eliminated city price differentials. The market is hampered by several features including inadequate pricing arrangements, a financially unsophisticated investor base, a lack of trained personnel and legal uncertainty. In contrast to other Asia-Pacific markets, individuals hold easily the largest proportion of bonds issued; around 75%. The market is closed to foreign participation.

Non-state bonds were introduced in the second half of the 1980s and include capital construction bonds, key enterprise bonds, financial bonds and local enterprise bonds. The bonds have varying maturities and coupons and are issued to both individuals and institutions. Bonds are sold voluntarily through banks and securities firms. The stock outstanding was Yuan61 bn at end-1991, however, secondary market turnover is low.

A bond futures contract was launched on the Shanghai Stock Exchange in late December 1992. There was virtually no trading of the contract until late 1994, when a premium on government bonds increased their attractiveness to investors. However, the nature of trading was largely speculative and the market was suspended in March 1995, after securities companies experienced large trading losses and market manipulation undermined the market. This was entirely predictable for a range of reasons.

²⁴ For example, on December 1 1990, the 1989 Treasury bond issue traded at 112.6 in Huheote, 113.0 in Beijing and 119.5 in Xi Ning (source: *China Security Market 1991*, China Finance Publishing House).

The market entirely lacks essential infrastructure, like a deep secondary physical market for bonds, natural interest rate exposures do not exist because interest rates are predominantly controlled, the risk management culture is embryonic, trading standards and regulations are inadequate, risk controls are absent, and so on. In effect, the supply conditions for derivatives are inadequate and hedging demand is essentially absent, given the controlled nature of the interest rate structure in China.

Hong Kong²⁵

The Hong Kong government bond market was activated in 1991, with a HK\$500 mn issue of two year bonds, prompted in part with a need to finance infrastructure projects.²⁶ Under a market making system, a strong secondary market quickly developed, with a turnover of HK\$1.7 bn in less than two months after issue.²⁷ The amount of bonds outstanding rose to HK\$3.6 bn by the first quarter of 1993. At that time, it was announced that government bonds would be replaced by Exchange Fund notes (with maturities out to three years in 1994), the proceeds of which would be invested, rather than being used to finance infrastructure projects, as the government had no net funding requirement. The change had little effect on the operation of the market.

Exchange fund bills are money market instruments (similar to standard treasury bills) that were introduced in March 1990, with the specific intent of assisting monetary operations. It is a paperless market and maturities range out to one year.

²⁵ I am grateful to the following people for providing valuable insights into the market's operation, during interviews in early-1994: Priscilla Chiu (Hong Kong Monetary Authority), Alfred Wong and Raymond Tse (Wardley Investment Services), Nichols Pang (Nomura Research Institute) and Justin Chan (Hong Kong and Shanghai Banking Corporation).

²⁶ The most recent previous issue was in 1984 for HK\$1 bn and secondary market trading of the issue was minimal - a strong fiscal position precluded the need for debt issues.

²⁷ See Office of the Exchange Fund (1991) and HKMA (1993, 1994, 1995) for details of market organisation and operation.

The bills are issued by the Hong Kong government, through tender, for the account of the Exchange Fund, which was given increased monetary control powers in 1988. The combined amount of Exchange Fund bills and notes outstanding and their daily turnover was HK\$52.3 bn and HK\$22.3 bn (equivalent to 5.1% and 2.2% of GDP), respectively, in 1994.²⁸ Exchange Fund bills easily dominate notes in terms of trading and are the largest amount outstanding. Given the short maturity spectrum of the notes, the two can be taken together, without loss of information.

Bills and notes are both supported by a market maker system. Exchange Fund notes benchmark quite well for the swap market and for corporate bonds. Transaction costs are low, having declined from around 20 basis points (bps) at the market's establishment to 5-10 in late 1994. Non-residents actively trade the market, though mainly from mainland China, not Japan or the USA.

India

Central government bonds constitute the main part of the government long dated securities market. State government securities and other public sector securities also exist and are of growing importance. The total amount outstanding of central government bonds in 1993 was Rupees 870 bn, equivalent to around 12% of GDP.

