

Contemporary exchange rate regimes: floating, fixed and hybrid

Willy Chetwin and Anella Munro¹

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Abstract

This paper considers the choices and trade-offs an economy faces when deciding on its combination of exchange rate, monetary policy and capital account policies. The discussion is set in the context of the monetary policy 'trilemma'. We review New Zealand's and other countries' policy choices in that context, and explore the implications of and motivation for different choices. Over time, advanced economies outside the euro area have tended to move towards open capital accounts, control of an interest rate for domestic price stability objectives and, consistent with those choices, have foregone control over the exchange rate. New Zealand's position has been a relatively clear choice in that direction, and has been stable since the mid-1980s. Pursuing greater exchange rate control would imply less influence over interest rates for domestic inflation objectives, or a less-open financial account and probably a larger stock of foreign currency reserves.

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1. INTRODUCTION

This paper considers the choice of monetary, capital account and exchange rate policies across countries, and looks at New Zealand's choice in that context. The monetary policy 'trilemma' hypothesis is one lens through which we can view that choice.² The trilemma states that, at any one time, it is possible to have only two of the following three things:

- a fixed exchange rate;
- independent monetary policy; and
- free cross-border capital movement.

The trilemma relates closely to pressure by financial markets to equalise returns across currencies. When the capital account is open, funds move across borders and between currencies to equalise returns on capital. If country authorities control the local interest rate (for example, to stabilise domestic inflation) then capital flows seeking to equalise returns will move the exchange rate to equalise returns on capital (i.e. interest rate arbitrage).³ Similarly, if country authorities stabilise the exchange rate, capital flows will move domestic interest rates to equalise returns on capital. An effort to control both would go against cross-border arbitrage, and the very large forces from bond markets and foreign exchange markets.

Closing the capital account, or offsetting capital flows by large scale foreign exchange intervention, would break the link between the exchange rate and domestic interest rates, preventing arbitrage of relative returns so that both the exchange rate and domestic interest rates can be controlled as instruments of policy. However, preventing cross-border arbitrage implies a sharp move away from access to international capital markets, and a consequent sharp rise in domestic borrowing costs.

The empirical literature largely supports the constraints implied by the trilemma.

New Zealand's policy choice since the mid-1980s has been a relatively clear choice of two of three aspects of the trilemma. The economy is open to external capital flows, domestic monetary policy is focused on domestic price stability, and the exchange rate floats freely: control of the exchange rate is foregone in favour of control over domestic monetary policy (see figure 1). That choice has been stable over time. (The history of the regime is discussed in detail in Sullivan (2013) that provides a view of New Zealand's historical exchange rate experience and policies.)

In standard macroeconomic models, New Zealand's regime is an efficient one. When the assumptions in those models of interest parity, prices being set in the producer country and asset markets being complete are eased, the associated distortions can lead to currency

² The 'trilemma' concept goes back at least to the work of Mundell in the 1960s. See Shambaugh (2004) and di Giovanni and Shambaugh (2006) for a more-detailed discussions of the trilemma hypothesis.

³ Chetwin, Ng and Steenkamp (2013) goes into greater detail on the influence on the exchange rate of relative returns on investment in different currencies.

misalignments, and the optimal solution in such models includes a degree of exchange rate influence to correct distortions.

Figure 1 – New Zealand's monetary and exchange rate regime



We look at the regimes and experiences of Australia, Chile, China, Denmark, Hong Kong, Japan, Korea, Singapore and Switzerland. Those countries were chosen to inform about the trade-offs involved in achieving greater control over the exchange rate by giving up internal price stability or financial openness to some degree. We consider the deviations of the regimes from complete openness and/or a clear fixed or floating exchange rate. We look at what those choices mean for economic adjustment mechanisms and what the trade-offs are among objectives of access to international capital, exchange rate control and control over domestic monetary policy.

Advanced countries tend to make relatively clear choices between fixed and floating exchange rate regimes, though vary significantly in financial openness. In some countries, there has been considerable variation over time in both influence over the exchange rate and the extent of restrictions on capital transactions.

When a country chooses greater exchange rate control, that means giving up, to some degree, either domestic price stability or free cross-border capital movement. More control of the exchange rate could provide a more-stable environment for firms facing international competition, but the loss of exchange rate flexibility requires more economic adjustment to occur through domestic prices and wages. In countries with fixed exchange rates, that has sometimes meant painful downward adjustment in prices and wages to restore competitiveness. Reducing openness to capital can protect against large capital inflows and outflows but reduces

access to external funding and, for a country with a large external debt like New Zealand, implies an increase in the cost of that funding.

A greater degree of exchange rate control would also require a larger stock of un-hedged foreign currency reserves that may be expensive to maintain.

Pursuing some control over both domestic interest rates and the exchange rate would allow greater flexibility in some situations, but poses a complex control problem (optimising over a hierarchy of objectives that can change over time). That risks undermining institutional clarity and transparency.

Changes in regime are relatively rare, and typically under pressure driven by extreme events. The stability of regimes may, in part, reflect the need to adapt institutions and to adapt to different adjustment mechanisms (e.g., development of foreign exchange hedging markets) when regimes change. In practice, when regimes change, the changes tend to occur under pressure.

In section 2 we review theory and concepts behind the choice of monetary, capital account and exchange rate policies, and the empirical literature on the constraints implied by the trilemma. In section 3, we consider the experience of countries that have chosen a greater degree of control over capital flows and/or exchange rates than New Zealand has. Section 4 concludes.

2. WHAT IS POSSIBLE? WHAT IS DESIRABLE?

Theory and evidence suggest the trilemma is an important constraint on a country's policy choice.

2.1 Volatility trade-offs

An important strand of the macroeconomic-model-based literature examines trade-offs inherent in the trilemma: pursuing stability in one dimension (e.g. exchange rate stability or internal price stability) gives rise to volatility in other variables. The analysis typically employs an open economy model and involves moving away from the freely floating exchange rate corner of the trilemma (pure inflation targeting) towards greater exchange rate stability. The questions tend to be about what happens if monetary policy tries to reduce volatility in the exchange rate as well as inflation, and sometimes also variability in output and interest rates.

Galí and Monacelli (2005) use a model to examine the trade-off between stabilising domestic factors (the output gap and domestic inflation) and external factors (the exchange rate and terms of trade). In their model, strict domestic inflation targeting ensures that domestic inflation and the output gap are simultaneously stabilised at target / zero. That comes at the cost of greater volatility in the nominal exchange rate than under the other regimes considered.

The other regimes that Galí and Monacelli consider are a pegged exchange rate; and two Taylor (1993)-type rules that respond, respectively, to domestic inflation and CPI inflation. Pegging the exchange rate allows no variability in the exchange rate, but of all policy choices gives rise to the greatest variability in the output gap and domestic inflation. The authors show that including the output gap in the reaction function (a feature of flexible inflation targeting) gives intermediate outcomes for variability of the nominal exchange rate, the output gap and domestic inflation. In that sense, most inflation targeting regimes can be considered 'intermediate' regimes in the context of the trilemma.

West (2003), Stephens (2006) and Hampton, Hargreaves and Twaddle (2006) ask similar questions in models calibrated to New Zealand. They ask whether monetary policy can trade off price stability with stability in other variables. The first two papers are based on New Keynesian-type models calibrated to the New Zealand economy. Hampton et al use the FPS model, a larger, micro-founded model used by the Reserve Bank of New Zealand at the time.

In West's (2003) model, a Taylor-type monetary policy rule includes the real exchange rate in addition to the traditional output gap and inflation. In that model, putting greater weight on reducing volatility in the level of the exchange rate significantly raises the volatility of output, inflation and interest rates. West concludes that a 25 per cent fall in the standard deviation of the real exchange rate would result in a rise in the standard deviations of output of about 10-15 per cent, of inflation volatility by about 0-15 per cent and of interest rate volatility by about 15-40 per cent. He notes that these figures might be understated, because they are based on an optimistic assumption about the central bank's ability to react to exchange rate movements.

Stephens (2006) builds on West's paper, considering two different central bank loss functions, only one of which contains the exchange rate. The results support the general conclusion for standard small open economy models (for example, Obstfeld and Rogoff, 2002), that seeking to avoid exchange rate volatility would have more costs than benefits. Stephens finds the two central banks behave much differently only when faced with direct exchange rate ('portfolio') shocks. For such shocks, a central bank whose loss function directly includes the exchange rate will move the interest rate much more sharply. Stephens notes that there is a risk of misreading the source of such a shock in real time, acting to offset the exchange rate move, and so hindering the role the exchange rate plays as a buffer in the face of demand shocks (as opposed to portfolio shocks). The paper also shows that public expectations of inflation can be an important consideration. Seeking to smooth the exchange rate means allowing inflation to deviate further from target. A forward-looking public will anticipate higher inflation and change their expectations, so that the central must be more aggressive with interest rates in future to offset any inflation pressure.

Hampton, Hargreaves and Twaddle's (2006) results are qualitatively very similar to West's. They consider a range of forward-looking central bank reaction functions. They also look at different models of how the exchange rate behaves, including a 'pure' uncovered interest parity (UIP) specification and a UIP-based specification with the addition of lagged and equilibrium terms in expectations formation and exchange rate determination itself. They find that using

monetary policy to increase exchange rate stability causes a relatively large reduction in the stability of interest rates, output and inflation – larger than West’s results indicate. That result is partly because the model used by Hampton et al has greater inertia in expectations formation.

2.2 Optimal policy choices

In the standard model of a financially open economy, studies of optimal policy have tended to suggest a floating exchange rate and internal price stability as an optimal policy choice (Obstfeld and Rogoff 2002). That result is based on a model with prices set in the producer country, sticky price adjustment, and complete asset markets.

A growing literature based on open economy New Keynesian models considers the conditions under which that result holds.⁴ When asset markets are incomplete or import prices are set in the destination country rather than the producing country, price stickiness across borders means prices do not necessarily adjust to reflect relative resource costs of production when the exchange rate moves. That leads to distortions in relative competitiveness, and so there may be a case to respond directly to some exchange rate fluctuations (e.g. Engel, 2009). Keeping the output gap at zero is not sufficient to address the distortion. International monetary spill-overs need to be internalised (Corsetti, Dedola and Leduc, 2010). As a result, optimal policy provides a case for the central bank to respond to exchange rate fluctuations directly, over and above the effect of the exchange rate on the output gap and inflation.

2.3 Empirical evidence

The empirical literature asks how strongly the trilemma hypothesis holds in practice, and asks about the durability of different exchange rate regimes. At a high level the conclusion is that when the capital account is open, the pressures of cross-border arbitrage mean a country cannot both peg its exchange rate and use monetary policy for domestic objectives.

Shambaugh (2004) finds, using data on 100 countries for the period 1974 to 2000, that the trilemma does hold. Specifically, interest rates in countries with pegs follow base country interest rates much more closely than is the case for countries with ‘non-pegs’ – floating and managed-floating exchange rates.⁵

Obstfeld, Shambaugh and Taylor (2005) find the constraints on macroeconomic policy implied by the trilemma to be largely borne out by history, using data covering the gold standard, Bretton Woods and the post-Bretton Woods era, and using both *de jure* (announced)

⁴ See Benigno and Benigno (2003), Galí and Monacelli (2005), Corsetti, Dedola and Leduc (2010), and Engel (2009) for a survey.

⁵ The base country is the one to whose currency the domestic currency is pegged, or would most naturally be pegged were the exchange rate fixed. Shambaugh’s testing uses a *de facto* classification of exchange rate regimes based on exchange rate volatility, and controls for capital controls and common shocks. For countries with pegged exchange rates relative to non-pegs, interest rates are more closely correlated with those in the base country. Further, regression equations involving base country interest rates explain a significant part of the variation in pegged countries’ interest rates. For non-pegged countries, such regressions have very low explanatory power.

classifications of exchange rate regimes and an attempt to measure de facto regimes (as developed by Shambaugh, 2004).⁶

They examine monetary policy independence by estimating how exchange rate and capital regimes affect the extent to which a country's short term domestic interest rates can differ from those in from some base country. They summarise their results as follows:

The overall lesson of our analysis is that the trilemma makes sense as a guiding policy framework... Absent capital controls, countries choosing to peg lose considerable monetary independence. At the same time, nonpegs appear to have a reasonable amount of autonomy even when there are no capital controls (p435)

2.3.1 Experience of intermediate regimes

An important question in the empirical literature is whether an economy must choose two of the three objectives under the trilemma (e.g. an open financial account and domestic price stability, with the exchange rate floating freely), or whether some combination is possible of all three (e.g. with an open capital account, accepting somewhat less monetary control to achieve a bit more exchange rate stability)?

Fischer (2001) discusses the 'bipolar' view of exchange rate regimes. Stated at its extreme, the bipolar view says that for countries with an open financial account, only hard pegs and free floats are sustainable exchange rate regimes, with what he calls 'intermediate' options not durable.

Fischer points out that in fact the bipolar view is more subtle than that: while soft exchange rate pegs are not sustainable, flexible exchange rate arrangements take more than one form and there can be scope to influence the exchange rate in a limited way, at times, while pointing monetary policy at domestic objectives. Consistent with that, Fischer argues that a better way of stating the bipolar view is that,

...for countries open to international capital flows: (i) soft exchange rate pegs are not sustainable; but (ii) a wide variety of flexible rate arrangements remain possible; and (iii) it is to be expected that policy in most countries will not be indifferent to exchange rate movements... (p5)

Fischer says most countries that describe their exchange rates as floating do still take account of exchange rates in monetary policy conduct. They do so without targeting a level or narrow range of exchange rates, and instead focus on reducing the variability of the exchange rate, subject to pursuing monetary policy's domestic objectives. In practice, influence over the exchange rate can come directly through taking account of the exchange rate in setting monetary policy or indirectly through the inclusion of the output gap in the Taylor rule (Galí and Monacelli, 2005), or through direct intervention in foreign exchange markets. He argues that it is

⁶ See also Husain, Mody and Rogoff (2005) and di Giovanni and Shambaugh (2006).

not possible, however, to defend a value or range of values of the exchange rate without devoting monetary policy to the sole goal of defending that value or range.

Cavoli and Rajan (2009) point out that countries can and do choose what they call intermediate exchange rate regimes. They suggest some influence over the exchange rate is possible if a country is willing to forsake a degree of monetary policy control. They note (p28),

a general trend towards somewhat greater exchange rate flexibility in Asia, though not complete flexibility. Unease persists about allowing a completely free float. This is apparent from the massive stockpiling of reserves in many Asian economies (China and Japan most notably, but also Korea, Taiwan, India, Hong Kong SAR and Singapore).

The cross-country empirical literature finds some scope to move away from the bipolar solutions to the trilemma (from the edges of the triangle of figure 1). For instance, with an open capital account it might be possible both to apply monetary policy to domestic objectives and to attenuate some shorter term exchange rate volatility. Shambaugh (2004) observes that with an open capital account there is some scope to move away from a hard peg or a free float.

In practice, countries with floating exchange rates tend to choose flexible inflation targeting. Exchange rate variability is often given an explicit role in the monetary policy decision framework. In New Zealand's case, for example, Clause 4b of the Reserve Bank's Policy Targets Agreement says that in pursuing the primary objective of price stability, the Reserve Bank should try to limit unnecessary volatility in the exchange rate. The word 'unnecessary' recognises that some degree of exchange rate variability is 'necessary' in the pursuit of price stability.

Moving away from an exchange rate peg, allowing the exchange rate to fluctuate in narrow bands would mean the exchange rate instead of domestic interest rates could absorb some – albeit perhaps a small part – of the effects of changes in relative interest rates. Further, if there are costs to arbitrage, small interest rate differentials might be able to persist.

However, going further, to influence the longer-term variation in or level of the exchange rate, would require giving up either significant control over domestic monetary policy or a degree of capital mobility.⁷ With an open capital account, the trade-off is between monetary policy control and stabilising the exchange rate.

Cavoli and Rajan (2009) suggest that emerging economies often seek a degree of exchange rate control partly because of their lesser financial development. In particular, they often have less-well hedged foreign liabilities, and so are more susceptible to shocks from exchange rate movements. For such economies, soft pegs have been more durable than for advanced economies (Husain, Mody and Rogoff, 2005).

⁷ Chetwin, Ng and Steenkamp (2013) and Reddell (2013) look at what drives movements in the exchange rate over different horizons – long term levels, cyclical behaviour and short term volatility – and what scope there is to influence those.

The constraint of the trilemma is strongest for advanced economies with relatively well-developed financial markets, meaning countries tend to move towards harder pegs or freer floats. Fischer (2001) presents data showing a shift over time of economies at all stages of development towards the bipolar solutions – more-firmly fixed or more-freely floating. An open capital account exposes intermediate regimes to greater pressures from financial markets, and so more-stark trade-offs between objectives.

Further, regimes that try to manage both the exchange rate and monetary policy in open economies can be unsustainable in the face of large economic shocks. Such shocks can lead markets to see the targeted exchange rate path as inconsistent with the monetary policy stance or macroeconomic conditions. The more complex is the control problem and the greater the financial demands, the less likely it is that the exchange rate regime will be durable. Fischer (2001) argues that soft pegs are unsustainable partly because of the option of adjusting the exchange rate when it is under pressure. This possibility increases the likelihood of speculative attacks that seek to force an adjustment.⁸

Empirical work suggests that capital controls can allow a degree of influence over both domestic monetary policy and the exchange rate. However, such controls appear to become less effective over time. Obstfeld, Shambaugh and Taylor (2005) found that capital controls became less effective through the Bretton Woods era, a time when capital controls were prevalent as a means of providing some monetary independence in the presence of fixed exchange rates. As the controls became less effective, the independence of monetary policy declined. It consequently became harder to sustain a combination of fixed exchange rate and independent monetary policy. In a survey of existing empirical studies, Habermeier, Kokenyne and Baba (2011) found capital controls can affect the composition of flows but do not have much effect on overall volume. Their own econometric work and case studies of a collection of emerging economies pointed to similar conclusions, and found that the effectiveness of measures tends to fall over time.

