Preliminary version
Do not quote

Why Do Countries Float the Way They Float?

Ricardo Hausmann, Ugo Panizza and Ernesto Stein

Research Department
Inter-American Development Bank

November 1999

Paper prepared for the Inter-American Seminar in Economics sponsored by the NBER and held at at CEMA, Buenos Aires, December 3 and 4, 1999. The authors would like to thank Michael Gavin for very helpful comments, and Patricia Cortés for excellent research assistance. The views expressed here are those of the authors, and do not necessarilly reflect those of the Inter-American Development Bank.

Why Do Countries Float the Way They Float?

1. Introduction

One of the most controversial issues of our time in terms of economic policy has been that of the choice of exchange rate regime. The debate about regime choice has recently gained new force, following the crises in Mexico, Asia, Russia and Brazil. While there is growing consensus about the problems associated with intermediate type regimes, including non-credible pegs, experts disagree on the relative merits of floating regimes *vis a vis* credible pegs such as those associated with currency boards or even monetary union.

The latest changes in regime around the world seem to be consistent with the consensus in favor of extreme regimes. While countries in the European Union have advanced toward monetary integration, several other countries have recently abandoned intermediate regimes in favor of floating exchange rates. In Latin America the movement toward floating regimes, which has been a long standing trend since the collapse of the Bretton Woods system, has accelerated this year, as Brazil, Chile, Colombia and Ecuador have abandoned intermediate regimes and replaced them with floating rates. This trend, for the case of Latin America, is clearly illustrated in Table 1. The new regime of choice in the region appears to be floating with inflation targets, a regime which also appears to be favored by the IMF.

In this paper we will claim, however, that there are substantial differences regarding the management of exchange rate policy that can be found among countries that consider themselves to be floating their exchange rates. In particular, emerging countries that float seem to behave very differently from developed countries that float: they show much more propensity to intervene in the foreign exchange market, either using reserves (of which they keep large amounts) or interest rate policy, and do not allow the same degree of flexibility to adjust to shocks. In fact, the policy of "benign neglect" toward the behavior of the exchange rate, which one would naturally associate to independently floating regimes, seems to be restricted to a small number of countries.

Our objectives are two. First, we will document the main differences in the way different kinds of countries float. Second, we will attempt to explain these differences in behavior. We will suggest that emerging countries may face important constraints which impose limits on the degree to which they are willing to let their exchange rates float freely. We explore two potential explanations for these differences, associated to some particular characteristics of emerging markets. First, these economies tend to have a higher pass-through from exchange rates to prices, which can result in a concern for the movements in the exchange rate, provided there is a concern about inflation. Second, they tend to have a large portion of liabilities (both private and public) denominated in foreign currency. Again, this could result in concerns regarding exchange rate movements, as depreciations hurt those exposed to dollar liabilities, and possibly the health of the banking sector. We do find that these characteristics (high pass through and foreign currency liabilities) tend to reduce the willingness of policymakers to let the exchange rate float freely, although the effects seem to be more clear-cut in the case of foreign currency liabilities

The identification of the different constraints faced by emerging markets when managing exchange rate policy is important, and should be taken into consideration for the choice of exchange rate regimes. In

Table 1: Exchange rate arrangements by period in Latin America

	1960-73		1974-81		1982-88		1989-94		As of April 1999	
Type of arrangement	# of Obs	%	# of Obs	%	# of Obs	%	# of Obs	%	# of Obs	%
Fixed to single currency	322	88.5	159	76.4	110	60.4	56	35.9	6	23.0
Fixed to basket					4	2.2				
Fixed w/frequent adj.	18	4.9	12	5.8	4	2.2	3	1.9		
Forward looking crawling peg			9	4.3	4	2.2	10	6.4		
Forward looking crawling band							3	1.9	1	3.8
Backward looking crawling peg	12	3.3	22	10.6	46	25.3	9	5.8	3	11.5
Backward looking crawling band							7	4.5	2	7.7
Dirty Floating	8	2.2	6	2.9	5	2.7	28	17.9	4	15.4
Free Floating	4	1.1			9	4.9	40	25.6	10	38.5
Total	364	100.0	208	100.0	182	100.0	156	100.0	26	100.0

Source: Frieden, Ghezzi and Stein (1999)

electing a regime, emerging countries should compare the merits of the possible float (rather than the ideal float) *vis a vis* the credible peg. The literature, however, has until recently mostly ignored these constraints faced by emerging countries when discussing the optimal choice of regime.[1]