The primary market has begun to develop since central government securities of five and ten year maturities were auctioned for the first time in mid-1992. The effort to increase investor interest and develop the market was motivated by a need to raise funds, following a government decision to phase out its borrowing from the Reserve Bank of India. The statutory liquidity ratio (29.5% at March 1995) is being reduced to 25% (from 38.5% in 1991). In a further attempt to develop the secondary market, Discount and Finance House of India began limited trading in long dated government securities in April 1992.

²⁸ Exchange Fund notes accounted for HK\$8.4 bn of the stock and HK\$2.8 bn of turnover.

The National Stock Exchange, established in mid-1994 to facilitate efficient securities trading, may assist development though, as a rule, secondary government bond trading usually takes place on OTC markets. Secondary market trading was small but growing in early 1995, inhibited by technical constraints, an inactive repo market and the absence of viable market makers.

Indonesia

There is no government bond market in Indonesia, because the government pursues a 'balanced budget', in which its deficit is met by 'development revenue' (another term for foreign borrowing). Public sector entities issue bonds in a small corporate bond market.

Japan²⁹

The first major post-war government bond issue was in 1966. The market serves as a means of government finance and the amount outstanding grew dramatically, from the mid-1970s, as fiscal deficits rose. The range of bonds issued has been widened since then and includes long term bonds, discount bonds, medium term (Chukoku) bonds and super long term bonds (over 10 years). At end-1994, the amount outstanding was equivalent to 39% of GDP. Further, regulation of the market has been eased (for example, bank dealing was permitted from 1984) and non-resident participation increased. Turnover exploded in the mid-1980s, but has since stabilised at a lower level. Annual turnover was equivalent to 2.1 times GDP in 1994, giving a stock liquidity ratio of 5.2. The market is second to the US Treasury bond market in world terms and is used by foreign investors to obtain and manage a yen exposure. However, trading is highly concentrated in benchmark issues, which prevents calculation of a true yield curve. Virtually all bonds are traded on the OTC market, mainly by banks and security houses.

²⁹ Further detail on the character and evolution of the Japanese financial system and the government bond market is given by Suzuki (1987), Fabozzi *et al* (1990), Tatewaki (1991), Masahiko and Turner (1992) and Euromoney (1994).

Repurchase agreements (*gensaki*) constitute a large market, but the vast majority are based on short term Treasury and Finance bills, rather than on long term bonds.³⁰

A primary dealer system for issues has been used since 1989; prior to that, bond issues were underwritten by securities and companies and financial institutions, with tenders only being used for short term debt issues. In 1994, 40% of ten year bonds were underwritten by a bank syndicate and 60% issued through competitive auction. The market supports a futures contracts on 10 and 20 year bonds, introduced on to the Tokyo Stock Exchange in 1985, and options on the 10 year futures contract, introduced in 1990. These are traded very actively; turnover is about three times that of the physical market. Relatively small markets in Japanese government bond futures exist in London (since 1987) and in futures and options on SIMEX (since 1993 and 1994, respectively).

Transactions costs are low, with bid-offer spreads of 1-2 bps for the most highly traded benchmark stocks. Spreads on off-the-run stocks are considerably higher; sometimes 20+ bps. Commissions are 0.25% for large size transactions, but most trading takes place on the OTC market, where dealers earn spreads.

Korea

Most government and public sector securities are short term instruments (Treasury bills, Foreign Exchange Equalisation Fund bonds, Grain Management Fund bonds). Monetary Stabilisation bonds are issued out to two years, but are predominantly under one year to maturity and so are treated as a money market instrument here. Longer term securities (National Investment bonds and National Housing bonds) constituted the main part of government marketable debt in the early 1980s, but their share fell to 17% by 1991 and they are not actively traded.

³⁰ Data presented in Table 3 of *Financial Markets*, January 1995, (Bank of Japan) imply that repos on long term government bonds constitute only 3.5% of total repos.

Below market yields and captive market constraints stymie market development. There are no market makers and foreign participation is restricted and minimal. An easing of trading restrictions and the introduction of seven year and ten year Treasury bonds from July 1995 are designed to encourage market development.