While there is growing evidence in the theoretical literature that the bipolar solutions may not be optimal (e.g. section 2.2, above), there are practical challenges in seeking more control over both the exchange rate and monetary policy when capital markets are relatively open. The result can be complex institutional arrangements, an unclear hierarchy of objectives and multiple instruments, making for less clarity about and transparency of the institutions involved.⁹ The different objectives might conflict with one another in some economic circumstances and be mutually-consistent in others. It can also be hard to identify the nature of economic shocks affecting the economy at a point in time, and how to balance the various objectives in

⁸ Intervening to resist appreciation means selling domestic currency in exchange for foreign exchange. The result, if done on a large scale, would be a large portfolio of foreign reserves. Intervening to resist depreciation means selling foreign exchange to buy domestic currency. To do that, a country must either have built a portfolio in advance or must borrow foreign currency at the time of intervention.

⁹ Hannoun (2012) discusses some of the challenges posed to monetary policy by the introduction of extraordinary measures since the GFC, the complexity that implies for the operation of policy, and the risk to credibility and price stability.

responding. Sullivan (2013) gives details of the range of objectives and tools used in New Zealand prior to the exchange rate float in 1985.

Reflecting recognition of the trade-off between monetary policy control and exchange rate stability, intervention is used by some central banks to reduce exchange rate volatility without targeting a level or range. If exchange rate control is achieved through sterilised intervention, the intervention may need to be on a large scale if foreign exchange markets are well developed and liquid. Switzerland provides a recent, if extraordinary, example. Sterilised intervention on a large scale requires considerable financial commitment and exposes the central bank to considerable foreign currency risk and potentially large carry costs if high domestic interest rates are not offset by depreciation of the local currency or if intervention fails to stem appreciation of the local currency over the medium term.¹⁰

Further, there are limits to what intervention can achieve. For example, Adler and Tovar (2011) find that foreign exchange intervention in response to appreciation pressure can slow the *pace* of appreciation, but does not appear to reduce the overall degree of appreciation. They also find that the effects of intervention are much weaker in countries with more-open capital accounts.¹¹

An open, inflation targeting country is unlikely to succeed for an extended period at influencing the exchange rate using intervention unless the intervention is consistent with longer-term fundamentals. Such intervention requires strong and credible institutions and willingness to take on significant financial risk. The longer the horizon over which such a country seeks to influence the nominal exchange rate, and the stronger the degree of control sought, the greater the need for financial capacity to offset market pressures that counteract the policy stance.

3. COUNTRY STUDIES

In considering alternatives to New Zealand's current policy choice it is useful to look at what other countries have chosen; their experiences, especially in the face of large economic shocks; and the trade-offs implicit in their policy choices. The aim is to provide context for thinking about whether New Zealand could benefit from moving away from its current combination of monetary policy, exchange rate and capital account regimes.

The countries are chosen because their experiences may help to inform about the trade-offs involved in achieving greater control over the exchange rate.

¹⁰ Fischer (2001, p7) notes

...the manner in which the EMS [European Monetary System] currencies were attacked in 1992 and 1993. It proved impossible to hold the adjustable pegs within the EMS after the rise in German interest rates necessitated by Germany's unification had imposed a domestically inappropriate monetary policy on other EMS members.

¹¹ Their study examines the effects of intervention within a short period after the action. The sample covers 2004-2010 (they exclude the 2008-09 crisis period) for 15 countries, most of which are emerging market economies from Latin America and Asia and two of which are small advanced economies (Australia and Israel).

We begin by identifying where each country is positioned on the trilemma – that is, what combination each has chosen of monetary policy objectives, exchange rate policy and financial openness. We then discuss briefly each country's experience. We look at how the economy has adjusted to major economic shocks, and where relevant at the regime's stability. Also pertinent are the structural and institutional factors that contribute to the success of the regime. Finally, we consider trade-offs among internal price stability, external price stability and financial openness that are associated with the regime.

In practice, many countries' trilemma choices largely reflect a combination of history; the tendency noted earlier in many countries towards floating exchange rates and domestic price stability; the costs of changing from one exchange rate regime to another; and in some cases inadequate reserves to defend a fixed exchange rate regime. Moreover, the country characteristics may in part reflect the chosen regime (Levy Yeyati, Sturzenegger and Reggio, 2010). In New Zealand's case, for example, the shift to a floating exchange rate regime occurred after a protracted period over which managing competing objectives had complicated policymaking (see Sullivan, 2013). Competitiveness had been sharply eroded, and resources to defend a fixed exchange rate had been exhausted. Over time, the supporting structures for the existing regime have been built up (e.g. markets for hedging instruments and hedging policies).

Our focus in the country studies is therefore less on the reason for the trilemma choice and more on the mechanisms through which the economy can adjust to economic shocks and the trade-offs involved.

3.1 Overview – countries' positions on the trilemma

The charts in figure 2 provide a stylised representation of the degree of capital account openness and exchange rate control for a range of countries. The vertical axis shows measures of financial account closure, and the horizontal axis measures control over the exchange rate.

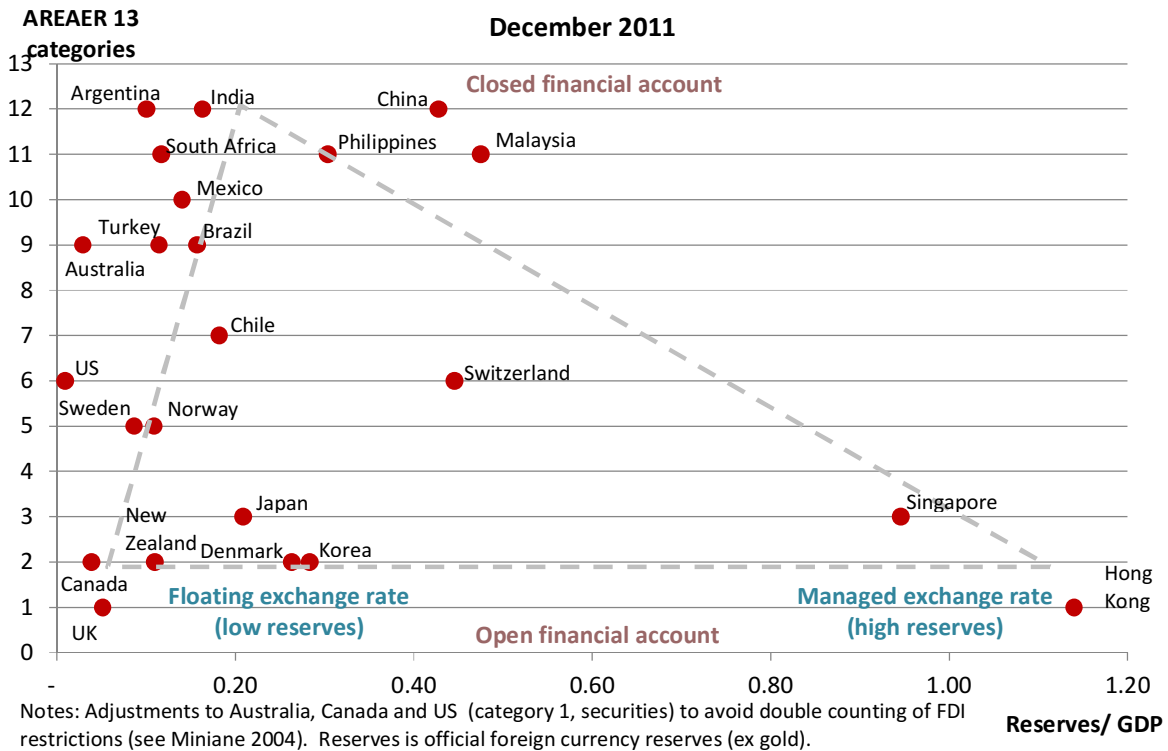
The vertical axis represents financial closure by two different measures, with more-closed economies closer to the top of the picture.¹² One measure is the number of categories (out of 13) in which a country has controls on capital transactions according to the IMF's Annual Report on Exchange Arrangements and Exchange Restrictions (AREAER) (see Miniane, 2004 and International Monetary Fund, 2011 and 2012i).¹³

Figure 2 – Stylised representation of trilemma choices

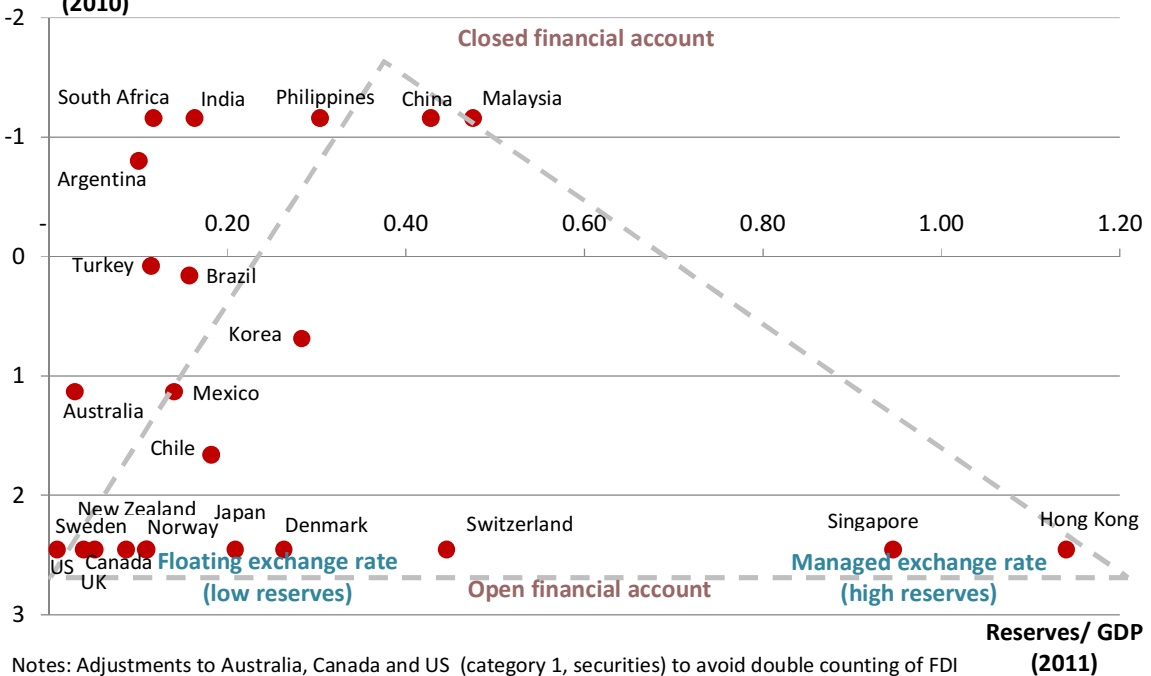
¹² There is a variety of empirical approaches to measuring those controls, all with advantages and disadvantages (see, for example, Chinn and Ito, 2008 on this and Habermeier, Kokenyne and Baba, 2011 on the difficulty more generally of measuring capital controls and their effects).

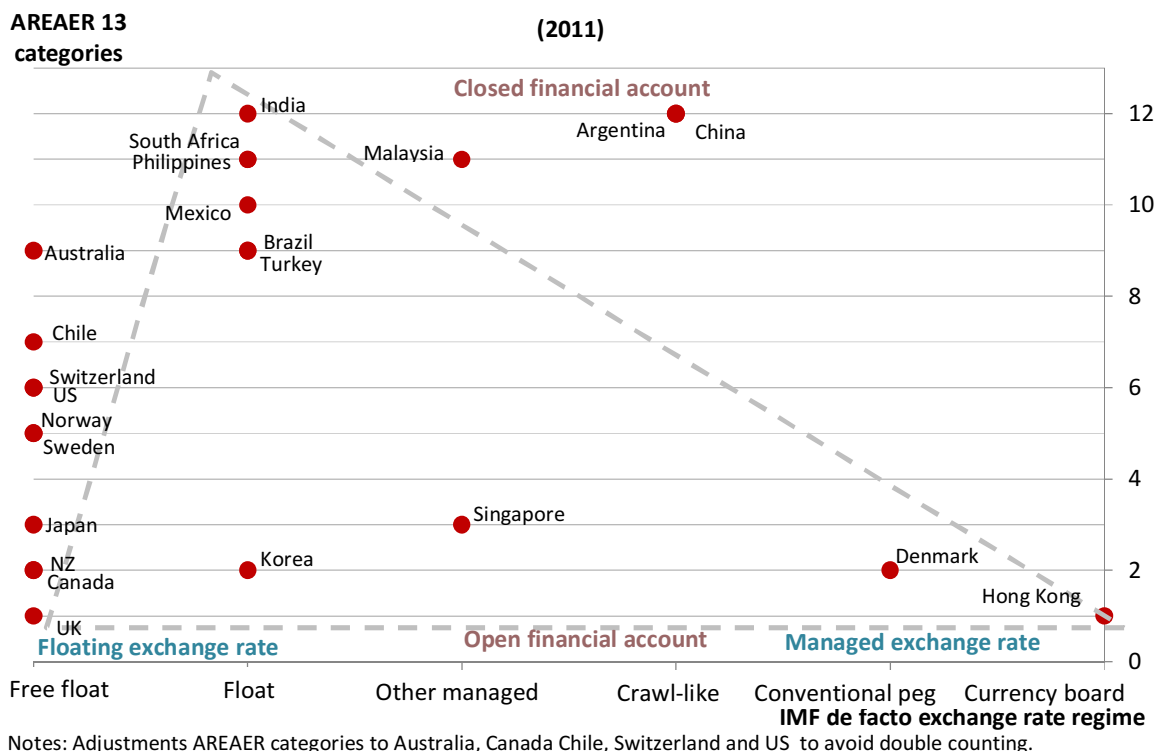
¹³ The advantage of this measure is that it is, in principle, comparable across countries. The disadvantage is that the report is completed by domestic authorities who may have differing opinions as to what constitutes a control and one light handed control registers the same as a plethora of controls in the same category.

(Capital controls vs. foreign currency reserves/GDP)



Chinn-Ito index (2010)





A higher number (a position higher on the vertical axis) indicates greater restrictions (the economy is more closed). The AREAER's information on capital transactions includes restrictions on capital and money market instruments, derivatives, credit operations, personal capital transactions, and provisions specific to financial institutions as well as on direct investment and real estate transactions (International Monetary Fund, 2011 and 2012i).

In practice, most countries have some policies identified in the AREAER as restrictions on capital flows, and there is a wide range in the number of categories for which controls are reported. The coverage that follows of individual countries elaborates on the nature of each country's controls, as listed in the AREAER. That discussion gives some indication of the difficulty of inferring how open is a country's capital account, and shows how the substance and intensity of restrictions, rather than just the number, can be important.

The other measure used to indicate the degree of financial closure is the Chinn-Ito index for 2010.¹⁴ Again, more-closed economies (more-negative on the Chinn-Ito index) are plotted higher on the vertical axis. The Chinn-Ito index is calculated by extracting the first principal component from a collection of binary indicators of controls in four main categories of the AREAER. Those variables indicate the presence or absence of: multiple exchange rates for the country; restrictions on current account transactions; restrictions on capital account transactions; and requirements for surrender of export proceeds. By looking at those four

¹⁴ The Chinn-Ito index comes originally from Chinn and Ito (2002) and is further explained in Chinn and Ito (2008). Data to 2010 are available at http://web.pdx.edu/~ito/Chinn-Ito_website.htm.

categories, rather than just capital account restrictions, the Chinn-Ito index tries to account for the fact that countries can influence capital flows through more than one channel. It also tries to give some indication of the intensity of controls, to the extent that intensity is correlated with the range of areas in which restrictions apply (Chinn and Ito, 2008).

The horizontal axis indicates an economy's degree of exchange rate control, again using two different measures.¹⁵

The first is foreign currency reserves relative to GDP, as a proxy for the degree of exchange rate control. The idea is that, for an open economy, a fixed exchange rate requires a stock of reserves that allows credible exchange rate control. A country can always print local currency and buy foreign currency, but a stock of reserves is required to prevent depreciation of the domestic currency. Holding reserves imposes costs, meaning large stocks of reserves tend to be limited to countries seeking a degree of exchange rate control. The two main sources of cost or potential cost are carry costs, because funding costs in high interest rate currencies are often not offset by currency depreciation; and foreign currency mismatch on the central bank's balance sheet.

The second measure is based on the IMF's classification of de facto regimes in the AREAER for 2011 (plotted so that more-flexible regimes are plotted closer to the left-hand side of the chart). The full range of AREAER exchange rate regime categories, from least flexible to most flexible, is as follows.

Hard pegs

- No separate legal tender
- Currency board

Soft pegs

- Conventional peg
- Stabilized arrangement
- Crawling peg
- Crawl-like arrangement
- Pegged exchange rate within horizontal bands

Other managed

- Other managed arrangement

Floating

- Floating
- Free floating

Countries that are relatively closed (near the top of figure 2) tend to have low reserves as a share of GDP. Exchange rate control can be achieved with a relatively low ratio of reserves to GDP because capital controls limit arbitrage between domestic and foreign assets (for example

¹⁵ There is a variety of approaches to measuring the degree of exchange rate control. For example, Shambaugh (2004), Husain, Mody and Rogoff (2005) and International Monetary Fund (2011 and 2012i).

China, discussed below in section 3.5) and foreign exchange market turnover tends to be low for those currencies.

Because intermediate exchange rate regimes are rarely successful over long periods in open economies, we might expect a country to move towards either the origin of figure 2 or towards greater reserve holdings as it becomes more financially open (move down and towards the corners of the dashed triangle). To some extent that appears to be the case: floating exchange rate countries such as New Zealand hold relatively low levels of reserves relative to GDP, while countries that choose to manage their exchange rates such as Hong Kong and Singapore tend to have large stocks of reserves.

Likewise, when we plot the IMF exchange rate classifications on the horizontal axis, the countries that both have low reserves and are more open tend to be classified by the IMF as having a free floating exchange rate (UK, New Zealand, Canada, the US, Norway and Sweden). Those with low reserves and a slightly more-closed financial account seem to operate regimes with slightly less flexibility – ‘floating’ in the IMF’s categorisation, which allows some intervention to moderate pace of movement or prevent undue fluctuations, rather than ‘free floating’.¹⁶ Korea has a relatively open economy and a floating (not free floating) exchange rate, and reserves significantly higher than other ‘floating’ countries that intervene in exchange rates but are less open than Korea.