2. How do floaters float?

In this section, we attempt to document important differences in the behavior of countries that formally have floating exchange rate regimes or wide bands, regarding the management of the exchange rates. It is important first to define the sample of countries that will be studied. For this, we worked with the IMF classification of exchange rate regimes, using the November 1999 issue of the IFS (which corresponds to regimes as of June 30th, 1999). The countries in our sample correspond to the following categories from the Exchange Arrangements classification of the IMF:

i) *independently floating*: as of June 1999, there were 48 countries classified under this label. More than half of these countries, however, are very small economies, mostly in Africa and the Middle East. Since our main interest is to look at the behavior of floaters in Latin America as compared to developed and emerging market economies, we restrict the sample to exclude such small countries.[2] The 17 countries we do include from this group are the following: Australia, Brazil, Canada, India, Indonesia, Japan, Korea, Mexico, New Zealand, Peru, Philippines, South Africa, Sweden, Switzerland, Thailand, United Kingdom, and the United States. To this group, we add Germany, which is classified as part of a monetary union (the Euro Area) but which can be considered to be floating independently vis a vis the dollar.

ii) *managed floating with no preannounced path for exchange rate*: For the same reasons as above, out of 25 countries in this category, we included in our sample the following seven: the Czech Republic, the Dominican Republic, Guatemala, Jamaica, Norway, Paraguay, and Singapore.

iii) *exchange rate with crawling or horizontal bands:* From this group, we only included countries in which the width of the band was at least 18 %, in order to provide sufficient flexibility. The five countries included under this last category are Colombia (crawling band of ∀9%), Chile (crawling band of ∀ 16%); Greece (horizontal band of ∀ 15%), Israel (crawling band of ∀ 15%) and Poland (crawling band of ∀ 12.5%). Of these countries, Chile and Colombia have more recently adopted independently floating exchange rate regimes.

As a result, our sample includes 30 countries: the G-3 (the US, Germany and Japan); nine other industrial countries (Australia, Canada, Greece, Israel, New Zealand, Norway, Sweden, Switzerland, and the United Kingdom); nine Latin American and Caribbean countries (Brazil, Chile, Colombia, Dominican Republic, Guatemala, Jamaica, Mexico, Paraguay and Peru); and nine other developing

[1] McKinnon's (1963) study of optimal currency areas does discuss the issue of exchange rate pass-through, relating it to the degree of openness of the economy.

[2] There are 30 small countries which we exclude from the independently floating category. These are Afganistan, Albania, Angola, Armenia, Congo, Eritrea, Gambia, Georgia, Ghana, Guinea, Guyana, Haití, Kazajstán, Liberia, Madagascar, Mauritius, Moldova, Mongolia, Mozambique, Papua New Guinea, Rwanda, Santo Tomé y Príncipe, Sierra Leona, Somalía, Sudán, Tanzanía, Uganda, Yemen Republic, Zambia, and Zimbabwe. We also excluded Ecuador, since it only adopted a floating regime in February 1999, and had prior to that a relatively narrow crawling band.

countries (the Czech Republic, Korea, Philippines, Indonesia, India, Poland, Singapore, South Africa and Thailand). For some purposes, we will later divide the two last groups into emerging countries and other developing countries.

In what follows, we will describe how the different countries behave by focusing on three aspects of their exchange rate management: i) the stock of reserves with which they float; ii) the extent to which they use these reserves to stabilize the exchange rate; and iii) the extent to which they use interest rates to stabilize the exchange rates. This section is meant to be purely descriptive. It shows that while some countries are pretty close to an ideal float, without much regard for the level of the exchange rate, others seem to set limits to the behavior of this variable. The analysis of why countries float the way they float is left for the next section.

2.1 The stock of reserves: some countries float with lifejacket

One of the dimensions in which floating countries differ very substantially is the level of reserves they maintain. A country that floats without regard for the level of the exchange rate will not need a lot of reserves to manage the exchange rate. In contrast, countries which for some reason are not willing to let the exchange rate take any level will need a large cushion of reserves to conduct exchange rate.

Figure 1 presents the level of reserves in each of the countries in our sample, normalized in each case by broad money (M2). The value of reserves corresponds to the average from April 1998 through April 1999. The figure shows very substantial differences across countries. Most salient is the low level of reserves held by the industrialized countries, as compared to the developing style floaters. While countries such as Singapore, Peru and Chile have reserves that exceed 50% of M2, most industrial countries keep a stock of reserves below 10% of M2. The difference in this dimension between the advanced floaters and the developing floaters is striking. Out of the 12 industrial country floaters, only two of them, Israel and Norway, have a pattern more akin to the developing style floaters. Of the 18 developing country floaters, only South Africa, the Dominican Republic, the Czech Republic and India resemble the industrial countries in this regard.