Malaysia

Until market reforms in 1987 (which included the introduction of market related coupon rates), the market for government securities was largely captive, yields were uncompetitive and trading was negligible.³¹ Reorganisation of the market was consistent with greater competition from liberalisation of bank deposit interest rates in 1978 and greater flexibility in lending rates. The central bank's need for a market suitable to conduct open market operations was another factor that stimulated reform.

Reorganisation of the market included issuance of securities with a wider range of maturities (especially short term paper) and an increase in the range of institutions permitted to deal in the market. At the beginning of 1989, twenty three principal dealers were appointed to underwrite primary market issues and provide two way price quotes in the secondary market. Spreads quoted by the dealers are subject to upper limits. Only principal dealers have access to the central bank's discount window. A scripless trading and automatic funds transfer system, 'Speeds', was introduced at the beginning of 1990 (it also covers Cagamas bonds). This increased access to small savers because splitting of denominations is easier.

Despite this range of measures, an active secondary market has failed to develop. Annual outright transactions rose from virtually nothing pre-1987 to almost M\$8 bn (8% of GDP) in 1989, but failed to build on this; outright turnover was M\$11 bn in 1994 (6% of GDP). The repo market is active and a useful means for bank liquidity management.

³¹ See Mohamed and Yacop (1990) for details on the pre-reform market.

No turnover data are available, but the amount of repos outstanding in 1991 suggest that it was slightly larger than GDP in 1991 (see figure 1 in the main text).

The failure to develop an active outright market probably comes back to the still largely captive nature of the market. The Employees Provident Fund (a statutory pension fund) held 60% of bonds outstanding in 1992 and is required to invest 70% of its receipts in government bonds. Similarly, the National Savings Bank is required to invest in government securities and commercial banks hold securities to meet liquidity and reserve requirements. This has effectively quarantined a large part of the market from active trading. Non-residents face a withholding tax of 20% and were banned from the market for a period in 1994, to reduce exchange rate speculation. Market makers earn a spread (usually 10+ bps, though this can vary over time and is sometimes lower). No other direct charges or taxes apply. The market is too immature to support an active trading in interest rate derivatives.

New Zealand

The market for Treasury bonds is large and active, though not across all maturities. Development of the market was influenced by heavy fiscal deficits that increased the supply of bonds and financial deregulation that improved market competitiveness. These included removal of regulations that provided a largely captive market and the use of fixed issue yields. Bond issues are now usually issued through tender and the National Debt Management Office maintains large liquid stock issues. The range of ordinary government stock includes short, medium and long dated bonds and index linked stock. An attempt is are being made to lengthen the markets active maturity spectrum.

Pricing on the government bond market acts as benchmark indicator for yields on private debt securities, though the market in the latter is small. Secondary market spreads are low, at 3-5 bps for benchmark stocks. At

end-1993 the total amount outstanding was NZ\$20 bn and annual turnover was NZ\$61 bn (25% and 75% of GDP respectively). The successful introduction of a Treasury bond futures contract on the New Zealand Futures and Options Exchange in 1986 supports secondary market trading. There is a modest market in options on the bond futures, which were introduced in December 1988. OTC instruments, like interest rate swaps and options exist, but the markets are small relative to the physical market and exchange traded derivatives. The market is used by the Reserve Bank of New Zealand for open market operations. Foreign participation in the market increased significantly in the early 1990s and accounted for 32% of the market in late 1994.

Pakistan

Longer term debt is issued to raise funds not met by either retail issues or Treasury bill issues. In 1989, the authorities began to rationalise the range of government debt instruments and their tax treatment, to prepare the way for an auction system for primary market distribution. The balance of government debt is shifting towards market priced instruments, as the stock of Federal Investment bonds and auctioned Treasury bills rises.

Primary dealers were appointed (and have since constituted a committee), a book-clearing mechanism was introduced and organisational reforms (including the establishment of a 'Securities Department' at the State Bank of Pakistan) were introduced in preparation of regular auctions. These began in May 1991, with the auctioning of Treasury bills and Federal Investment bonds. It is intended to adjust returns on other government debt instruments to those recorded at the auctions. Federal Investment bond auctions were improved in September 1991 with the abolition of ceilings on bank holdings. The IMF is providing technical assistance to develop the secondary market. This will help achieve a medium term objective to operate monetary management on a market based system.