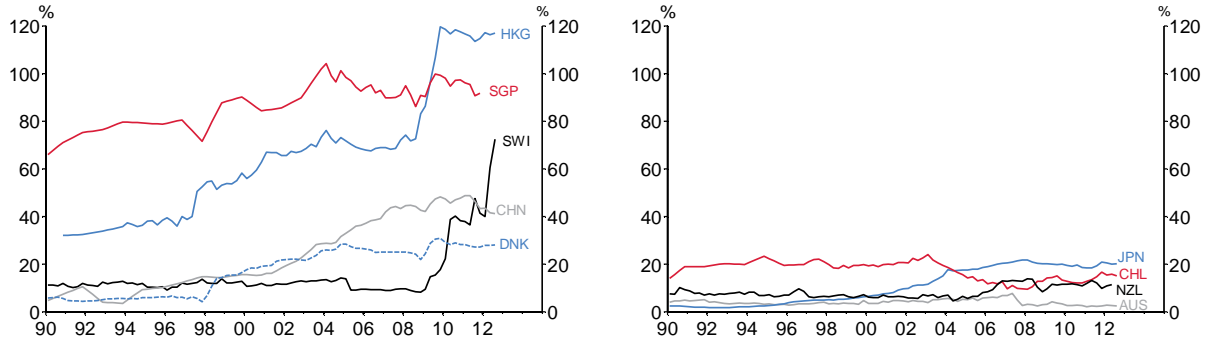
Hong Kong (with a fixed exchange rate) and Singapore (with a managed exchange rate) both have quite open economies on the AREAER and Chinn-Ito measures, and have high ratios of reserves to GDP compared with most countries. Switzerland, which was close to New Zealand on the chart in 2007 sharply increased reserves (from about 10 percent of GDP in early 2009 to 40 percent in 2010 and around 70 percent by the end of 2012, by which time its intervention had led the IMF to re-classify the Swiss franc as an ‘other managed’ arrangement) as part of the effort to resist the sharp appreciation of the franc associated with extraordinary capital inflows from the Euro Area, in particular.

Figure 3 shows growth in holdings of foreign currency reserves (as a share of GDP) since 1990 in a selection of countries. This gives a sense of how countries have moved along the horizontal axis in Figure 3 over time. Reserve holdings in Hong Kong and Switzerland have risen sharply in the years following the Global Financial Crisis (GFC), as Hong Kong has purchased foreign currency to defend the exchange rate peg and Switzerland has sought to prevent appreciation of the franc. Reserves have risen steadily in Korea and in China since the early 2000s as those countries have become more financially open. An exception is Chile, where the stock of

¹⁶ A regime is classified as ‘free floating’ if ‘intervention occurs only exceptionally (no more than three times in the previous six months, each time for no more than three business days) and aims to address disorderly market conditions. A regime is classified as ‘floating’ if it is ‘largely market determined, without an ascertainable or predictable path for the rate...Foreign exchange market intervention may be either direct or indirect and serves to moderate the rate of change and prevent undue fluctuations in the exchange rate, but policies targeting a specific level of the exchange rate are incompatible with floating.’ A regime might also be ‘floating’ rather than ‘free floating’ if there are no data (either public or provided privately to the IMF) to confirm that the intervention limits for free floating are met (International Monetary Fund, 2011).

reserves has fallen since the monetary policy regime moved away from exchange rate stabilisation to inflation targeting.

Figure 3 – Foreign exchange reserves as percentage of GDP*

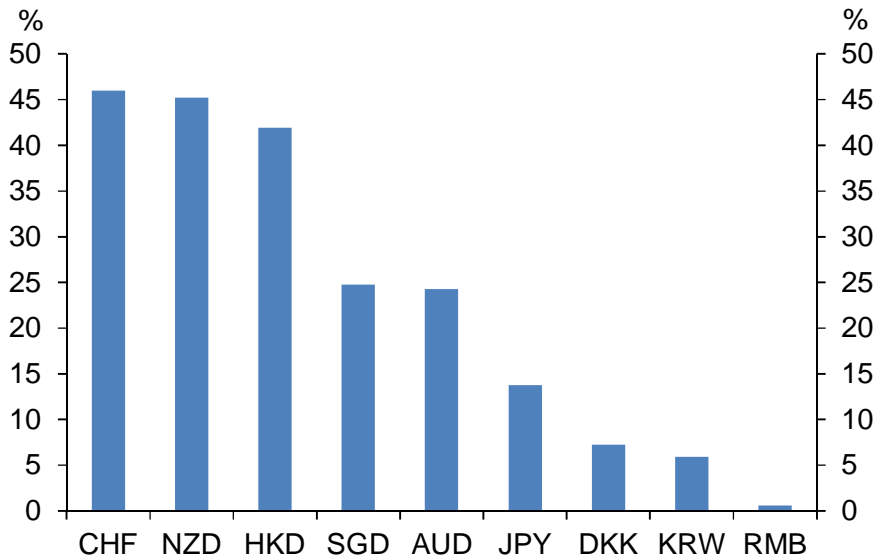


Source: IMF

* Quarterly data have been interpolated from annual observations for the following countries and periods: Hong Kong up to 1993Q3; Chile up to 1996Q3; China up to 1999Q3; Singapore up to 2003 Q3.

As an indication of how heavily traded some of these currencies are, Figure 4 shows the average daily volume of trading in each country's currency (Bank for International Settlements, 2010), as a share of annual GDP. With high turnover in foreign currency markets, Hong Kong and Singapore require large stocks of reserves to credibly influence foreign exchange markets.

Figure 4 – Daily foreign exchange market turnover as a share of GDP



Source: Bank for International Settlements and International Monetary Fund

Table 1 shows indicative costs of holding reserves across countries. In principle, the cost should be zero if UIP holds and the countries have similar risk characteristics to the US. In practice, most countries are perceived as higher risk than the US, and high-real-interest-rate currencies

tend to have high short term excess returns because exchange rate movements tend not to offset those returns (Engel, 2012).

Table 1 – Cost of holding reserves

	Interest carry vs US Tbill ^{1,2}	Average exchange rate valuation vs. USD ²	Cost of holding USD reserves relative to home currency returns (% p.a.) ²
Australia	2.34	0.87	3.21
Chile	3.90	-1.54	2.35
Denmark	-0.01	-0.02	-0.02
Korea	-0.10	-0.34	-0.44
Hong Kong	-2.70	0.59	-2.10
Japan	-0.05	-3.37	-3.41
New Zealand	2.88	0.64	3.52
Singapore	-1.61	0.79	-0.82
Switzerland	-1.79	1.21	-0.58

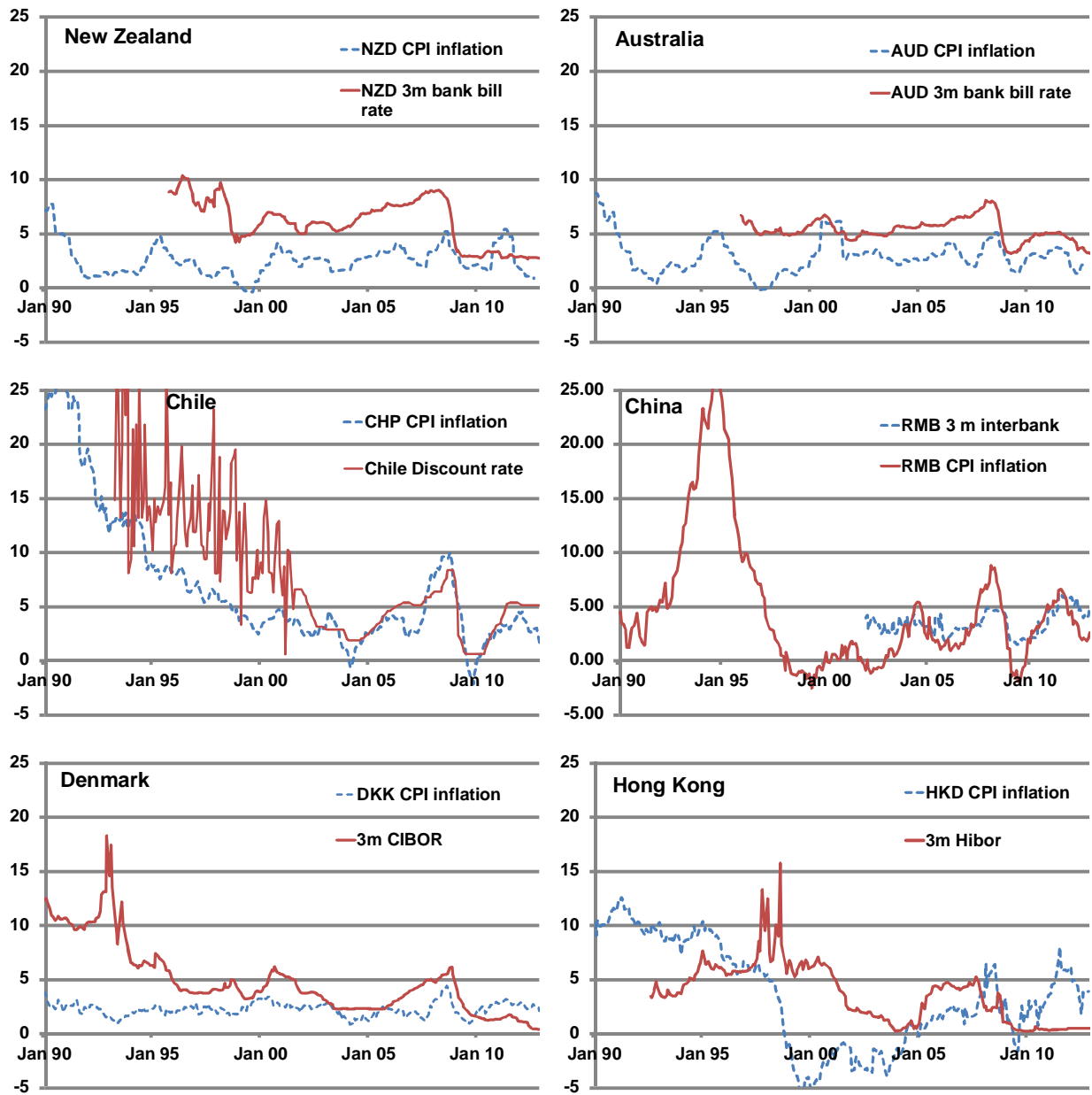
¹ Interest rates as follows: United States: 3m Tbill; Australia:13week Treasury note; Chile and Korea: central bank discount rate; Denmark central bank rate; Hong Kong: 91-day Tbill; Japan: financing bill rate; New Zealand 3m Bank Bill; Singapore: Tbill rate; Switzerland: Federal Debt Register Claims (average).

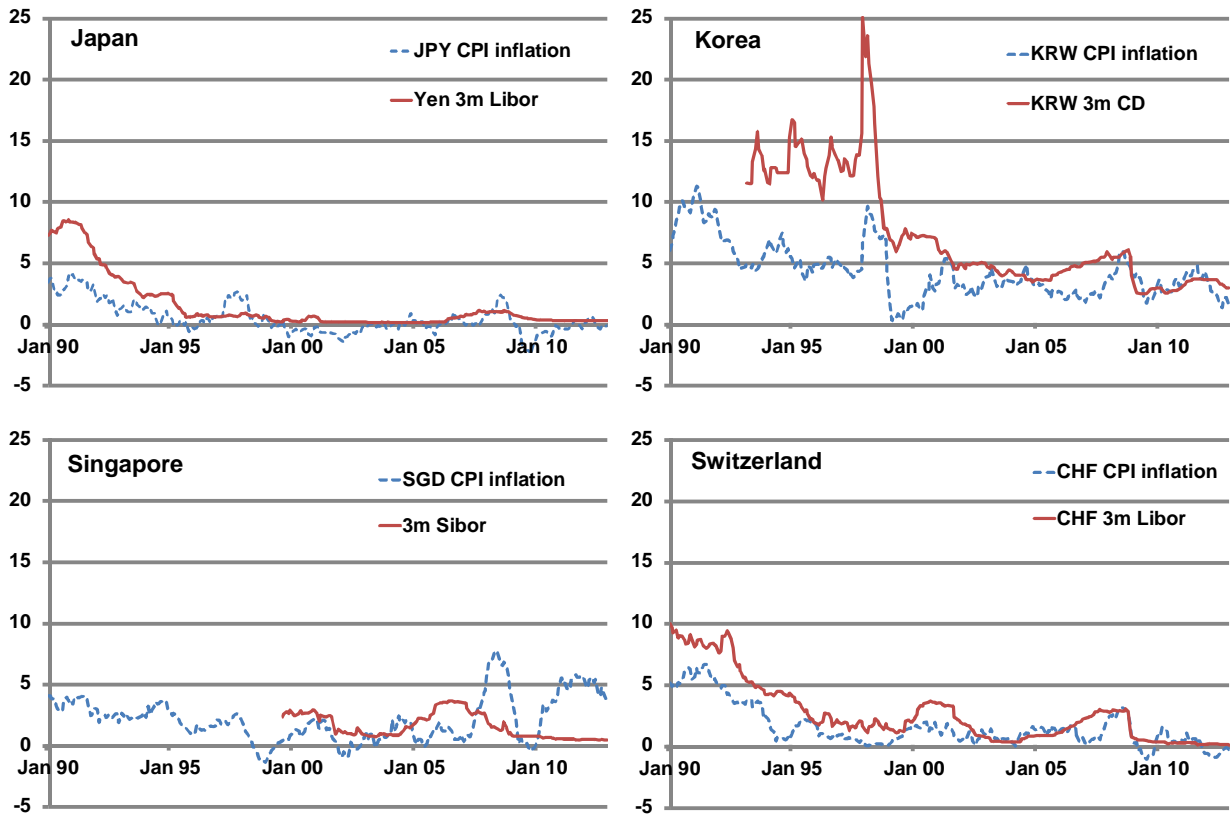
² Jan 1995 to Nov 2012.

Source: IMF, International Financial Statistics, except Denmark: Bloomberg.

Figure 5 shows interest and inflation rates; and figure 6 shows movements in real and nominal effective exchange rates.