Figure 2 shows the same variable, reserves/M2, grouped for different categories of countries. The figure suggests that the level of reserves needed to manage exchange rates is closely associated to the level of development. On average, emerging market floaters keep almost six times as much reserves as do G-3 floaters, and more than twice as much as other industrial countries. Interestingly, the non-emerging developing countries tend to keep fewer reserves than the emerging country floaters. Among the emerging countries, those in Latin America have on average reserves equivalent to 43.6% of M2, while the South East Asian ones have 35% of M2.

In general, these results seem to provide evidence consistent with the argument by Calvo suggesting that emerging countries seem to be floating "with lifejacket". It is interesting to note that Argentina and Uruguay, perhaps the two countries in Latin America that have a stronger commitment in terms of their exchange rate, have levels of reserves below those of most of their floating counterparts in Latin America.[3]

[3] Reserves/M2 are approximately 28% in the case of Argentina, and 20% in the case of Uruguay.

2.2 Stabilizing exchange rates with reserves

To what extent do floaters attempt to stabilize exchange rates by intervening in the foreign exchange market? In order to answer this question, we look at the relative volatilities of the exchange rate and of reserves. We choose to work with relative volatilities, because we think that comparisons based solely on the volatility of exchange rates alone, or of reserves alone, could be misleading. The exchange rate in a country could be more volatile than that in another simply because it is subject to larger external shocks. Comparing exchange rate volatilities does not provide a complete idea of the willingness of this country to defend its parity. It may be the case that the volatile country is intervening in the foreign exchange market to keep the exchange rate within certain limits, while the country subject to less volatility is letting the exchange rate float independently. Similarly, comparing volatility of reserves may be problematic too. It is possible for reserves during a particular period to be relatively stable due to the absence of shocks that would have warranted a movement in the exchange rate, even in a country that would intervene heavily if a shock warrants it. A possible drawback of using relative volatilities is that one does not know if the ratio is high because of the numerator being unusually high, or the denominator unusually low. For this reason, Table 1A in the appendix presents the volatility of reserves, and that of exchange rates country by country, as well as the ranking of the countries in the sample according to each of these these measures.

As a measure of exchange rate volatility, we use the standard deviation of the rate of depreciation, rather than that of the level of the exchange rate, since it is possible that the (implicit) objective of the intervention is to achieve a crawling peg with a fairly constant rate of crawl, rather than simply to keep the exchange rate at a certain level. As a measure of the volatility of reserves, we use the standard deviation of the stock of reserves, normalized by the dollar value of the stock of broad money (M2). In order to avoid changes in the exchange rate from affecting the measured volatility of reserves through the dollar value of M2, the monetary aggregate is averaged over the period under consideration.

More precisely, the indicator of the degree to which countries intervene in the foreign exchange markets is:

$$RES = \frac{std(dev)}{std(res/\bar{M}2)} \ ;$$

This indicator provides information about how "flexible" exchange rate regimes are in reality. Under a truly fixed exchange rate regime or a crawling peg with a constant rate of crawl, the standard deviation of devaluations would be zero. Therefore, our indicator would take a value of zero as well. In the limit of a perfectly floating regime, in which there is no foreign exchange intervention at all, the denominator would be 0, and our index would tend to infinity. The value of the index can give us a good indication of the degree to which, independently of the formal classification, the regime is "de facto" floating or not.[4]

In calculating our foreign exchange intervention indicator, an important aspect is to define which exchange rate should be used in the calculations for each country. While the exchange rate *vis a vis* the

[4] Recent work by Sturzenegger and Levi Yeyati (1999) has used volatility of reserves and exchange rates in order to classify countries according to their "de facto" regimes.

dollar is the natural one to use in most cases, in others it is not. For the case of countries in Europe, we used the exchange rate against the mark as a basis for our calculations.[5] In the case of New Zealand, we tried both the US dollar and the Australian dollar, and we found that the links to the Australian dollar are much stronger, which led us to use this exchange rate in the analysis.[6] In the case of the United States, we used the nominal effective exchange rate as the basis for our indicators. In all other cases, we used the exchange rate with respect to the dollar.[7]

Figure 3 shows the results of our index of foreign exchange intervention. For most countries, the values of the index correspond to the period January 1997-April 1999 (or until the latest month available from IFS). In the case of countries which abandoned fixed or intermediate exchange rate regimes after January 1997, we chose to start the period of measurement three months after the regime shift, in order to exclude the initial period, so as to give the exchange rate enough time to stabilize at a new level.[8] As with the stock of reserves, the differences among floating countries are striking. The relative volatility of exchange rates *vis a vis* that of reserves is very large in Japan, the United States and the UK, suggesting that these countries are very close to a pure float. Germany and Australia also show high values for this index.