Federal Investment bonds have four maturities; one year, three years, five years and ten years. The stock of Federal Investment bonds outstanding at end-1994 was Rupees 175 bn; 71% of the federal government's domestic bond issues outstanding. The relative size of Federal Investment bond gross issues illustrate their rapid rise in importance. Comparison of bank holdings of Federal Investment bonds before and after secondary market trading show that 6% of the average amount outstanding in 1994 changed hands over the year. No turnover data are available for Federal Investment bonds, but the secondary market is known to be very small.

Philippines

Long term government securities account for most of the government's marketable domestic debt, but are not listed on the stock exchanges and were not actively traded until recently. In 1986, the government introduced a market orientated auction system, which increased marketability of securities. Before this the market was captive and uncompetitive in yield terms. A strong market failed to take hold by 1991, at which time turnover was equivalent to only 3.2% of GDP.

The amount outstanding in the market more than doubled in the early 1990s and at end-1994, the amount outstanding was Peso 264 bn, equivalent to 15% of GDP. Turnover appears to have increased dramatically over this period too. Money market turnover data published by the central bank includes a category covering 'other' government securities, which are largely central government and public sector bonds with a maturity of over one year. Turnover under this heading rose from 5.6% of GDP in 1991 to 41.4% in 1994. Repurchase agreements on government securities, which had almost died out due to regulatory and tax disincentives, picked up in 1994 but remained a small part of a modest market.

Singapore³²

There is a sizeable primary market for government bonds, but the secondary market is modest. The market was revamped in 1987, along the same lines as the US Treasury bond and bill markets. This was done to improve the efficiency of the market and the financial system, rather than as a means of raising debt more easily. Provision of a benchmark price, an additional savings outlet, improved liquidity and development of Singapore's financial skill base were key objectives. Yields at the time of issue are determined through a competitive tender system and trading is scrippless.

Since reform, government security dealers act as market makers and, along with domestic financial institutions, are the most active market participants. Changed liquid asset requirements for banks assisted the pick up in trading. A serious impediment to market development is the high proportion of bonds held by the Central Provident Fund, the State statutory savings fund. It holds around 70% of bonds on issue and is not an active trader. In addition, while non-residents are permitted to trade in the market, their participation is minimal, detracted by withholding tax arrangements and low yields; a situation the authorities seem quite happy with. Capital gains tax does not apply, which encourages investors to hold stock until maturity, rather than trade it.

After the 1987 reforms, turnover on the market immediately jumped to a high level,³³ but under these constraints has since stabilised at a much more modest level that still satisfies banks' reserves and liquidity management.

³² I am grateful to Jeff Ang (DnB), Sim Buck Khim (Citibank), Thomas Wong (GK Goh) and staff of the Monetary Authority of Singapore, amongst others, for interviews that provided useful insights into Singapore's financial markets. MAS (1989) and Huat (1992) are useful reference documents.

³³ Some have expressed scepticism at the size of the reported figures and suggest, that the market is smaller. MAS publishes annual turnover data for government securities (which includes Treasury bills) in the text of its *Annual Report*. Specific data on bonds are not presented, but based on discussion with market analysts in Singapore, it is reasonable to assume that bond trading experienced a similar pattern over time as government securities.

Information in the Monetary Authority of Singapore's (MAS) *Annual Report 1993/94* implies that outright turnover (that is, turnover excluding repos) was S\$180 mn per day, almost half of the market for government securities. On an annual basis this level of turnover is equivalent to 50% of GDP and provides a stock liquidity ratio of one.

The market provides a benchmark for long term bank deposit rates but, in contrast to Hong Kong, it is not broad enough or deep enough to effectively benchmark for derivatives, like swaps. This is partly attributed to absence of a need for a large market to finance government deficits. Thus, the 'true' market rate is hard to pin down and yield movements reflect shifting liquidity management balances more than an underlying change in the demand/supply of long term capital. The market has not been widely used for hedging derivatives position.

Transactions costs in the market are low. There are no direct charges and the bid-offer spread is 5 bps on liquid stocks (but considerably higher for off-the-run stocks). Prior to reform spreads were 50 bps, or more, and often no quotes were available. The market is not actively used by the MAS in its monetary operations.