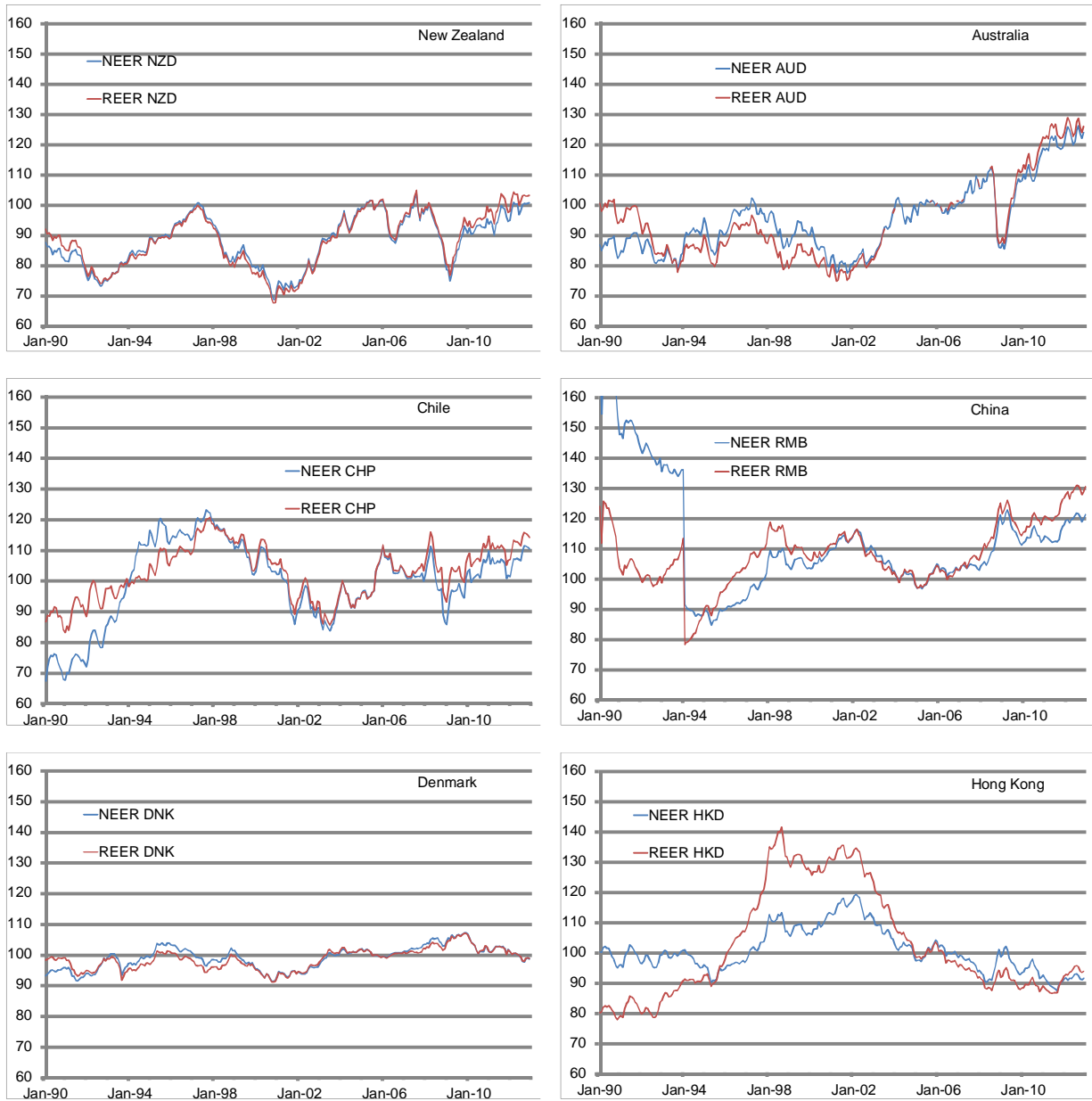
Figure 5 – Interest rates and inflation

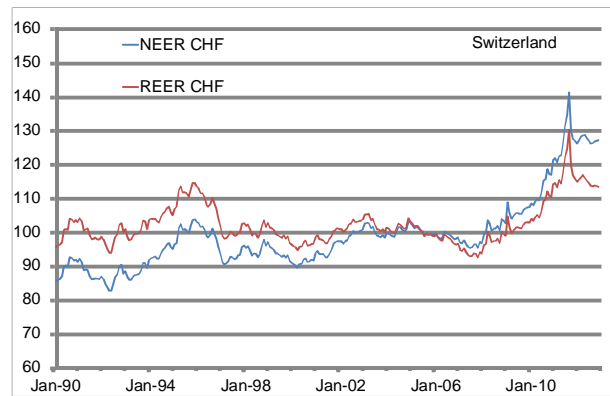
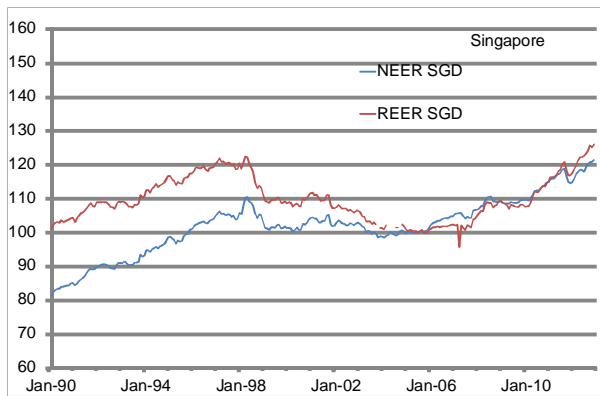
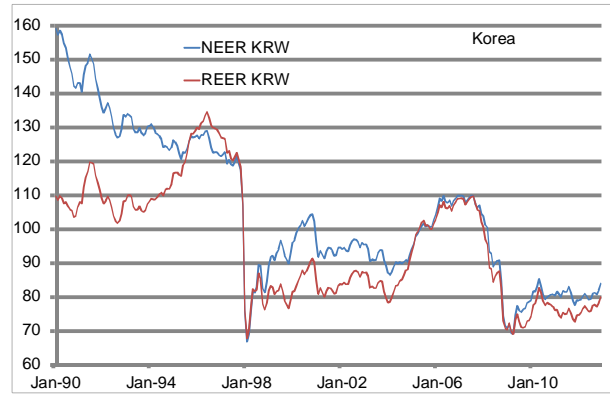
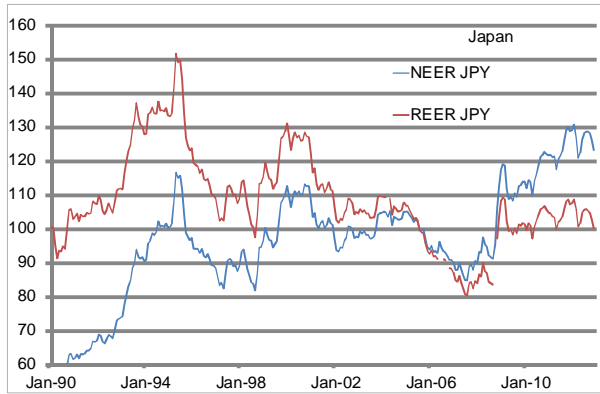




Sources: Haver, Bloomberg, International Monetary Fund, Danmarks Nationalbank

Figure 6 – Real and nominal effective exchange rates





Sources: Haver, International Monetary Fund

3.2 New Zealand

3.2.1 The policy choice

It is commonly accepted that the New Zealand economy is financially open, with a floating exchange rate and inflation targeting monetary policy. That characterises New Zealand as a fairly clear ‘bipolar’ choice (see Figure 1 for a depiction).

In practice, New Zealand’s regime differs from a clear bipolar choice in three respects.

First, while price stability is clearly the primary objective of the inflation targeting regime, the regime is one of ‘flexible’ inflation targeting. That is, the inflation objective is specified ‘on average over the medium term’ and the Reserve Bank must ‘have regard to the efficiency and soundness of the financial system, and seek to avoid unnecessary instability in output, interest rates and the exchange rate’. The word ‘unnecessary’ recognises that some volatility in those variables is necessary given the focus on price stability. The Policy Targets Agreement (PTA) also recognises that a range of shocks can cause significant but temporary movements in headline inflation, and that the Bank should focus on the persistent component of inflation rather than trying to directly offset such shocks.

Second, in 2004 the Reserve Bank of New Zealand announced a policy on foreign exchange market intervention to influence the value of the New Zealand dollar in certain circumstances (Orr, 2004). Those circumstances are: when the New Zealand dollar is considered exceptionally high or low and unjustified by fundamentals; there is some scope for market influence; and intervention would be consistent with primary objective of price stability. Intervention under the 2004 policy does not target a specific level for the exchange rate. It first occurred in 2007 (following 20 years of a pure float) and has, in practice, been modest in size. Associated with that policy, the structural and temporary increase in reserves together amounted to less than 3 percent of GDP.¹⁷

Among the currencies discussed in this section, the New Zealand dollar is one of the most-heavily traded as a share of GDP: average daily turnover in April 2010 was about 45 percent of GDP, close to Switzerland’s and Hong Kong’s. Reflecting the floating exchange rate regime and policy on intervention, foreign currency reserves as a share of GDP are among the lowest in the group of countries we examine at about 11 percent of GDP (figure 3).

Finally, New Zealand reports capital controls in three categories of the IMF’s 2011 Annual Report on Exchange Arrangements and Exchange Restrictions (AREAER).

- *Capital market securities:*
 - limits on foreign ownership of Air New Zealand and Telecom New Zealand.
- *Direct investment:*

¹⁷ New Zealand’s reserves increased from about seven per cent of GDP in 2004 to twelve per cent of GDP in 2007. The rise was mainly the result of a structural increase in the level of reserves following an occasional review of reserves adequacy for the purpose of providing liquidity to dysfunctional markets in the event of extreme foreign exchange stress (not to influence the level of the exchange rate).

- required approval for foreign direct investment in sensitive land.
- *Real estate transactions:*
 - an investor test for foreign investment in sensitive land, including large blocks of rural land, environmentally sensitive land, coastal land, land adjoining lakes, rivers, reserves and heritage areas.

Controls in those areas are not unusual among either emerging or developed economies. They are unlikely to pose major impediments to overall capital flows, and do not directly affect arbitrage in the bond and foreign currency markets perhaps most relevant to the exchange rate. On the Chinn-Ito index, New Zealand scores 2.46, the same as the UK and US.

A material reduction in openness to capital might have undesirable implications for countries that depend on foreign funding. For an economy with a large external debt like New Zealand, reduced openness could mean higher domestic interest rates, to equalise the supply and demand for funding (i.e. to encourage greater domestic savings and moderate investment).

3.2.2 The economy and the exchange rate regime

New Zealand's share of trade in GDP is around the middle of the pack for the group of countries we examine. In gross terms, exports and imports are around 30 percent of GDP; in value added terms, exports and imports are 22-23 percent of GDP (figures 7 and 8).

As a commodity-producing economy, New Zealand's exchange rate has reacted to large swings in commodity prices and the terms of trade, helping limit the effects of price movements in both directions on incomes of commodity exporters. For example, the exchange rate depreciated sharply when global demand and the terms of trade fell with the Asian Crisis and GFC, and rose through the mid-2000s with strong demand and prices for New Zealand's export commodities. At the same time, firms competing in the non-commodity tradables sector have at times been subject to large exchange rate fluctuations unrelated to international prices for their output.

New Zealand does not have a single dominant trading partner, and its business cycle is not evidently driven by common factors with Australia, its most significant trading partner. Hall and McDermott (2012) find that New Zealand-specific factors, rather than common Australasian factors, drive much of New Zealand's cycle. That suggests there have been benefits from a separate currency and monetary policy. Hall (2005), using simulations, finds that adopting US or Australian monetary policy (interest and exchange rates) during the 1990s might have led to modest short run output gains for New Zealand, but greater excess demand pressure, higher CPI inflation, and in the case of US monetary policy, a larger current account deficit and higher debt. New Zealand would also likely have experienced greater economic volatility in the face of foreign shocks. Hall and McDermott (2012) observe that economic structure and so the outcomes for New Zealand might change over time with a common currency (i.e. structure might be somewhat endogenous to the regime).

New Zealand's financial sector has been robust to swings in the exchange rate. In particular, much of New Zealand's foreign currency debt is hedged (Drage, Munro and Sleeman, 2005).

3.2.3 Trade-offs

New Zealand's policy choice means it is relatively close to a bipolar choice on the trilemma, with discretion over monetary policy and very little independent influence over the exchange rate. It has relatively few capital controls, even compared with many other advanced countries.

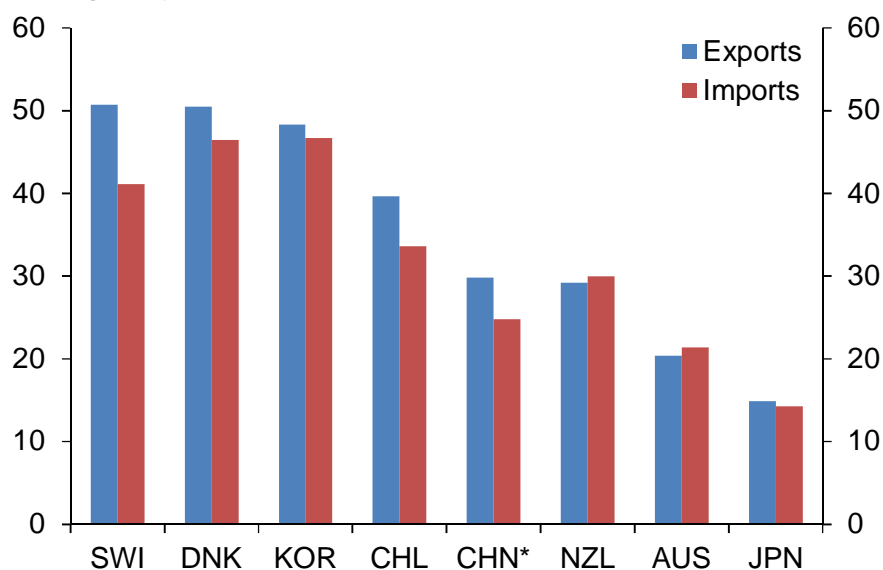
Theory and empirics tell us that greater control of the exchange rate would require either imposition of capital controls or trade-offs between the domestic price stability objective and exchange rate stability. As discussed in section 2, the literature suggests capital controls become increasingly difficult to maintain (are increasingly circumvented) as financial markets become more developed. There are also reasons to believe that reduced access to foreign funding could be costly.

In view of the high rate of foreign exchange market turnover relative to GDP, a greater degree of exchange rate stability without giving up control over monetary policy would probably require a much larger stock of un-hedged foreign currency reserves *ex ante* to limit depreciation in the New Zealand dollar, or commitment to accumulating large stock in resisting appreciation of the New Zealand dollar.

Such a stock may be expensive to maintain if the relatively high home interest rates are not offset by depreciation of the New Zealand dollar. Over the period 1990 to 2011, US dollar reserves would have cost over 4 percent per annum relative to the local funding cost (see table 1): for a portfolio equal to 75 percent of GDP (around Switzerland's level) that would amount to about 3 percent of GDP per year. Another consequence is a large currency mismatch on the central bank's (or Government's) balance sheet. That leads to volatility in mark-to-market profitability with exchange rate fluctuations.

New Zealand's relatively clear policy choice supports institutional clarity and transparency. An intermediate regime would allow greater flexibility in some situations, but would also pose a more complex control problem (i.e. optimising over a hierarchy of objectives that could change over time). Such an intermediate solution would complicate communication and compromise institutional clarity and transparency.

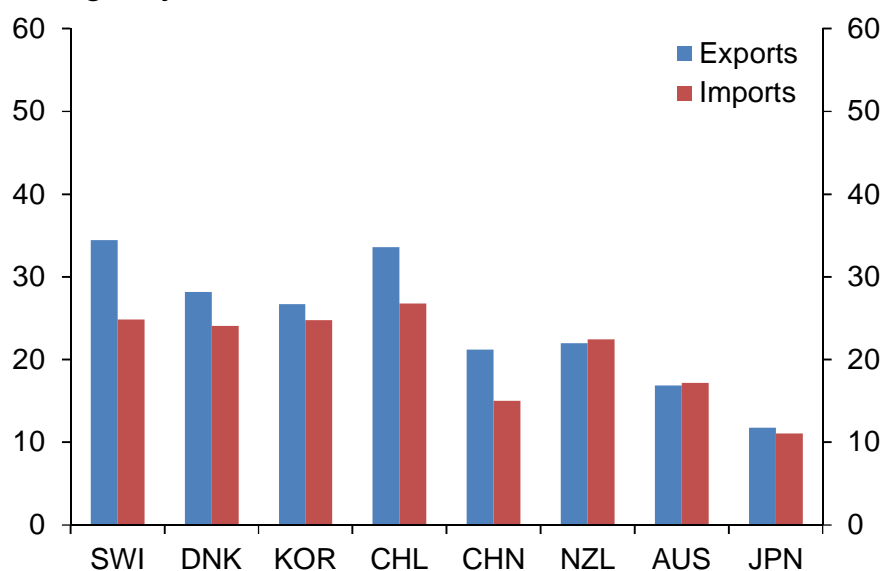
Figure 7 – Gross nominal trade as a share of GDP
Average of years 2005, 2008, 2009*



Source: International Monetary Fund

* For China, merchandise trade data are used, instead of total exports and imports. The choice of 2005, 2008 and 2009 is to match the available data on value added in trade.

Figure 8 – Nominal value added in trade as a share of GDP
Average of years 2005, 2008, 2009*



Source: OECD

* The choice of 2005, 2008 and 2009 is to match the available data on value added in trade.

3.3 Australia

3.3.1 *The policy choice*

Australia's monetary policy regime is defined by its inflation target and a financially open economy, consistent with Sydney's role as a regional financial centre. In the years immediately following the floating of the Australian dollar in 1983, foreign exchange market intervention was used to smooth short term volatility. Over time, foreign exchange market intervention has become much less frequent and more targeted towards addressing periods of market dysfunction (Newman, Potter and Wright, 2011). That characterisation also is consistent with a very low level of foreign currency reserves to GDP and a floating exchange rate.

On the AREAER and Chinn-Ito measures, Australia shows up as considerably less financially open than New Zealand. It reports capital controls in 8 of 13 categories of the AREAER, up from 6 in 2008. On the Chinn-Ito index, Australia scores 1.13, down from 2.46 in 1995, below the 2.46 figure for New Zealand, the UK and the US. It is on that aspect of the Australian regime that we focus here.

In the IMF's 2011 AREAER, Australia reports financial account restrictions in the following areas:

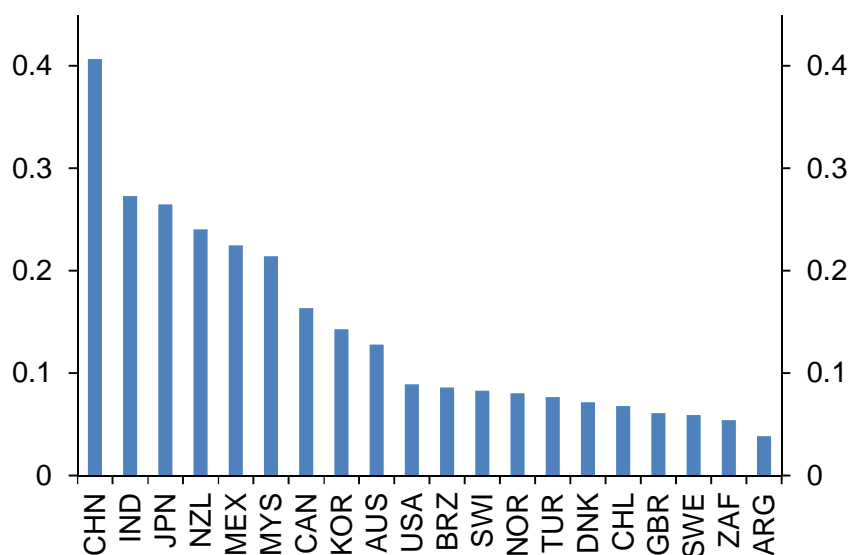
- *Money market instruments:*
 - subject to regulation under the Corporations Act.
- *Collective investment securities:*
 - only Australian public companies may issue collective investment securities in registered managed investment plans. ASIC may make exceptions.
- *Derivatives and other instruments:*
 - market participants must hold an Australian licence or a foreign licence subject to requirements and supervision that are sufficiently equivalent, in relation to the degree of investor protection and market integrity they achieve, to those in Australia.
- *Commercial credits:*
 - credit providers need to be licenced by ASIC, comply with responsible lending provisions and participate in an external dispute resolution programme.
- *Financial credits:*
 - providers must hold an Australian credit licence, and comply with responsible lending provisions.
- *Direct investment:*
 - controls apply to banking, real estate, civil aviation and uranium; acquisitions of urban land; investments of more than 5 percent in existing media operations; acquisition of partial or controlling interests in Australian businesses valued at over A\$231m; direct investment by foreign governments or their agencies; limits on foreign ownership in Telstra (5 percent foreign individuals; 35 percent foreign aggregate). Ownership of Australian flag vessels must be through an Australian company; foreign life insurers may not operate through branches.
- *Real estate transactions:*

- controls on foreign ownership apply except for some categories such as developed, non-residential, non-heritage commercial real estate; time share plans used less than 4 weeks a year; approved migrants and holdings through certain financial structures.
- *Provisions specific to commercial banks and other credit institutions:*
 - an Australian financial services licence is generally required.

While Australia reports considerably more controls on capital transactions than does New Zealand in the AREAER, it is difficult to evaluate the extent to which those controls are meaningful restrictions on capital flows that give greater exchange rate or monetary policy control; or are measures to promote responsible lending for consumer protection; or are requirements for more-complete reporting. In the AREAER list of foreign direct investment and real estate controls, Australia's listed controls appear more exclusive than New Zealand's.