At the other end of the spectrum, we find a mix of countries that seem to intervene substantially in the foreign exchange market, demonstrating a behavior closer to that of fixed regimes. Some of them are from Latin America (Chile, Guatemala, Peru and Paraguay), while others are the countries of the European Union which have not joined the Euro (Greece, Norway, and Sweden), which show a preference to keep their exchange rates *vis a vis* their neighbors very stable. Among the East Asian floaters, Singapore is the one that seems to intervene the most. Interestingly, the set of countries at the lower extreme of the index includes countries with wide bands (such as Greece and Chile), countries under managed floating regimes (such as Norway, Paraguay and Singapore) and countries which are labeled as independent floaters (Sweden, Perú, and Guatemala, which is classified now as managed floating, but was classified as independently floating as late as December 1998).

Figure 4 shows the same index, now averaged according to country groups. The index for the emerging countries is one tenth that corresponding to the G-3, one half that of other developed floaters, and twice the size of that in other developing countries. This clearly shows that the ability to float freely is closely associated to the level of development. Among the emerging floaters, those in East Asia seem to be closer to the ideal float, in comparison to the Latin American countries. However, with the exception of Indonesia and Thailand, even these countries are very far from de facto independent floating.[9]

2.3 Stabilizing exchange rates with interest rates

[5] In the case of the transition economies in our sample, the Czech Republic and Poland, we also used the mark, after finding that exchange rate volatility *vis a vis* the mark was lower than that with respect to the dollar.
[6] The correlation between the US dollar exchange rates of Australia and New Zealand (in logs) over the period 1998-1999 is 0.97. Australia is New Zealand's most important trading partner (25% of New Zealand's imports are originated in Australia).
[7] Data on exchange rates and on reserves was taken from IFS.
[8] In the case of Indonesia, we started 5 months after the regime shift in order to avoid a period of extreme instability.
[9] We also worked with an alternative index of foreign exchange intervention, which considers the volatility of changes in reserves rather than levels. The results are very similar, and are therefore not reported here.

In the previous section we focused on one of the variables that monetary authorities can use to manage exchange rates: the reserves. But intervention in the foreign exchange market is not the only channel that monetary authorities have in order to influence movements in the exchange rate. They can also affect it by tightening or loosening monetary policy. Thus, in this section we will look at the relative volatility of exchange rates and interest rates as another indication of the degree to which economic authorities are willing to let the exchange rate float freely.

While all economists would agree that movements in reserves indicate the willingness of the authorities to influence the level of the exchange rate, the use of interest rate movements to capture the intention to control exchange rates is more controversial.[10] It is clear that tightening monetary policy will result in pressure for appreciation of the currency, and loosening monetary policy will result in pressures for depreciation. Critics point out that the interest rate is a variable that can change for many reasons, not just as a result of the authorities' desire to control exchange rate policy. It can change as a result of external factors such as changes in external interest rates, or changes in sentiment toward emerging markets. Unlike the sale of reserves, movements in the interest rate do not necessarily indicate a voluntary action by the monetary authorities. While we recognize that these arguments have some merit, it should be stressed that under a pure floating regime, policymakers should be able to set interest rates independently in order to achieve whatever objectives they pursue, and let the exchange rate absorb the shocks. In the ideal world of pure float, therefore, any change in interest rates could be regarded as voluntary.

Another argument against the use of measures related to interest rate volatility to quantify intervention is that interest rates may be responding to a depreciation not for the sake of exchange rates per-se, but out of concern with inflation. This may be particularly important in the case of economies that float with an inflation target, and have a high exchange rate pass-through. In such cases, monetary authorities may want to tighten monetary policy in response to a depreciation in order to meet the inflation target, through the effect of the monetary squeeze both on the exchange rate and on aggregate demand. In other words, the behavior of interest rates would be consistent with managed exchange rates, but also with floating regimes combined with inflation targets. While this "observational equivalence" may be a concern when trying to classify countries into different regimes, it does not pose a problem here. We want to show that different countries float in different ways. For our purposes, it is not important to know if there is a concern about exchange rates per-se. What matters is whether authorities act "as if" that concern existed.

In addition to these more conceptual points, examples abound of countries which have in fact used interest rates actively in order to avoid the depreciation of the currency. The behavior of European countries before the 1992 collapse of the EMS is a case in point. The increase in Brazilian interest rates prior to the collapse of the Real is a recent Latin American example. These considerations justify the focus on the behavior of interest rates as a variable of interest.