Sri Lanka

The principal subscribers to both short and long term government securities are captive sources; Employees' Provident Fund, National Savings Bank, Employees' Trust Fund and the Insurance Corporation of Sri Lanka. Subscriptions from other investors are low. The captive nature of the market and the failure of the bond yields to reflect market interest rates has prevented the development of an active secondary market. The stock outstanding at end-1992 was equivalent to 18% of GDP.

Taiwan³⁴

A strong fiscal stance limited the size of Taiwan's government bond market until recent years; the amount on issue was small and trading was minimal. Below market yields dampened investor demand and bonds were held mainly for liquidity management purposes. However, a significant part of the National Development Plan (1991-96) is being financed through the bond market, which has given the market a great fillip. A major reform was the introduction in November 1991 of a US Treasury bond type auction system, based on designated primary dealers (19 securities companies and 23 banks in 1994), replacing a fixed price allocation system amongst banks that was not very market sensitive. The amount outstanding in the market rose from 3% to 10% of GDP between 1990 and 1993, while turnover jumped from 35% to 229% of GDP over this period. This places the market amongst the largest and most active in the region, in both nominal and GDP percentage terms. A weak stock market improved investor receptiveness to the market's development but, despite its size, there are still occasional bouts of extended illiquidity in the market.

Secondary market trading is mainly OTC and repos form the bulk of the market. Derivatives are not traded but are planned and, together with greater dealer competition flowing from financial sector reform, is expected to improve stability of trading patterns. Introduction of derivatives is being delayed by concerns generated by global derivatives problems. This caution is warranted as an active risk management culture is still in the early stages of development. Spreads on the market are low, at 3-5 bps; compared with 10-25 before the primary dealer system was introduced. No commissions are charged in the OTC market. Non-residents can only participate indirectly in the market (through Qualified Foreign Institutional Investor guidelines) and so are not active.

³⁴ I am grateful to Steven Kwiatkowski (Springfield Financial Advisory) for providing me with information on Taiwan's government bond market.

Thailand

The central government and government enterprises issue long term bonds. The bonds are issued almost exclusively in domestic currency. Government bonds are underwritten by the Bank of Thailand and the banking system held over 75% of the stock outstanding in the early 1990s. Government bonds are listed on the stock exchange (SET) but turnover on the exchange is minimal. A repo market exists and is used by Bank of Thailand to conduct open market operations. Firm turnover data are not available for the OTC market, but it is small. Data from the Bank of Thailand's Deposits and Bonds department place the market with a turnover of around 18% per cent of GDP in the early 1990s and it appears to have fallen since then. A declining stock of government bonds since the early 1990s weakened the market; at end-1994 the amount outstanding was Baht65 bn (2% of GDP), compared with over three times that amount at the start of the decade.

Following an initiative by the Securities Exchange Commission, 62 institutions (banks and securities and finance companies) founded a Bond Dealers Club in September 1994. Its objective is to promote development of the market for private sector and public debt instruments, especially by facilitating secondary market trading. A computerised trading system, 'BONDNET', was established to assist trading, which picked up but was still marginal in economic terms at the end of the first quarter of 1995 (equivalent to 2-3% of GDP on an annual basis). The Bond Dealers Club sees most potential in the corporate bond market, with the government bond market restricted by government policy.³⁵ While worthwhile progress in developing a corporate bond market can be made, the absence of a liquid government bond market to provide price benchmarks and liquidity and risk management facilities puts a limit on its potential.

³⁵ These views are the outcome of a meeting with a working group from the Bond Dealers Club, led by its President Mr Narong Pattamasaevi, which visited Sydney in April 1995. Officials from Bank of Thailand and the Securities and Exchange Commission were part of the group.

Appendix 2.