By way of contrast, Australia shows up as less restrictive than New Zealand in an OECD index of the restrictiveness of foreign direct investment (FDI) rules (Figure 9, which shows the same sample of countries as appears in figure 2, except that OECD index data are not available for Hong Kong, the Philippines and Singapore). That index gauges restrictiveness of FDI rules according, with 0 indicating an open economy and 1 a closed economy. The index is based on scores for four components: foreign equity limitations; screening or approval mechanisms; restrictions on the employment of foreigners as key personnel; and operational restrictions (such as on operating as a branch, capital repatriation, or land ownership).¹⁸

Figure 9 – OECD Foreign direct investment regulatory restrictiveness index (2012)



Source: OECD

*The figure for Malaysia is preliminary

¹⁸ See <http://www.oecd.org/daf/inv/mne/fdiindex.htm>. Most of the difference between Australia and New Zealand on this index appears due to the screening or approval mechanisms component, which indicates the presence or absence of such mechanisms that differ between foreign and domestic investors.

In principle, if there were less cross-border capital mobility for Australia, the country should have some scope to stabilise the exchange rate as well as domestic prices. However, that is not apparent in the exchange rate and inflation variability of Australia relative to New Zealand in figures 5 and 6. The AUD real effective exchange rate has appreciated by considerably more than the New Zealand dollar since 1990, consistent with a larger rise in the terms of trade and relative productivity gains.

Greater controls could be part of an explanation for lower net external debt in Australia than in New Zealand, but there are other factors including substantial superannuation savings.

3.3.2 *The economy and the exchange rate regime*

Australia's floating currency is seen to have served the economy well. It has helped to absorb large shifts in the terms of trade associated with commodity export prices. During the GFC, the currency depreciated sharply as commodity export prices fell and there was a generalised flight to the US dollar. That depreciation helped to support demand for Australian exports through a period of falling demand and weak external trade. With Australia's external debt mostly denominated in Australian dollars either directly or through well-developed financial hedging markets, that depreciation did not lead to adverse exchange rate valuation effects. In practice, as in New Zealand, it supported continued rollover of Australia's external debt by reducing the required rollover in foreign markets in foreign currency terms.

3.3.3 *Trade-offs*

As in the case of New Zealand, Australia's monetary policy regime provides relatively stable internal prices, providing stability for local households and firms in domestic currency terms. The floating exchange rate has tended to move closely with export commodity prices, helping to smooth incomes of commodity exporters in local currency terms. However, trade-exposed businesses for which international prices have not moved with the major commodity exports have seen large fluctuations in incomes and competitiveness.

Australia has considerably more controls on capital transactions than New Zealand. Many of the controls relate to incorporation in Australia, and it is difficult to judge the extent to which they are meaningful impediments to the movement of capital. In the foreign direct investment and real estate categories, Australia's controls are more extensive under the AREAER but score as less restrictive on the OECD's index (figure 9).

It is unclear whether those rules have provided Australia with greater scope for exchange rate stabilisation. In practice the Australia dollar has appreciated by more over the last two decades, consistent with stronger terms of trade gains and higher productivity growth.

3.4 Chile

3.4.1 The policy choice

Prior to adopting the free float in September 1999, Chile's policy choice was a combination of inflation targeting, management of the exchange rate within a band, and a range of structural and episodically-applied capital controls.¹⁹ An export-focused strategy for growth and development included an explicit objective of maintaining a weak real exchange rate.

In September 1999, Chile formally adopted an inflation targeting regime. Chile's current inflation target is 3 plus or minus 1 percent CPI inflation.²⁰

Chile has controls in 8 of the 13 AREAER categories, and scores 1.66 on the Chinn-Ito index – between Australia at 1.13 and New Zealand at 2.46. In the 2011 AREAER, Chile reports controls in the following areas.

- *Capital market securities:*
 - affected by laws on FDI;
 - limits on purchases of foreign securities by insurance companies, pensions funds and social security funds;
 - sale or issue by non-residents in the local market limited to USD and EUR and, with permission of the central bank, pesos.
- *Money market instruments:*
 - sale or issue by non-residents in the local market limited to USD and EUR and, with permission of the central bank, pesos.
- *Collective investment securities:*
 - money market instruments: Sale or issue by non-residents in the local market limited to USD and EUR and, with permission of the central bank, pesos.
- *Derivatives and other instruments:*
 - sale or issue by non-residents in the local market limited to USD and EUR and, with permission of the central bank, pesos;
 - operations in financial derivatives subject to central bank rules.
- *Direct investment:*
 - incorporation requirements for registration of shipping vessels and establishment of non-bank, non-insurance financial companies and auditing of financial institutions;
 - limits on foreign ownership in the transport sector and broadcasting.
- *Real estate transactions:*
 - ownership by nationals of bordering countries in border areas.
- *Provisions specific to commercial banks and other credit institutions:*

¹⁹ Indeed, Chile has over the past few decades experienced a wide range of choices in the menu of options for exchange rate policies, with the sole exception of giving up a national currency altogether (similarly to New Zealand's experience in the decades leading up to the adoption of a floating exchange rate and inflation targeting – see Sullivan (2013).

²⁰ Schmidt-Hebbel and Tapia (2002) review Chile's inflation targeting experience. For more on the overall macroeconomic policy framework, see De Gregorio (2011) and De Gregorio and Labbé (2011).

- limits on banks' foreign currency operations;
- short term external borrowing subject to a 3.6 percent reserve requirement;
- limits on banks' foreign accounts;
- lending to nonresidents subject to prudential requirements.
- Basel Committee on Banking Supervision limits on interest rate risk and currency risk for foreign currency lending;
- foreign currency deposits limited to USD;
- ceilings on loans rates related to average markets rates;
- limits on purchases of foreign securities by insurance companies, pensions funds and social security funds.

Foreign currency reserves fluctuated around or just below 20 percent of GDP from the early 1990s until the early 2000s, before gradually easing to about 10 percent of GDP just prior to the GFC and climbing again in 2007 and 2008 (Figure 3).

3.4.2 The economy and the exchange rate regime

Chile is a small OECD economy highly dependent on volatile commodity (copper) income. Its financial sector is one of the deepest and most sound in Latin America. Exports of value added at 34 percent of GDP and imports at 27 percent of GDP are a bit higher than New Zealand's.

Morandé and Tapia (2002, p1) describe the pre-1999 experience as a 'quest for a reasonable exchange rate policy' in the face of global economic volatility, large domestic business cycles, imperfections in various product markets, a developing financial system, and at-times substantial capital inflows and political economy pressures.

Chile introduced a range of capital controls, including an unremunerated reserve requirement (URR) on borrowers of foreign credit in June 1991 because of concern about an appreciating exchange rate and loss of monetary control, following a period of very strong capital inflows (De Gregorio, Edwards and Valdes, 2000). The URR was subsequently widened and strengthened to address avoidance and continued pressure.²¹ In 1998, during the general flight from emerging markets following the Asian crisis and strong downward pressure on the peso, the URR was dropped to zero in two steps.

Evidence is mixed about how the URR affected interest rates, the real exchange rate and aggregate capital inflows. De Gregorio et al (2000) found that detectable effects were generally short-term and small, but found some evidence of a more persistent and substantial effect in shifting inflows towards longer-maturity claims. Edwards and Rigobon (2009), accounting econometrically for the co-existence of the URR with exchange rate target band arrangements, found larger depreciation effects on the exchange rate from capital controls, a reduction in the

²¹ The URR was a requirement that borrowers of certain types of foreign credit deposit 20 percent of the value of the credit with the central bank in a non-interest bearing account, for between 90 days and one year depending on the maturity of the credit. De Gregorio et al (2000) show a chronology of key changes to the URR regime, and the effective tax on foreign borrowing represented by the URR. Another type of capital account restriction, a minimum holding period for foreign institutional investors in Chilean capital markets was also in force in the early 1990s.

sensitivity of the exchange rate to external shocks, but an increase in exchange rate volatility. Almost all the literature suggests the URR imposed costs in the forms of avoidance activity and a distorted cost of capital, the latter particularly problematic for smaller firms without access to international capital markets or preferential lending (Forbes, 2007).

Within its core macroeconomic framework, Chile considered exchange rate appreciation pressure in 2011 sufficiently extraordinary to intervene in the foreign exchange market. This was referred to as a 'reserve hoarding program' which took the form of an announced intention to accumulate (in a sterilised way) reserves to strengthen the international liquidity position and preserve policy capacity (de Gregorio, 2011). Notably, the authorities sought to dampen expectations of the effect the intervention would have on the exchange rate (Reuters, 2011), emphasising that the programme was intended not only to 'reduce exchange rate tensions, but also to strengthen our international liquidity position' against external financial shocks (de Gregorio, 2011).

3.4.3 The trade-offs

Chile's choice of trilemma position has not obviously insulated the economy from external volatility any more than New Zealand's or Australia's similar choices. Nonetheless, in the face of recent appreciation pressure Chile has not chosen to use capital controls to allow exchange rate management and domestically-focused monetary policy as was used in the 1990s. This illustrates the international experience that such controls become less effective as countries become more financially developed.

Rather than being because of capital controls, Cowan and De Gregorio (2005) suggest Chile's relative resilience during the crisis of the late 1990s was because of sound banking regulation and a relative absence of currency risk on banks' balance sheets. They conclude that even in the 1990s the URR played at best a small role in affecting the size and maturity of Chile's external borrowing. They find little evidence that the URR significantly affected total capital flows or the exchange rate. During the 1990s, most borrowing was done by non-financial corporations, an unusual pattern compared with other countries. One explanation might be that non-financial corporations found it easier to avoid paying the URR.

3.5 China

3.5.1 The policy choice

Monetary policy in China aims to maintain the stability of the currency's value, and through that stability to promote economic growth. Policy is implemented through targets for monetary aggregates.²²

China describes its exchange rate regime since 2005 as a '...managed floating regime based on market demand and supply with reference to a basket of currencies...' (Hu, 2010). In the

²² While inflation targets are announced at the start of each year for the coming year, these have tended to move in line with experienced inflation (OECD, 2011). They do not represent an 'inflation target' in the sense used in many other countries in our sample.

AREAER, the IMF classifies the exchange rate regime as a 'crawl-like arrangement'. In practice, the currency appears to move more steadily against the USD than does the effective exchange rate (i.e. a rate against a basket of countries – see, for example, Cavoli and Rajan, 2009). The flexibility allowed has varied over time by permitting a wider or narrower range within which market forces can move the exchange rate around a central parity rate (see, for example, OECD, 2012). Foreign currency reserves rose from around 10 percent of GDP in the mid-1990s to 20 percent in 2002 and have been between 40 and 50 percent of GDP since 2007 (accumulation in the order of USD 3 trillion in nominal terms).

China has controls on capital transactions in 12 of the AREAER's 13 categories. The Chinn-Ito index suggests China has the highest degree of capital controls of the countries in our sample. Daily RMB turnover in 2010 was very low compared with other countries discussed here: less than 1 percent of GDP.

3.5.2 The economy and the exchange rate regime

China is a fast-growing, developing economy, for which the export sector has been an important source of growth. Merchandise exports made up about 20 percent of GDP in 1998, and had grown to about 35 percent in the years before the GFC.

People's Bank of China Deputy Governor Hu (2010) talks about the place of the exchange rate regime in the wider macroeconomic objectives, saying a managed float is a choice that facilitates economic restructuring and balanced and sustainable development. As part of that restructuring, there has been a deliberate policy of gradual financial liberalisation and opening.

As financial markets develop and participants improve risk management, the announced intention is to widen the band within which the exchange rate can move flexibly in response to the market, in a '...a self-initiated, controllable, and gradual process... and keep the exchange rate basically stable at an adaptive and equilibrium level' (People's Bank of China, 2012). Consistent with that, offshore trading in RMB has been allowed in Hong Kong, and increased use of the currency has been allowed in settlement of trade transactions (International Monetary Fund, 2012c).

After moving to the current exchange rate regime in 2005, in July 2008 China narrowed the floating range – within which the exchange rate is allowed to fluctuate around a central parity rate – to address domestic weakness and deflationary pressure in the face of the GFC (Hu, 2010). In 2010, China began restoring the pre-crisis flexibility by widening the allowable range of variation, and resuming an appreciation of the nominal exchange rate path, consistent with China's higher productivity growth.

3.5.3 The trade-offs

The closed capital account and large reserves portfolio compared with turnover in the currency allow China to manage the exchange rate within quite narrow bands, while still using monetary policy for domestic objectives. For countries like New Zealand with much higher ratio of turnover to reserves, the ability to influence the currency significantly is likely to be much lower. While

China's foreign reserves amount to just over 40 percent of GDP, in 2010 average daily RMB turnover was about 1 percent of foreign exchange reserves, compared with 25 and 35 percent for the Singapore and Hong Kong dollars respectively, 117 percent for the Swiss franc, and 920 percent for the New Zealand dollar.

The foreign reserves pool both aids (because it is large relative to foreign exchange turnover) and results from managing the exchange rate. Holding a large pool of reserves is also a source of financial risk. Diversification of the reserve pool, as a means of limiting risk, is difficult for China because the absolute size of the pool means large reallocation could affect the price received for assets sold (OECD, 2011).

The fiscal cost of funding foreign exchange reserves can be significant because of the difference between domestic interest rates (the borrowing cost) and foreign (the return on invested reserves).²³ Before the GFC, Chinese short term interest rates were low relative equivalent US and European rates, so China would have benefited. Since 2009, Chinese rates have risen relative to extremely low rates in major advanced economies: at the start of 2013 Chinese 3-month interbank rates were more than 3.5 percentage points higher.²⁴ (Likewise, New Zealand's interest rates have generally been quite high relative to those of reserve currencies).

Capital account opening and financial development improve access to, pricing of, and allocation of finance. However, as China moves towards a more-open capital account and more-internationalised currency, as we see in New Zealand and other very-open economies, arbitrage pressure will come to bear more heavily on the trade-off between monetary policy control and exchange rate stability. For China, control over one or both of the exchange rate control and domestic monetary policy can be expected to weaken. As the OECD (2011) puts it,

...the authorities would have to choose between a quasi-fixed exchange rate and retaining sovereignty over monetary policy. If the renminbi was fully internationalised, then maintaining a fixed exchange rate against the US dollar, or even a managed peg, would require following the monetary policy of the United States. A small flexible economy, such as Hong Kong, China is able to maintain such a regime, at the cost of large changes in prices from time to time. For a large economy (such as China) with an internationalised currency, and a business cycle that is not synchronised with that of the United States, a fixed exchange rate is unlikely to be optimal for jobs or inflation.

In the meantime, the cost and risk involved in changing regimes is reflected in the authorities' preference for gradual financial liberalisation and capital account opening.

²³ Bordo, Humpage and Schwartz (2012) suggest that China sterilised 41 percent of its reserve accumulation from 2004 to 2009. Even so, the money base grew sharply.

²⁴ With the stock of foreign currency liquidity above 40 percent of GDP, the cost of the interest differential might amount to something around 1.5 percent of GDP per year at present.

3.6 Denmark

3.6.1 *The policy choice*

Denmark's monetary and exchange rate policy aim to keep the krone stable against the euro. A desired outcome is to keep prices stable. The IMF classifies the regime as a 'conventional peg' of the Danish krone to the euro under ERM II (the European Exchange Rate Mechanism). The par rate is 746.038 krone per 100 euro, with the rate allowed to move within a band 2.25 percent above or below par. The DN suggests the narrow bands are possible because of a relatively high degree of economic convergence with the euro area.²⁵ Danish participation in the euro was rejected by a referendum in September 2000.

The main policy instruments for maintaining the peg are interest rates and foreign exchange intervention. Under normal conditions, the Danmarks Nationalbank (DN) adjusts interest rates in line with the European Central Bank's rates. When there is upward or downward pressure on the currency, the DN adjusts rates separately.

Foreign reserves are around quarter of GDP, up from around 11 percent before the GFC. The sharpest climb was in 2009 when reserves rose by about 10 percent of GDP. Daily foreign exchange market turnover in 2010 was about 7 percent of GDP – slightly higher than Korea's, lower than Japan's, and about one-sixth of New Zealand's ratio.

Denmark reports controls in two of the 13 capital transaction categories in the 2011 AREAER, notably the following.

- *Direct investment:*
 - limits on (1) non-EU ownership in Danish flag vessels, except through an enterprise incorporated in Denmark; (2) commercial fishing; (3) airlines established in Denmark, (4) accounting services and legal services; and (5) collective investment schemes under EU directives.
- *Institutional investors:*
 - limits (maximum) on insurance companies' foreign currency assets.

Similarly, the Chinn-Ito index suggests Denmark is very open, with a score of 2.46.

3.6.2 *The economy and the exchange rate regime*

Value added in Denmark's exports amounts to about 28 percent of GDP and in imports around 24 percent. In gross terms, those numbers are around 51 and 47 percent of GDP. About 35 percent of the country's exports go to the euro area.

Since the GFC, inflows of capital have at various times put pressure on the exchange rate. The DN has needed to lower official interest rates as European official rates have fallen, and to

²⁵ The par rate is a conversion of the previous rate against the Deutsche Mark (DEM), and was last adjusted (against the DEM) in 1987. A fixed rate has been in place since 1982. The standard band around par under ERM II is 15 percent. See, for example, commentary on the DN's website: http://www.nationalbanken.dk/DNUK/MonetaryPolicy.nsf/side/Exchange_Rate_Mechanism_ERM_III!OpenDocument

intervene in foreign exchange markets to maintain the peg. The latest such episode has been from late 2011 with safe haven inflows to Denmark reflecting nervousness about sovereign debt positions in parts of the euro area (see Jørgensen and Risbjerg, 2012, Risbjerg 2012, and International Monetary Fund 2013 for accounts of events).²⁶

The DN intervened in foreign exchange markets from August 2011, and lowered official interest rates in a series of cuts from mid-2012. By the end of that series of cuts in July 2012, 'current account' balances held by banks at the DN were paid zero percent interest and one of the other official rates – the certificate of deposit (CD) rate paid on reserve balances above an upper limit on 'current account' balances – was cut to -0.2 percent. Together with ECB actions that eased concerns about the euro area situation, these actions meant the peg was maintained.

3.6.3 The trade-offs

The peg provides exchange rate stability with a major trading partner. Convergence and integration with the euro area mean the exchange rate with other currencies will relatively often be appropriate to Denmark's economic conditions; and that ECB monetary policy will also be tend to be relatively appropriate to Denmark's economy under more-normal conditions, helping keep inflation low and stable.²⁷

Nonetheless, there have been periods in which the Danish real effective exchange rate has deviated considerably from the equivalent euro area rate, reflecting the difference between Denmark's and the wider euro zone's trade exposure to other countries. This was notable through the early 2000s (figure 10). Further, the DN notes fiscal and other economic policies must support the peg for the peg to succeed, which at times could constrain those policies.²⁸

Denmark's competitiveness has fallen against other European countries over the last couple of decades: the country's share of global exports has been falling since the 1990s, and, more recently, unit labour costs having picked up since 2005 (before dropping with the GFC and climbing again thereafter). Behind rising unit labour costs is a combination of rising wages and weak labour productivity growth. A high aggregate price level relative to countries elsewhere in Europe harms competitiveness when combined with a pegged exchange rate (International Monetary Fund, 2013).

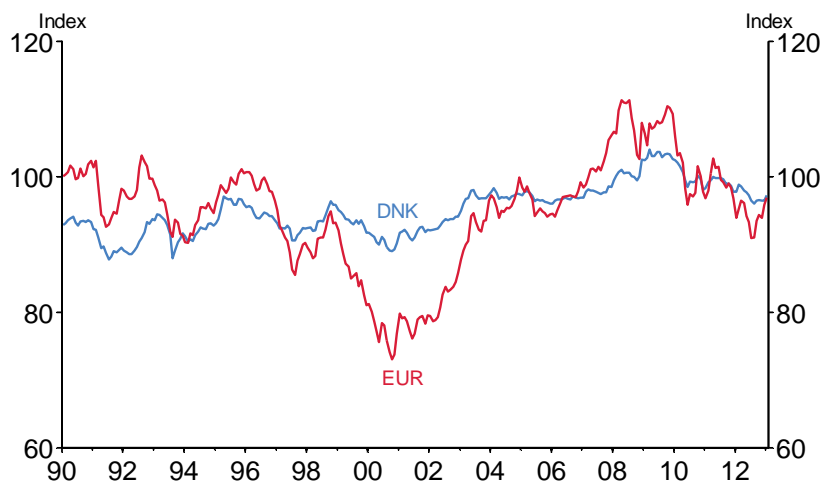
Table 1 shows that holding foreign reserves has cheap for Denmark. The peg means exchange rate risk is limited, so long as the peg can be maintained in the face of pressure. The peg, economic integration and Denmark's high credit rating mean Danish interest rates move similarly and at similar levels to euro area rates, so the interest differential has not posed a significant cost.

²⁶ The IMF attributes the flows to Denmark's AAA rating, longstanding current account surplus, low government debt, and the fact that a pegged exchange rate reduced downside currency risk. The long period of current account surpluses, in spite of falling competitiveness, reflects strong net income resulting from a high net international investment position (International Monetary Fund, 2013b).

²⁷ In its 2012 Article IV Consultation, the IMF took the view that the peg has served Denmark well in anchoring inflation and minimising exchange rate volatility with major trading partners (International Monetary Fund, 2012j).

²⁸ http://www.nationalbanken.dk/DNUK/Tasks.nsf/side/Distribution_of_responsibilities!OpenDocument

Figure 10 – Real effective exchange rates for Danish krone and euro
Index 2010 = 100



Source: Bank for International Settlements

Further, Denmark has been able to manage its exchange rate peg with relatively low reserves, in spite of an open capital account. This likely reflects close economic integration with the euro area, so that the Danish krone might often (though not always, as suggested by figure 10) move broadly similarly to the euro even without the peg; but more importantly it reflects the fact that under normal circumstances the DN has been able to move interest rates closely in step with euro zone rates.

In periods of international financial stress, the certainty provided by the peg likely encourages capital inflows: the fixed exchange rate removes downside exchange rate risk for investors wanting to hold DKK-denominated investments. The capital inflows and exchange rate pressure, and the need for both interest rate cuts and foreign exchange intervention in response, suggest the trilemma remains important for Denmark.

As noted above, Denmark benefits from exchange rate stability with a major partner; and relatively high convergence reduces the costs to Denmark of giving up monetary policy discretion and exchange rate flexibility. For New Zealand, section 3.2 discussed work on the macroeconomic effects of adopting an Australian or US dollar and monetary policy.

The recent experience of peripheral economies in the euro zone indicates that convergence is important to whether joining a currency union is beneficial. When there remain significant differences in business cycles and competitiveness within a currency union, the fixed exchange rate (with others in the union) and adoption of union monetary policy mean other variables must adjust to changes in the environment. In those countries, and in Hong Kong (below), adjustment to changing conditions can be forced into painful adjustment of domestic wages and prices. In peripheral euro zone economies, the difficulty of adjusting in that way – and consequent

divergences in competitiveness within the region – has become increasingly visible in recent years.

3.7 Hong Kong

3.7.1 The policy choice

The Hong Kong dollar is officially linked to the US dollar under the Linked Exchange Rate system (a currency board). Hong Kong has a relatively open financial account, reporting financial account restrictions in only one of 13 categories in the IMF's AREAER.

- *Derivatives and other instruments:*
 - Hong Kong Exchanges and Clearing, Ltd. (which oversees the Stock Exchange of Hong Kong, the Hong Kong Futures Exchange, and the associated clearinghouses) sets disclosure and position limits on derivative contracts for risk management reasons.

Hong Kong scores 2.46 on the Chinn-Ito index, part of the most-open group in this section with New Zealand, Switzerland, Japan and others.

Consistent with an open financial account and a fixed exchange rate, the monetary policy objective is formally specified by the Financial Secretary as maintaining the currency board (external price stability), implying that Hong Kong's interest rates are determined largely by US monetary policy.²⁹

Hong Kong's regime differs from a pure fixed exchange rate/open financial account in at least three respects:

- A band around the USD peg (7.75-7.85 HKD/USD) allows some variation in the value of the HKD relative to the USD peg.
- The Linked Exchange Rate System differs from a pure currency board in that not all components of the monetary base are freely interchangeable. That deviation implies some scope for discretionary monetary policy, but the IMF Article IV for 2000 judged the deviations to be small in practice (International Monetary Fund, 2001).
- The Hong Kong stock and futures exchanges and associated clearing houses impose disclosure and position limits on derivative products. Hang Seng Index (HSI) and Hang Seng China Enterprises Index (HSCEI) futures and options contracts are restricted to a combined delta limit of 10,000 and 12,000 contracts.

3.7.2 The economy and the exchange rate regime

According to the Hong Kong Monetary Authority (HKMA), the currency board plays an important part in supporting Hong Kong's role as a trading, service and financial centre. The transparent rule-based currency board is predictable and credible.

²⁹ Letter to the Hong Kong Monetary Authority dated 25 June 2003. This and other references to the HKMA can be found at the HKMA's website information page: http://www.hkma.gov.hk/eng/classroom/page/work/work_02_01.htm

The HKMA takes the position that the currency board makes the Hong Kong economy less vulnerable to external shocks. An important difference between Hong Kong and New Zealand is the degree of trade penetration. In New Zealand, gross imports and exports are each about 30-35 percent of GDP. In Hong Kong, gross imports and exports are each about 180 percent of GDP and include a high re-export share (data are not available for Hong Kong on the value added in trade series of figure 8). The fixed exchange rate in Hong Kong ensures that the value of trade and financial services are fairly stable in local currency terms and are not vulnerable to exchange rate valuation effects. In New Zealand exchange rate exposure is hedged, to some degree, through use of financial contracts.

In Hong Kong, the benefits of nominal exchange rate stability come at the cost of higher domestic price and wage variability when conditions in Hong Kong vary from those in major trading partners or when US monetary policy does not fit the needs of the local economy. The Asian Crisis (1997-98), SARS (2002) and the GFC are recent examples. When US monetary policy is too stimulatory for the local economy, rising prices appreciate the HK dollar in real terms, undermining competitiveness, and rising asset prices may lead to financial stability concerns. When the Hong Kong economy is weak, real depreciation to restore competitiveness must be achieved through falling prices, wages and rents, which can be very difficult to implement.

During the Asian Crisis, adjustment in many Asian countries occurred through exchange rate depreciation. In Hong Kong, the fixed exchange rate was maintained, despite several speculative attacks. With a fixed exchange rate, post-Asian Crisis adjustment to maintain competitiveness occurred mainly through factor price adjustment: several years of CPI deflation, falling wage growth, including a period of negative nominal wage inflation in 1999-2000, declines in rents and a fall in property prices of more than 60 percent from the 1997 peak. From 1997 to 2000, wages for new employees were reduced by more than 20 percent (Wong, Ip-Wing and Fung, 2001), and there was a series of cuts in public sector wages and employment. Those adjustments were extraordinarily difficult to implement and maintain in the face of political and labour opposition, but there was no other way for Hong Kong to maintain competitiveness, with a fixed exchange rate.

As noted in the IMF's 2012 Article IV report, Hong Kong's exchange rate regime requires flexible factor and product markets (flexible wages, prices and rents), and strong prudential policy to manage the effects of asset price volatility (International Monetary Fund, 2013).

3.7.3 The trade-offs

Hong Kong's experience illustrates the trade-offs between a floating and fixed exchange rate regime in response to shocks.

In exchange for relative exchange rate stability, Hong Kong's adjustment to shocks requires greater adjustment to domestic factor costs and involves considerable intervention in foreign currency markets. The fixed exchange rate regime makes the traded-goods sector in Hong Kong less vulnerable to external shocks, but increases the vulnerability of the non-traded

sectors to price adjustments in response to large shocks. Downward adjustments to prices and wages can be very painful.

When US monetary policy is too tight for Hong Kong's economy (e.g. during the aftermath of the Asian Crisis), the strong dollar undermines competitiveness and downward adjustment to prices and wages has at times been very painful. When US monetary policy has been too easy for Hong Kong's economy (e.g. during the aftermath of the GFC), Hong Kong has experienced strong asset price appreciation and has needed to purchase large amounts of foreign currency to preserve the exchange rate peg. The greater asset price volatility has required robust prudential regulation.

Under a flexible exchange rate system, competitiveness can be restored through nominal devaluation which tends to be less painful to implement than downward adjustments to prices and wages. Agents in a floating rate regime are exposed to exchange rate volatility; short term fluctuations can be managed to some extent through financial hedging.³⁰ Managing wage income and price and rent variability is perhaps best achieved through a buffer stock of wealth.

The currency board is seen to have served Hong Kong well in providing price certainty for key service industries. From a theoretical perspective, it is unlikely that there is a free lunch in choosing one regime over another. The relative success of Hong Kong also reflects strong productivity growth, location advantages (proximity to China and major trade routes), and conservative fiscal and conservative prudential policies.³¹ To the extent that the monetary/exchange rate regime has supported that success, it also reflects a willingness to undertake difficult domestic wage and price adjustment to address competitive pressures.

3.8 Japan

3.8.1 The policy choice

The Bank of Japan conducts monetary policy with the aim of maintaining price stability, so as to contribute to sound development of the national economy. The regime is not formally inflation targeting, but since 2006 the Policy Board of the Bank of Japan has identified a rate of CPI inflation that it understands as price stability. In February 2012 the Policy Board started referring to the 'price stability goal', and in January 2013 the 'price stability target' to emphasise the focus on avoiding deflation (Bank of Japan, 2012).

The AREAER classifies Japan's de facto exchange rate regime as free floating. Foreign currency reserves have been around 20 percent of GDP since 2005, after climbing from their mid-1990s level of 2-3 percent of GDP. Official data indicate intervention through the 1990s and up to March 2004, and then a pause before a period of intervention from late-2010 to late-2011. In 2010, average daily turnover in Japanese yen was under 15 percent of GDP – around the

³⁰ See Briggs (2004) on hedging by New Zealand firms.

³¹ To the extent that prudential policies discourage capital inflows, they may have a similar effect to a capital control. See Fahri and Werning (2012) on why capital controls may be desirable from a theoretical perspective in the presence of sticky prices.

same as Canada; about half of the figures for Australia and Singapore; and less than one third of the ratios in Switzerland, New Zealand and Hong Kong.

In Japan, foreign exchange market policy is carried out via intervention that is, in effect, automatically sterilised. That means intervention's effects on the economy and the exchange rate's value also depend on whether the Bank of Japan responds by increasing the money supply at the same time as intervention is taking place, so allowing the intervention to depress interest rates (e.g. Fatum and Hutchison, 2005).

On the AREAER, Japan reports having capital controls in eight of the 13 recorded categories.

- Limits on insurance companies' foreign currency exposure (which are counted under six of the 13 AREAER categories).
- *Direct investment:*
 - Outward: prior notification required for investment in some industries (fisheries, leather, weapons and narcotics).
 - Inward: Prior notification required for investment in aircraft, nuclear, weaponry (for national security); utilities, communications, media (for public order); biological and security (for public safety); primary industries. Limits of foreign investment in Nippon Telegraph and Telephone, broadcasting, civil aeronautics.
- *Institutional investors:*
 - limits (maximum) on insurance companies' foreign currency assets.

On the Chinn-Ito index Japan scores 2.46, appearing considerably more open than that count of AREAER categories would suggest. That score is the same as New Zealand, the US and UK, and more open than Chile, Australia, Korea and China.

3.8.2 The economy and the exchange rate regime

Compared with the other countries in our group, Japan's trade share in GDP is low: value added in exports and imports are about 12 and 11 percent of GDP. Gross export and import ratios are slightly higher.

The overnight rate fell to virtually zero in early 1999, and inflation has been negative since 1998, and Ueda (2012) describes Japan as having been in a liquidity trap since 1999. A zero-interest rate policy – with a commitment to keep interest rates near zero until deflationary concerns were dispelled – was introduced in April 1999, at various times supported by a commitment to forms of quantitative easing and to keeping the measures in place for as long as deflation continued.

The intervention during this period can be seen as part of the collection of quantitative easing actions. Ito (2005) discusses intervention in Japan from 1995 to 2004. He argues that in 2001-2002 intervention aimed to signal that the yen was overvalued. In 2003, up to September, the aim was to prevent appreciation that could have derailed the recovery. When the recovery started to look likely in September, intervention paused. It resumed thereafter for a different reason: to counter pressure from speculative long positions that anticipated the end of

intervention in the face of international pressure (Ito 2005). Despite the very large size of the intervention after September 2003, it is seen to have been less effective than previous episodes of intervention (Fatum and Hutchison, 2005)

In October 2010, the Bank of Japan introduced 'comprehensive monetary easing': keeping the policy interest rate at 0 to 0.1 percent; committing to a near-zero interest rate until price stability is in sight; and establishing the 'Asset Purchase Program' to lower the cost of longer-term funds. Intervention between September 2010 and November 2011 was part of the unconventional monetary easing and provision of liquidity to markets (e.g. Bank of Japan, 2010).

When the Bank of Japan announced the price stability 'target' in January 2013, it also announced an open-ended asset purchase programme, describing it as 'aggressive monetary easing' in combination with continuation of near-zero interest rates (Bank of Japan, 2013). The stated aim of the programme was to provide stimulatory financial conditions to stimulate aggregate demand to avoid deflation.

The BIS's nominal effective exchange indices show that in 2011 the yen was at its highest point since the start of the series (1964), and it remained around that level until the last quarter of 2012. However, the real exchange rate was in fact around the post-1990 average, reflecting Japan's long period of deflation while prices in trading partner economies generally rose.

3.8.3 The trade-offs

The post-GFC episode of large-scale unconventional monetary easing is consistent with a weak outlook for inflation and the output gap. Bordo, Humpage and Schwartz (2012) argue that most Japanese foreign exchange intervention since 1991 has been consistent with the stance of monetary policy. It has involved purchases of foreign currency during periods of weak growth, deflation and with policy interest rates near the zero bound.

IMF staff in the 2012 Article IV Consultation suggested further monetary easing was necessary. They noted that doing so by expanding the Asset Purchase Program could have benefits of both raising inflation expectations and helping depreciate the exchange rate 'which would be important channels given the current low interest rate environment' (International Monetary Fund, 2012e, pp17-18).

When intervention has leaned against foreign exchange market pressure, as in late-2003 to early-2004, intervention appears to have done little to affect the exchange rate.

The relatively small pool of foreign currency reserves relative to foreign exchange market turnover suggests that Japan would find it hard to influence the exchange rate materially for a sustained period, perhaps unless intervention were consistent with the direction in which monetary policy was already trying to move. The interest cost of funding reserves for Japan has been low relative to others in our group, so that accumulating more foreign currency reserves would have been relatively cheap. That said, the exchange rate risk on a large reserves portfolio might have been a factor in the decision not to do so.

For an inflation targeting economy like New Zealand that has interest rates above zero, unsterilized intervention would have implications for control of the monetary policy interest rate. New Zealand has typically not been in a situation in which monetary policy's stance and foreign exchange intervention would be mutually reinforcing. When the exchange rate has been high, the economy has generally been strong. Further, the cost of funding reserves for New Zealand would likely be higher than for Japan, because of relatively high interest rates in New Zealand.

3.9 Korea

3.9.1 *The policy choice*

Monetary policy's primary objective in Korea is price stability, which takes the form of a medium term CPI inflation target. For 2013 to the end of 2015, the target is 2.5 to 3.5 percent. The main policy instrument is a short term interest rate.

Korea's exchange rate is largely market determined. The IMF's AREAER classifies the exchange rate as 'floating', but not 'free floating' (International Monetary Fund, 2012i). While the Bank of Korea does not have a target rate or band, it can and from time-to-time does intervene to smooth large fluctuations. Korea has a portfolio of foreign reserves equal to about 28 percent of nominal GDP.³² While relatively large for an economy with a floating exchange rate, that pool is small compared with countries like Singapore, Hong Kong and Switzerland (Figure 3). Turnover in the Korean Won is also small as a share of GDP compared with those countries (Figure 4).

Because there is not a target exchange rate level, monetary policy has been able to pursue the inflation target, including dropping interest rates sharply in 2008-09.

Korea has been increasingly open since the Asian Crisis to (initially) inward and (subsequently) outward capital flows, in a range of instruments.³³ While Korea has capital controls in only 3 of the 13 AREAER categories, on the Chinn-Ito index for 2010 Korea scores 0.69. The latter makes it more open than China, but less open than other countries in our sample. In 2011, Korea had controls in the following AREAER categories.