Data Sources, Nominal Yields and Inflation

<i>Country</i>	<i>Definition</i>	<i>Source</i>
Australia	Treasury bonds, 10 years	RBA <i>Bulletin database</i>
China	Treasury bills, three year 1981-87, three year 1988-91.	PCPH <i>1992 Almanac</i>
Japan	Central government bond yield	RBA <i>Bulletin database</i>
Korea	National Housing Bond (T1) yield (arithmetic avg.)	IMF <i>IFS</i>
Malaysia	Coupons on allocations 5 years	BNM <i>BNM (1989)</i>
New Zealand	Treasury bonds 10 years plus (unweighted avg)	IMF <i>IFS</i>
Pakistan	Central government 10 years plus	IMF <i>IFS</i>
Philippines	Weighted average rate on 'other' government securities.	CBP <i>Annual Report (tab. 3.2)</i>
Singapore	Treasury bond, 5 years	MAS <i>Statistical Bulletin</i>
Sri Lanka	Central government 5-6 year original maturity	IMF <i>IFS</i>
Taiwan	Issue yields; no secondary market yields available	CBC <i>Financial Stats. Monthly</i>
Thailand	coupon rate on allocations to financial institutions	IMF <i>IFS</i>
International rate	US government Treasury bond yield (10 years plus)	RBA <i>Bulletin database</i>
Other data	Sources for money market interest rates, inflation, and economic growth.	<i>IFS, RBA and CBC</i>

IFS - *International Financial Statistics*.

RBA - Reserve Bank of Australia *Bulletin* databank.

RBNZ - Reserve Bank of New Zealand.

BNM - Bank Negara Malaysia (1989).

CBC - Central Bank of China

MAS - Monetary Authority of Singapore

PCPH - People's China Publishing House

CBP - Central Bank of the Philippines.

Appendix 3.

Background Econometric Work for Tables 4 and 5.

This appendix provides more detail on the regressions summarised in tables 4 and 5 of the main text. In countries where results are reported for both pre-reform and post-reform periods, the former are given in the shaded areas.

The following regression mnemonics are used below:

ΔGDP_{t-t-j}	Growth (annualised) in GDP from time t-j to t, where j is 4 and 12 quarters for one year and three year growth, respectively;
$\Delta INF_{t-t-j j}$	Change in the consumer price inflation rate between t-j and t;
$(Y_d - I_d)_{t-j}$	Term structure at time t-j;

The models are of the form:

Economic growth:

$$\Delta GDP_{t-t-j} = a_0 + a_1 * (Y_d - I_d)_{t-j}.$$

Inflation:

$$\Delta INF_{t-t-j j} = b_0 + b_1 * (Y_d - I_d)_{t-j}.$$

Economic Growth & the Term Structure of Interest Rates

$\Delta GDP_{t-tj} =$	$(Y_d - I_d)_{t-j}$	<i>constant</i>	$j =$	$adj R^2$	<i>No. obs.</i>
Australia					
1970.3-83.3	-0.09 (0.34)	3.01 (5.83)	4	0.00	53
1983.4-93.4	0.39 (1.96)	3.47 (6.51)	4	0.16	41
1972.3-85.3	-0.04 (1.60)	3.07 (10.9)	12	-0.01	53
1985.4-93.4	0.25 (1.91)	3.25 (6.51)	12	0.19	33
Japan					
1970.4-81.4	0.45 (2.22)	4.07 (7.30)	4	0.10	45
1982.1-93.4	0.90 (2.82)	3.48 (6.55)	4	0.12	42
1972.4-83.4	0.05 (0.71)	3.82 (15.8)	12	-0.01	45
1983.4-93.4	0.30 (0.57)	3.94 (6.73)	12	0.00	34
Korea					
1978.1-93.4	-0.38 (1.29)	9.56 (9.15)	4	0.04	64
1980.1-93.4	-0.53 (4.82)	9.67 (9.31)	12	0.31	57
Singapore					
1988.2-93.4	0.75 (1.46)	7.13 (11.6)	4	0.02	23
1990.2-93.4	0.94 (2.30)	6.40 (13.0)	12	0.32	15
$\Delta MAN_{t-tj} =$	$(Y_d - I_d)_{t-j}$	<i>constant</i>	$j =$	$adj R^2$	<i>No. obs.</i>
New Zealand					
1978.1-84.4	-1.13 (0.61)	5.95 (1.66)	4	0.02	27
1985.1-93.4	0.37 (0.70)	-0.02 (0.01)	4	0.00	35
1980.2-86.4	-0.92 (2.99)	4.92 (7.56)	12	0.19	26
1987.1-93.4	0.02 (0.27)	-1.22 (2.03)	12	-0.04	27
Pakistan					
1977.3-92.2	-0.05 (0.13)	8.68 (9.50)	4	-0.02	60
1980.3-92.2	-0.96 (2.42)	9.47 (17.5)	12	0.11	52