- *Derivatives and other instruments:*
 - OTC derivatives transactions must be made through domestic foreign exchange banks, or have Bank of Korea (BOK) approval. Limits on banks' foreign exchange derivatives contracts to 40 percent of capital (domestic banks) and 200 percent of capital (foreign bank branches). [Note that Korean FX turnover is low relative to GDP, particularly in the FX swap segment which is normally the largest market segment.]

³² In December 1997, after the Asian Crisis, Korea ended the use of daily fluctuation limits for the interbank exchange rate.

³³ Kim, Kim and Suh (2009) provide a detailed background of capital account liberalisation in Korea since the Asian Crisis.

- *Direct investment:*
 - Outward: investment by financial institutions and insurance companies requires FSC notification and approval. Residents must notify a designated foreign exchange bank.
 - Inward: limits on foreign ownership (typically 49 percent) apply to primary sectors, financial institutions, the transport sector, communications/media, and residential public sector utilities.
- *Provisions specific to commercial banks and credit institutions:*
 - Lending to non-residents in Korean won of more than KRW30 billion (USD28 million) requires BOK notification.
 - Foreign currency loans to residents limited to funding overseas transactions and investment, except small and medium local manufacturers.
 - Investment by local foreign exchange agencies in locally issued foreign currency securities restricted.
 - Reserve requirements and differential liquid asset requirements on foreign currency deposits.
 - Limits on net open positions of foreign exchange banks.
- *Institutional investors:*
 - Liquid asset requirements on financial institutions' foreign currency holdings.

3.9.2 The economy and the exchange rate regime

Trade is important to Korea's economy: gross exports and imports are just under 50 percent of GDP, while in value added terms they are closer to 25 percent of GDP.

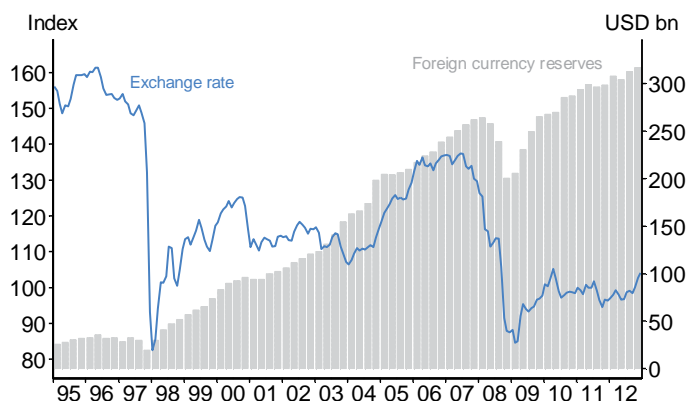
During the Asian Crisis, currency mismatch was a problem for Korean banks (as for other Asian countries). During the GFC, there was no currency mismatch, per se, but there was maturity mismatch on the banks' foreign currency books. Part of that exposure was related to large export industries such as shipbuilding that had long-gestation investment funded by short-term borrowing.

When the GFC hit, banks lost the ability to roll over their US dollar funding, an event the IMF describes as a sudden stop. The Bank of Korea provided about USD 65 billion in reserves to cushion the US dollar liquidity squeeze and made use of the US Federal Reserve's US dollar swap lines, but credit growth and economic activity still slowed sharply (International Monetary Fund, 2012g) and the exchange rate depreciated sharply (figure 11).

Periods of heightened exchange rate and capital flow volatility since the GFC have been a source of risk. Capital flow liberalisation and a floating exchange rate led to deeper and more-liquid foreign exchange markets and greater access to foreign-sourced funding. Greater access to hedging products means that firms have more capacity to absorb spot exchange rate movements than in the past, reducing the premium on exchange rate stability. That allows monetary policy to target inflation. Nonetheless, the availability of hedging tools for exchange rate risk remains limited: non-residents are not allowed to issue Korean won bonds, so there is no hedging counterparty equivalent to that provided in New Zealand dollars through issuance of

eurokiwi and uridashi bonds. In that environment, increased use of short-term foreign currency denominated funding meant greater exposure to exchange rate and capital flow volatility (International Monetary Fund, 2012h).

Figure 11 – Korean foreign reserves and nominal effective exchange rate*



Source: Bank of Korea and Bank for International Settlements

* The effective exchange rate measure is that for the BIS's narrow basket.

The policy response has included a collection of macroprudential measures since 2010.³⁴ Their direct focus is vulnerability of balance sheets to exchange rate movements and changes in capital flows. At the same time, the measures quite-directly target foreign-currency-denominated exposures. The new policies appear to have affected portfolio choices and reduced the sensitivity of the exchange rate and capital flows to external conditions and risk appetite (International Monetary Fund, 2012h).³⁵

3.9.3 The trade-offs

Market development and greater financial openness have likely reduced the effectiveness of capital flow measures. That, combined with arbitrage pressure, means managing the exchange rate has likely become more difficult if domestic monetary policy is to be maintained.³⁶ Kim, Kim and Suh (2009) and the International Monetary Fund (2012h) note that arbitrage in financial markets make it difficult for monetary policy to lean against a build-up of short-term foreign

³⁴ The measures include caps on banks' ratios of domestic currency-denominated loans to deposits and their foreign exchange derivative positions; a withholding tax on interest payments on foreigners' bond investments; a levy on banks' non-deposit foreign currency liabilities, with the levy rate higher for shorter maturity liabilities; and stopping financial companies from obtaining kimchi bonds (foreign currency bonds issued in the Korean local market) if the issuer intends to swap the proceeds into Korean won.

³⁵ The International Monetary Fund (2012a, 2012g and 2012h) suggests the measures have been reasonably effective at improving the maturity profiles of banks' foreign-currency-denominated funding and shifting the composition of foreigners' holdings of domestic bonds (overall holdings have fallen, while the maturity of such investments has lengthened).

³⁶ The IMF's 2012 Article IV report on Korea notes that the volatility of capital flows has led to swings in the exchange rate even with intervention, citing as an example a surge in capital outflows in the third quarter 2011 after a fall in global risk appetite. There was a net outflow of around USD 15 billion, and in spite of intervention which lowered foreign reserves by about USD 8 billion, the exchange rate depreciated by 10 percent. Note also the period around the Global Financial Crisis in figure 11, when foreign currency reserves were run down substantially, but the nominal exchange rate still depreciated sharply.

currency liabilities when Korean banks' non-core borrowing seems driven more by US interest rates (the relative cost of offshore funding) than the domestic policy rate.

This experience supports the observation – relevant to New Zealand – that with an open capital account and developed financial markets, it becomes harder and more complex to try to manage both the exchange rate and domestic interest rates. Market forces can be strong, and intervention can be expected to have limited effect when relative interest rates, relative returns in the wider economy and swings in international risk appetite drive large capital flows. Prudential tools can help address the risk from currency mismatch on private balance sheets, and, to some extent, are addressing a risk that stems from limited availability of hedging because of regulation (which is less of a problem for New Zealand).

3.10 Singapore

3.10.1 *The policy choice*

Singapore's monetary policy regime is characterised by a managed exchange rate and a relatively open financial account. In the IMF AREAER, Singapore reports financial account restrictions in three areas (financial credits; provisions specific to commercial banks and other financial institutions; and controls on real estate investment).³⁷

Singapore

- *Financial credits:*
 - Non-resident financial institutions must convert Singapore dollar proceeds (exceeding SGD 5 million) to foreign currency before using such funds to finance activities outside Singapore.
- *Real estate transactions:*
 - Restrictions apply to non-resident investment in landed property and public housing.
- *Provisions specific to commercial banks and other credit institutions:*
 - Reserve requirements on foreign currency deposits (except via Asian Clearing Union banks),
 - Restrictions on loans, contingent credit lines and swaps involving a spot sale of SGD to non-resident financial institutions
 - Limits on insurers' foreign currency mismatch risk.

On the Chinn-Ito index, Singapore scores 2.46 (the same as Hong Kong, New Zealand, the UK and the US).

In the trilemma framework, Singapore appears as being away from the bipolar choices: with a relatively open financial account, a managed, but time-varying, exchange rate should allow a

³⁷ In the aftermath of the Asian Crisis, additional restrictions were imposed on securities, on financial derivatives and other instruments, and on financial credits. The number of categories with restrictions increased to 6 of 13 in 2000-2008 and declined to 3 of 13 in 2011. The Singaporean regime may be also seen as intermediate in the trilemma sense if financial openness is state-dependent.

degree of control over domestic monetary conditions. Monetary policy involves managing the exchange rate with the primary objective medium term price stability as a basis for sustainable growth. With imports accounting for a large share of the consumption basket (as in Hong Kong), the exchange rate is a relatively powerful instrument for influencing Singapore's consumer price inflation, both directly through import prices and indirectly through demand for local goods and services that is subject to competitive pressures in the international market (International Monetary Fund, 2012f).

The exchange rate is influenced through intervention in the foreign exchange market. Interest arbitrage should then set the domestic interest rate according to the forward path of the exchange rate (expected monetary policy) and the forward path of foreign interest rates.

3.10.2 The economy and the exchange rate regime

Singapore's exchange rate regime appears to have served the country well. As in the case of Hong Kong, the Singapore economy has a high share of trade and financial services and the relatively stable exchange rate has provided price stability for those sectors.

Not only has exchange rate volatility been low in Singapore, but internal prices have also been fairly stable and income growth has been high on average. The ability of the MAS to alter the exchange rate path to suit the needs of the domestic economy – i.e. the medium term price stability objective – allows Singapore to moderate (relative to a fixed exchange rate) the degree to which domestic prices and wages need to adjust in response to adverse shocks.

Singapore's success also reflects factors other than the monetary policy regime, such as strong productivity growth, institutional capability, location advantages (proximity to major trade routes) and structural policies that have explicitly supported domestic savings and productivity growth.³⁸ Higher domestic savings imply lower domestic real interest rates, and a weaker real exchange rate.

3.10.3 The trade-offs

Inflation in Singapore has averaged less than 2 percent per annum since the mid-1980s, consistent with the gradual appreciation of the nominal exchange rate. The standard deviation of annual inflation was 2.1 percentage points over 2000 to 2011, compared with 1 percentage point in New Zealand. As such there appears to have been some trade-off between internal and external price stability. At the same time, Singapore's GDP has been more volatile than New Zealand's: over a range of sub-periods since 1987, the standard deviation of Singapore's annual growth rate was at least twice that of New Zealand's.

Singapore's regime faces concerns about capital inflows and competitiveness similar to those faced in a floating exchange rate regime such as New Zealand's. Domestic inflation undermines competitiveness both directly and because a monetary tightening (appreciating nominal exchange rate) further erodes the competitiveness of exporting and import-competing

³⁸ See International Monetary Fund (2012f) for a summary of Singapore's current policy framework for increasing productivity.

industries. In addition, expected exchange rate appreciation may attract capital inflows that drive down domestic interest rates relative to foreign rates, encouraging expansion of interest sensitive sectors (e.g. housing) and asset price inflation.³⁹ In Singapore, macro-prudential measures are used to moderate demand for real estate and credit to support financial stability (International Monetary Fund, 2012f).

Two factors in particular would need to be considered for a country considering a Singapore-type monetary/exchange rate regime.

First, controlling the forward exchange rate path requires a credibly large stock of reserves, and consistent with that, Singapore's reserves are about 95 percent of GDP compared with about 10 percent in New Zealand. The cost of holding reserves can be high (see table 1 for a cross-country comparison). From 1990 to 2011, the average short term Singapore government borrowing rate was 1.8 percent p.a. below returns on the US Treasury bill. Over the same period, the Singapore dollar appreciated by an average 1.84 percent per year, giving an overall cost of holding reserves of only 0.03 percent p.a. For New Zealand, that cost would have been over 4 percent per year (an average NZD appreciation of 1.4 percent and an average carry cost of 3.1 percent per annum). So an open foreign exchange position of an additional 90 percent of GDP could cost about 4 percent of GDP per annum (without accounting for any endogenous savings response to that high cost under a managed exchange rate regime).⁴⁰

Second, Singapore's primary focus on controlling inflation perhaps aids credibility, because it helps reduce the complexity of the control problem and the demands on institutional capability. Viewed in the context of a modern macroeconomic model, Singapore's regime is more standard than it might at first glance appear. The MAS adjusts the exchange rate, rather than an interest rate, in response to domestic inflation developments, with interest arbitrage closing the model. A monetary policy tightening (a nominal exchange rate appreciation) implies a decline in prices to restore real exchange rate equilibrium. If prices are sticky, then the real exchange rate initially appreciates, implying a rise in real interest rates, initially through higher nominal interest rates and then through a relative fall in domestic prices.

Singapore's regime has been remarkably successful at achieving both exchange rate stability and domestic price stability. While the exchange rate is managed, some of the adjustment in domestic factor costs that Hong Kong faces with a peg has in Singapore probably been absorbed instead in adjustments to the exchange rate band or the forward exchange rate path.

While exchange rate volatility has been lower than for New Zealand, the overall magnitude of cyclical variation has been similar and appreciation over the post-GFC period has been strong.

³⁹ Similarly in a floating exchange rate regime, high nominal interest rates may attract capital inflows, leading to a continued appreciation of the exchange rate rather than an initial appreciation followed by expected depreciation.

⁴⁰ This cost is for an open foreign exchange position. Because the RBNZ intervention mandate is focused on providing liquidity to the market in the event of extreme dysfunction, the RBNZ has been able to fund foreign currency liquidity more cheaply using foreign currency borrowing and swaps (See Munro and Reddell, 2012).

Finally, the regime is associated with a very large stock of foreign currency reserves and the associated carry costs and currency mismatch.

3.11 Switzerland

3.11.1 The policy choice

Switzerland operates a flexible inflation targeting regime. Monetary policy focuses on price stability, and in pursuing that objective is required to take account of economic developments. The price stability objective is defined as CPI inflation less than 2 percent. Usually that objective is pursued through an intermediate target for the Swiss franc London Interbank Offer Rate (LIBOR). Inflation has been low and stable.

In recent years, with market interest rates near zero, inflation very low and strong exchange rate appreciation driven by safe-haven capital inflows, the Swiss National Bank (SNB) has turned to a collection of supplementary monetary policy tools. Since September 2011, the SNB has prevented exchange rate appreciation beyond an announced limit. Foreign currency reserves are currently over 70 percent of GDP, having risen from about 10 percent in the years immediately before the GFC as the SNB has purchased foreign currency to prevent appreciation. That has led the IMF to change the classification of Switzerland's exchange rate arrangement from free floating to 'other managed' in the 2012 edition of the AREAER (International Monetary Fund, 2012i).⁴¹

On the Chinn-Ito index, Switzerland is as open as the other small, open economies in our sample. In 2011 the country had restrictions in 8 of the 13 categories counted in the AREAER.

- *Capital market securities:*
 - Limits on insurance companies use of securities for reserves
- *Money market instruments:*
 - Limits on insurance companies use of money market instruments for reserves
- *Collective investment securities:*
 - Limits on insurance companies use of collective investment securities for reserves. Local issuance of collective investment instruments by non-residents is subject to a stamp duty; distributors must be licensed.
- *Derivatives and other instruments*
- *Financial credits:*
 - Controls on insurance companies' credits to non-residents for reserves, unless vested in securities.
- *Direct investment:*
 - Controls apply to the film industry, shipping for commercial purposes, air transport, energy and broadcasting.
- *Real estate transactions:*

⁴¹ Between the early 1980s and 2009, SNB intervention in foreign exchange was extremely rare (Jordan, 2012b and Zurbrugg, 2012).

- Limits on Swiss pension funds' acquisition of foreign real estate. Restrictions on non-resident investment in real estate except for primary residences, professional and business use.
- *Provisions to institutional investors*
 - Limits (max.) on investment by insurance companies as above.

3.11.2 The economy and the exchange rate regime

Swiss foreign trade is heavily concentrated in Europe, including the euro zone.⁴² Traditionally the exchange rate has been viewed as a buffer to economic shifts affecting fundamentals in Switzerland and its markets. However, recent financial shocks and changes in international risk appetite are seen to have moved the exchange rate in ways that do not necessarily reflect economic fundamentals.

Switzerland is a financial centre. Significant capital controls would compromise that role and, because of financial sophistication, may be difficult to enforce. Further, the Swiss franc is traded in relatively large volume: daily foreign exchange turnover in April 2010 was over 45 percent of annual GDP (similar to New Zealand). A relatively liquid foreign exchange market means that influencing the currency over an extended period requires a large financial commitment, as illustrated by the rapid rise in Swiss foreign currency reserves in the past few years.

Appreciation pressure in 2008 and 2009 was met by large scale intervention that caused the SNB's balance sheet to grow by around 50 percent. Following continued pressure on the exchange rate, the SNB announced on 6 September 2011 it would prevent appreciation, setting a floor on the EUR/CHF exchange rate at one Swiss franc twenty.⁴³ To enforce the minimum rate it committed to 'purchase foreign exchange in unlimited quantities' (Hildebrand, 2011).⁴⁴

3.11.3 The trade-offs

The SNB assessment is that the exchange rate floor 'has made a decisive contribution to stabilising the Swiss economy' (Jordan, 2012b, p5). In its December 2012 *Quarterly Bulletin* the SNB notes that inflationary pressure remained minimal with the output gap negative (Swiss National Bank, 2012).

The episode brings significant costs and risk, however. As a small, open economy, Switzerland's success in resisting appreciation has required an open-ended commitment to buy foreign currency and resulted in actual purchases amounting to about 60 percent of GDP.

⁴² In 2011, around 78 percent of Switzerland's imports came from and 57 percent of exports went to the European Union (source: European Commission, <http://ec.europa.eu/trade/creating-opportunities/bilateral-relations/statistics/>).

⁴³ For an exchange rate defined this way – as euros per franc – a fall in the number is an appreciation of the franc. Choosing the CHF/EUR rate as the target rate (rather than a basket) was a relatively natural choice given Switzerland's heavy trade with European countries. International Monetary Fund (2012b) provides an account of events in 2011 in particular.

⁴⁴ The experience points to the importance of credibility in at least two ways. First, efforts to stem appreciation failed until the floor was introduced with a commitment to buy unlimited foreign exchange. Second, the SNB evidently saw it as extremely important to reaffirm commitment to the floor in April 2012 after a few transactions in foreign exchange markets took place at below 1.2 Swiss francs per euro (Jordan, 2012a).

Those reserves must be funded, with implications either for inflation (by funding through monetary expansion) or the fiscal position (a rise in the currency mismatch and gross debt).

A very strong *ex ante* fiscal position has likely been an important factor in the success of the intervention and preventing appreciation. Further, the fact that intervention seeks to prevent deflation risk means monetary expansion would not pose such an upward risk to inflation expectations as it might in an economy like New Zealand where interest rates are above zero and inflation has been positive.

The extent of reserves accumulation reflects, in part, high turnover in the Swiss franc. Turnover of the New Zealand dollar is similar as a share of GDP, though the magnitude of safe-haven flows that Switzerland received as a result of the euro area crisis were larger than New Zealand might be expected to face over a short time.

Finally, the operational demands of making the floor effective are evident (Jordan, 2012a):

How is the SNB organised in operational terms for implementing the minimum exchange rate? Since the introduction of the minimum exchange rate, the SNB has monitored the foreign exchange market from market opening in Asia on Sunday evening to market closing in New York on Friday evening without any interruption...The SNB accepts well over 100 banks with more than 700 trading desks as counterparties. Thanks to this network of contacts, the global foreign exchange market is almost completely covered. On the part of the SNB, the trading limits amount to some hundreds of billions of euros a day.

4. CONCLUSION

The monetary policy trilemma is a useful tool for thinking about exchange rate, monetary and capital account policy choices for New Zealand as for other countries. It helps define the set of potential policies and informs about the trade-offs. The empirical literature points to the trilemma being an important constraint on policy choices.

The trilemma implies that to obtain greater control over the exchange rate, New Zealand would have to forego some control of domestic monetary policy, restrict capital flows, or both. Restricting capital flows would limit the economy's access to international funding.

Advanced economies (except in the euro area) have tended to move over time towards a combination of an open capital account and a floating exchange rate, with control over domestic monetary policy for domestic objectives. Similarly, within the group of countries in section 3 (Korea and Chile to date, and China's planned direction) we see a move towards greater openness and less-rigid exchange rate management as countries develop. There is a collection of reasons.

A large pool of un-hedged foreign reserves needed to influence the exchange rate can be costly to fund for New Zealand, because New Zealand interest rates tend to be high relative to the returns in reserve currencies, and the higher interest rates tend not to be offset by currency depreciation (e.g. Engel, 2012). A large stock of unsterilized reserves also involves significant exposure to exchange rate risk for the central bank. When the exchange rate's movement is limited, some other variable like prices or wages must move to help the economy adjust to shocks. At times, that will require downward movements in prices and wages (as in Hong Kong after the Asian Crisis, for example, and peripheral European countries more recently). Capital controls become harder to enforce as a financial system becomes more liberalised, developed and open to international capital flows. In light of that last fact, and the benefits of access to international markets, prudential measures have been used by some countries as a better way of addressing risk from exposure of balance sheets to exchange rate and capital flow fluctuations. Prudential measures target the accumulation of risk on balance sheets rather than capital flows or exchange rate movements directly. That has been an important shift in policy globally since the GFC.

While the trilemma is an important constraint, most countries' regimes are intermediate in the sense that there is some divergence from a clear hierarchy of two of the three objectives. Examples include some controls on capital transactions, flexible inflation targeting, and occasional foreign exchange intervention. Intermediate regimes involve multiple objectives, and may require multiple instruments leading to a complex control problem.

That complication can undermine the transparency and clarity of policy institutions and potentially the durability of the regime in the face of large shocks. Different objectives will at times suggest different settings for a given instrument; or the ceding of control over short term interest rates might require use of administrative and regulatory policies to manage some kinds of domestic pressure.

Standard New Keynesian models of financially-open economies have tended to suggest a floating exchange rate and pursuit of internal price stability as an optimal policy choice. However, a growing literature varies the assumptions of the models, for example by assuming that asset markets are incomplete or prices are set in the destination country rather than the producing country. Under such conditions, prices do not necessarily reflect resource costs, leading to distortions in relative competitiveness and so there may be a case to respond directly to some exchange rate fluctuations.

References

- Adler, G and C Tovar (2011) "Foreign exchange intervention: a shield against appreciation winds". Working Paper 11/65. International Monetary Fund, Washington, DC.
- Bank for International Settlements (2010) "Triennial central bank survey: foreign exchange and derivatives market activity in 2010". Bank for International Settlements, Basel.
- Bank of Japan (2010) "Statement by the Governor". 15 September.
<http://www.boj.or.jp/en/announcements/press/danwa/dan1009b.htm/>
- Bank of Japan (2012) "The price stability goal in the medium to long term". 14 February.
http://www.boj.or.jp/en/announcements/release_2012/k120214b.pdf
- Bank of Japan (2013) "Introduction of the "Price Stability Target" and the "Open-Ended Asset Purchasing Method"". 22 January.
http://www.boj.or.jp/en/announcements/release_2013/k130122a.pdf
- Benigno, G and P Benigno (2003) "Price Stability in Open Economies". *Review of Economic Studies* 70(245): 743-764.
- Bordo, M, O Humpage and A Schwartz (2012) "Foreign-exchange intervention and the fundamental trilemma of international finance: notes for currency wars". *VOXEU* 18 June. <http://www.voxeu.org/article/notes-currency-wars-trilemma-international-finance>
- Briggs, P (2004) "Currency hedging by exporters and importers". *Reserve Bank of New Zealand Bulletin* 67(4): 17-27.
- Cassino, E and D Oxley (2013) "Exchange rate valuation and its impact on the real economy". Paper prepared for a joint Reserve Bank-Treasury Exchange Rate Policy Forum: Issues and Policy Implications. Wellington, 26 March 2013.
- Cavoli, T and R Rajan (2009) *Exchange rate regimes and macroeconomic management in Asia*, (Hong Kong University Press, Hong Kong).
- Chetwin, W, T Ng and D Steenkamp (2013) "The New Zealand experience of short- and medium-term real exchange rate volatility: drivers and policy implications". Paper prepared for a joint Reserve Bank-Treasury Exchange Rate Policy Forum: Issues and Policy Implications. Wellington, 26 March 2013.
- Chinn, M and H Ito (2002) "Capital account liberalization, institutions and financial development: cross country evidence". *NBER Working Paper Series* 8967.

- Chinn, M and H Ito (2008) "A new measure of financial openness". *Journal of Comparative Policy Analysis* 10(3): 309-322.
- Corsetti, G, L Dedola and S Leduc (2010) "Optimal Monetary Policy in Open Economies" in B Friedman & M Woodford (eds), *Handbook of Monetary Economics*, edition 1, volume 3: 861-933 (Elsevier).
- Cowan, K and J De Gregorio (2005) "International borrowing, capital controls and the exchange rate: lessons from Chile". *NBER Working Paper Series* 11382.
- De Gregorio, J (2011) "Chile's approach to external turbulences and threats". *Speech at the Economic and Entrepreneurial Vision 2011-2012*. Santiago, 19 October.
<http://www.bis.org/review/r111108g.pdf>
- De Gregorio, J, S Edwards and R Valdes (2000) "Controls on capital inflows: do they work?". *Journal of Development Economics* 63(1): 59-83.
- De Gregorio, J and F Labbé (2011) "Copper, the real exchange rate, and macroeconomic fluctuations in Chile". *Central Bank of Chile Working Papers* No 640.
- di Giovanni, J and J Shambaugh (2006) "The impact of foreign interest rates on the economy: the role of the exchange rate regime". *IMF Working Papers* WP/06/37.
- Drage, Munro and Sleeman (2005) "An update on Eurokiwi and Uridashi bonds". *Reserve Bank of New Zealand Bulletin* 68(3): 28-38.
- Edwards, S (2007) "Capital controls, sudden stops, and current account reversals" in S Edwards (ed) *Capital controls and capital inflows in emerging economies: policies, practices and consequences*: 73-120 (University of Chicago Press)
- Edwards, S and R Rigobon (2009) "Capital controls on inflows, exchange rate volatility and external vulnerability". *Journal of International Economics* 78(2): 256-267.
- Engel, C (2009) "Exchange rate policies". *Federal Reserve Bank of Dallas Staff Papers* No. 8.
- Engel, C (2012), "The Real Exchange Rate, Real Interest Rates, and the Risk Premium". Unpublished working paper. University of Wisconsin. <http://www.ssc.wisc.edu/~cengel/>
- Fahri, E and I Werning (2012), "Dealing with the Trilemma: Optimal Capital Controls with Fixed Exchange Rates". Unpublished working paper. Harvard University.
http://www.economics.harvard.edu/faculty/fahri/papers_fahri
- Fato, R and M Hutchison (2005) "Foreign exchange intervention and monetary policy in Japan, 2003-04". *International Economics and Economic Policy* 2(2-3): 241-260.

- Fischer, S (2001) "Distinguished lecture on economics in government: Exchange rate regimes: Is the bipolar view correct?". *Journal of Economic Perspectives* 15(2): 3-24.
- Galí, J and T Monacelli (2005) "Monetary policy and exchange rate volatility in a small open economy". *Review of Economic Studies* 72(3): 707-734.
- Forbes, K (2007) "The microeconomic evidence on capital controls: no free lunch" in S Edwards (ed) *Capital controls and capital inflows in emerging economies: policies, practices and consequences*: 171-202 (University of Chicago Press)
- Habermeier, K, A Kokenyne and C Baba (2011) "The effectiveness of capital controls and prudential measures in managing large capital inflows". IMF Staff Discussion Note SDN/11/14. International Monetary Fund, Washington, DC.
- Hall, V (2005) "An Australasian currency, New Zealand adopting the US dollar, or an independent monetary policy". *CAMA Working Paper Series* 21/2005.
- Hall, V and J McDermott (2012) "Is there an unobserved components common cycle for Australasia? Implications for a common currency". *New Zealand Economic Papers* 46(2): 119-141.
- Hampton, T, D Hargreaves and J Twaddle (2006) "Other stabilisation objectives within an inflation targeting regime: Some stochastic simulation experiments". *Reserve Bank of New Zealand Discussion Paper Series* DP2006/04.
- Hannoun, H (2012) "Monetary policy in the crisis: testing the limits of monetary policy". *Speech at the 47th SEACEN Governors' Conference*. Seoul, February.
<http://www.bis.org/speeches/sp120216.htm>
- Hildebrand, P (2011) "Short statement by Philipp Hildebrand on 6 September 2011 with regard to the introduction of a minimum Swiss franc exchange rate against the euro".
http://www.snb.ch/en/mmr/speeches/id/ref_20110906_pmh/source/ref_20110906_pmh.en.pdf
- Hu, X (2010) "Successful experiences of further reforming the RMB exchange rate regime". *Speech*. July.
- Husain, A, A Mody and K Rogoff (2005) "Exchange rate regime durability and performance in developing versus advanced economies". *Journal of Monetary Economics* 52(1): 35-64.
- International Monetary Fund (2001) "People's Republic of China – Hong Kong Special Administrative Region: 2000 Article IV Consultation". Country Report 01/43, March. International Monetary Fund, Washington, DC.

- International Monetary Fund (2011) "Annual report on exchange arrangements and exchange restrictions". International Monetary Fund, Washington, DC.
- International Monetary Fund (2012a) "Liberalizing capital flows and managing outflows – background paper". International Monetary Fund, Washington, DC.
- International Monetary Fund (2012b) "Switzerland: selected issues paper". Country Report 12/107, May. International Monetary Fund, Washington, DC.
- International Monetary Fund (2012c) "People's Republic of China: 2012 Article IV Consultation". Country Report 12/195, July. International Monetary Fund, Washington, DC.
- International Monetary Fund (2012d) "Macroeconomic Policy Frameworks for Resource-Rich Developing Countries - Background Paper 1". International Monetary Fund, Washington, DC.
- International Monetary Fund (2012e) "Japan: 2012 Article IV Consultation". Country Report 12/208, August. International Monetary Fund, Washington, DC.
- International Monetary Fund (2012f) "Singapore: 2012 Article IV Consultation". Country Report 12/248, August. International Monetary Fund, Washington, DC.
- International Monetary Fund (2012g) "Korea: 2012 Article IV Consultation". Country Report 12/275, September. International Monetary Fund, Washington, DC.
- International Monetary Fund (2012h) "The interaction of monetary and macroprudential policies – background paper". December. International Monetary Fund, Washington, DC.
- International Monetary Fund (2012i) "Annual report on exchange arrangements and exchange restrictions". International Monetary Fund, Washington, DC.
- International Monetary Fund (2012j) "Denmark: staff report for the 2012 Article IV Consultation". *Country Report 13/22*. International Monetary Fund, Washington, DC.
- International Monetary Fund (2013a) "People's Republic of China – Hong Kong Special Administrative Region: 2012 Article IV Consultation". *Country Report 13/11*. International Monetary Fund, Washington, DC.
- International Monetary Fund (2013b) "Denmark: Selected issues paper". *Country Report 13/23*. International Monetary Fund, Washington, DC.
- Ito, T (2005) "Interventions and Japanese economic recovery". *International Economics and Economic Policy* 2(2-3): 219-239.

- Jordan, T (2012a) "Discussion on the topic of the euro/Swiss franc minimum exchange rate". Zurich, 10 April.
http://www.snb.ch/en/mmr/speeches/id/ref_20120410_tjn/source/ref_20120410_tjn.en.pdf
- Jordan, T (2012b) "Monetary policy in the financial crisis – measures, effects and risks". *address to the Swiss Banking Global Symposium*. Zurich, 16 November.
http://www.snb.ch/en/mmr/speeches/id/ref_20121116_tjn/source/ref_20121116_tjn.en.pdf
- Jørgensen, A and L Risbjerg (2012) "Negative interest rates". *Danmarks Nationalbank Monetary Review*. 3rd quarter, part 1: 59-72.
- Kim, K, B Kim and Y Suh (2009) "Opening to capital flows and implications from Korea". *Bank of Korea Economic Papers* 12(1): 74-112.
- Levy Yeyati, E, F Sturzenegger and I Reggion (2010) "On the endogeneity of exchange rate regimes". *European Economic Review* 54: 659-677.
- Miniane, J (2004) "A New Set of Measures on Capital Account Restrictions". *IMF Staff Papers* 51(2): 276–308.
- Morandé, F and M Tapia (2002) "Exchange rate policy in Chile: from the band to floating and beyond". *Central Bank of Chile Working Papers* No 152.
- Munro, A and M Reddell (2012) "Foreign currency reserves: why we hold them influences how we fund them". *Reserve Bank of New Zealand Bulletin* 75(3): 35-45.
- Newman, V, C Potter and M Wright (2011) "Foreign exchange market intervention". *Reserve Bank of Australia Bulletin* December: 67-76.
- Obstfeld, M and K Rogoff (2002), "Inflation-targeting, exchange rate pass-through, and volatility". *American Economic Review* 92(2): 102-107.
- Obstfeld, M, J Shambaugh and A Taylor (2005) "The trilemma in history: tradeoffs among exchange rates, monetary policies, and capital mobility". *Review of Economics and Statistics* 87(3): 423-438.
- OECD (2011) "China's emergence as a market economy: achievements and challenges". *OECD contribution to the China Development Forum*. Beijing, March.
- OECD (2012) *China in focus: lessons and challenges* (OECD, Paris).

- Orr, A (2004) "Speech excerpt on the Reserve Bank's exchange rate intervention proposal". *Address by Adrian Orr, Deputy Governor*. Whangarei, 25 March.
<http://www.rbnz.govt.nz/speeches/0148372.html>
- People's Bank of China (2012) *Monetary Policy Report*, August.
- Reddell, M (2013) "New Zealand's long(ish)-run exchange rate "overvaluation": some perspectives on causes". Paper prepared for a joint Reserve Bank-Treasury Exchange Rate Policy Forum: Issues and Policy Implications. Wellington, 26 March 2013.
- Reuters (2011) "Chile cbank chief: FX intervention effects limited". 4 April.
<http://in.reuters.com/article/2011/04/04/chile-cenbank-intervention-idUSSAG00278520110404>
- Risbjerg, L (2012) "Liquidity of Danmarks Nationalbank and the Banks". *Danmarks Nationalbank Monetary Review*. 1st quarter, part 1: 89-100.
- Schmidt-Hebbel, K and M Tapia (2002) "Inflation targeting in Chile". *The North American Journal of Economics and Finance* 13(2): 125-146.
- Shambaugh, J (2004) "The effect of fixed exchange rates on monetary policy". *Quarterly Journal of Economics* 119(1): 301-352.
- Stephens, D (2006) "Should monetary policy attempt to reduce exchange rate volatility in New Zealand?". *Reserve Bank of New Zealand Discussion Paper Series* 2006/05.
- Sullivan, R (2013) "New Zealand history of monetary and exchange rate regimes". Paper prepared for a joint Reserve Bank-Treasury Exchange Rate Policy Forum: Issues and Policy Implications. Wellington, 26 March 2013.
- Swiss National Bank (2012) *Quarterly Bulletin* 30(4).
- Taylor, J (1993) "Discretion versus policy rules in practice". *Carnegie-Rochester series on public policy* 39: 195-214.
- Ueda, K (2012) "Japan's deflation and the Bank of Japan's experience with non-traditional monetary policy". *Journal of Money, Credit and Banking* supplement to 44(1): 175-190.
- West, K (2003) "Monetary policy and the volatility of real exchange rates in New Zealand". *Reserve Bank of New Zealand Discussion Paper Series*, 2003/09.
- Wong, J, Y Ip-wing, E Law and L Fung (2001) "Corporate restructuring in Hong Kong in the aftermath of the Asian financial crisis". *Hong Kong Monetary Authority Quarterly Bulletin* 27, May: 1-21

Zurbrügg, F (2012) "Challenges posed by the growth in the SNB's foreign exchange reserves".
Speech at a money market event. Geneva, 8 November.
http://www.snb.ch/en/mmr/speeches/id/ref_20121108_zur/source/ref_20121108_zur.en.pdf