Note: OLS regression methods used, with quarterly data. Absolute t -statistics, calculated using the Newey West (1989) procedure to correct for autocorrelation and heteroscedasticity, are reported in brackets. ΔMAN_{t-tj} represents the growth in manufacturing output between time $t-j$ and t , which is used here in the absence of quarterly GDP data.

Inflation Changes & the Term Structure of Interest Rates

$\Delta \text{INF}_{t+j} =$	$(Y_t - I_t)_{t-j}$	constant	j	$\text{adj } R^2$	No. obs.
Australia					
1972.3-83.3.4	0.15 (0.63)	0.63 (0.75)	4	-0.01	53
1983.4-93.4	-0.11 (0.45)	-0.92 (1.09)	4	-0.02	41
1970.4-81.4	0.37 (0.67)	0.68 (0.31)	12	-0.00	53
1982.1-93.4	0.86 (3.76)	-0.96 (0.91)	12	0.29	33
Japan					
1970.4-81.4	1.67 (3.43)	-0.92 (0.70)	4	0.27	45
1982.1-93.4	0.78 (3.13)	-0.38 (1.36)	4	0.20	42
1970.4-81.4	2.54 (3.48)	-2.74 (1.70)	12	0.42	45
1982.1-93.4	0.45 (0.62)	-0.24 (-2.36)	12	-0.01	34
Korea					
1979.1-93.4	1.17 (4.69)	-3.32 (2.34)	4	0.41	60
1979.4.1-93.4	1.29 (2.87)	-5.13 (1.47)	12	0.12	57
New Zealand					
1971.2-84.4	0.21 (0.26)	-0.46 (0.19)	4	-0.02	55
1985.1-93.4	1.56 (5.72)	0.55 (-0.59)	12	0.43	36
1974.1-86.4	0.16 (0.22)	0.49 (0.17)	12	-0.02	55
1987.1-93.4	1.98 (5.48)	-2.07 (2.06)	12	0.57	27
Pakistan					
1977.3-93.3	0.19 (0.85)	-0.21 (1.33)	4	-0.00	65
1980.3-93.3	-0.13 (0.16)	0.68 (0.56)	12	-0.02	57
Singapore					
1980.2-94.4	-0.17 (0.85)	0.68 (1.33)	4	-0.03	27
1980.2-93.4	-0.15 (0.76)	0.52 (0.70)	4	-0.07	27
1990.2-94.4	0.52 (1.19)	-0.31 (0.78)	12	0.00	19
Malaysia					
1973.1-88.2	0.16 (0.35)	-0.33 (0.45)	4	-0.01	62
1976.3-88.2	0.17 (0.29)	-2.33 (2.35)	12	-0.01	54
Sri Lanka					
1984.2-93.4	0.03 (0.04)	-0.65 (-0.36)	4	-0.03	39
1986.2-93.4	1.60 (3.26)	-0.33 (0.15)	12	0.22	31
Thailand					
1981.1-93.4	0.51 (3.44)	1.69 (2.76)	4	0.39	52
1983-93.4	1.12 (4.40)	4.24 (7.33)	12	0.59	44

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Paper Number

1. Conference on Inflation
Edited by Bill Norton, October 1991
2. Conference on Monetary and Financial Supervision
Edited by Bill Norton, August 1992
3. Asian Financial Markets, Paper at Australasian
Finance and Banking Conference, December 1992
4. Australian Financial Markets, Paper at Australian
Institute of Bankers Conference, July 1993
5. Alternative Measures of Financial Development,
Paper at Conference of Economists, September
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6. Saving, Investment and Government Saving: Asian
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7. Conference on Financial Stability,
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8. Money, Budget Deficits, Economic Activity and
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