Figure 5 presents the relative volatility of devaluations *vis a vis* interest rates in our sample of countries, while figure 6 presents the same information by group of countries. Whenever it was available, we used money market interest rates from IFS to calculate the interest rate volatility.[11] In

[10] See, for example, Levi Yeyati and Sturzenegger (1999)

[11] Rather than working with annual interest rates, for the calculation of the volatility of interest rates we converted interest rates into monthly rates. The reason is the following: If a country has during the period under study a downward trend in

cases in which these rates were unavailable, we used data on money market rates from Bloomberg and, when these were unavailable or the series not long enough, we replaced money market rates with lending or deposit rates from IFS, as available. As was the case with the reserves, the index corresponds to the period January 1997-April 1999 (or until the latest month available from IFS), except for those which abandoned fixed exchange rate regimes after January 1997, in which case we started the period of measurement three months after the regime shift.

As in the case of our other measures, there are very substantial differences across countries. Japan is by far the country with the highest ratio. As can be seen in Table A1 in the Appendix, the volatility of exchange rates in this country is not unusually high, but the volatility of interest rates is well below that of all other countries. In the G-3 countries as a group, the ratio of volatilities is one order of magnitude larger than in the case of emerging countries, while in other developed countries the ratio is more than twice as large. Interestingly, the ratio is much lower in the case of countries in Latin America, whether they are classified as emerging or other developing. In fact, eight out of the ten countries with the lowest ratios are from Latin America. Guatemala is the only country from this region in which the ratio takes on an intermediate value.

The relative volatilities, however, do not offer a complete picture of the difference in behavior regarding the use of interest rates among different groups of countries. The volatility of interest rates per-se does not give a good idea of whether the interest rates are used in order to control exchange rates or for other purposes. To illustrate this point clearly, we compare the interest rate response to changes in exchange rates in two countries that formally float but which exhibit radically different behavior: Australia and Mexico.[12]

Figure 7 shows the behavior of exchange rates and interest rates in Australia for the period January 1997- August 1999 in which the country was hit by the East Asian crisis. We observe that as the crisis hit, the currency was allowed to depreciate[13] while interest rates were lowered *anti-cyclically* in order to protect the economy from the deflationary effects of the external shock. This resembles the textbook case of free floating: under a negative external shock, the exchange rate can be allowed to move in one direction, while interest rates are used to maintain internal balance and hence are moved in the other direction. Contrast this experience with that of Mexico (Figure 8), where the exchange rate and domestic interest rates move together in a very tight manner. Hence, as the external situation worsens, the currency depreciates and interest rates are jacked up in a *pro-cyclical* manner. The case of Mexico represents that of a country which cannot afford to show "benign neglect" regarding the behavior of the exchange rate.[14]

3. Why do countries float the way they float?

---

inflation, this will translate into a downward trend in interest rates, as well as in monthly devaluation. By using the same unit of time for the devaluation and the interest rates, we ensure that the effect of these trends due to changes in inflation on both volatilities will be fairly symmetric, and will cancel out when the relative volatilities are calculated.

[12] This discussion of Australia and Mexico draws heavily from Hausmann (1999b).

[13] Following the Latin American convention, we measure the exchange rate as the domestic price of foreign exchange and hence a depreciation is a move up.

[14] The behaviors illustrated with the cases of Australia and Mexico are not always as clear-cut in the case of other developed and emerging economies.

In this section, we will attempt to uncover some of the reasons for the difference in behavior among floaters. We will focus on two separate aspects. First, authorities may care about the exchange rate in countries in which the pass-through from exchange rates to prices is large, and inflation is an important consideration. Attention to the exchange rate should be smaller in countries where the effects of exchange rate changes on prices is small, or when the pass-through takes a long time to take effect. To study this hypothesis, we will develop a rough measure of the pass-through from exchange rates to prices for the countries in our sample. We then use this measure to test whether the countries with high pass-through tend to intervene more in the foreign exchange market, either through reserves or interest rates.

Second, we focus on the extent of foreign currency liabilities as an explanation for the willingness of the policymakers to manage the exchange rate. If the degree of foreign currency liabilities is important, depreciations may generate widespread bankruptcies (if the liabilities are in the private sector) or result in serious fiscal consequences (if the liabilities are in the public sector) or both.[15] This may create incentives for the policymakers to avoid large depreciations. In the absence of good data on foreign currency liabilities, we use a variable that captures the ability of countries to borrow abroad in their own currency as a proxy. We then use this variable to test whether it has an effect on the degree of exchange rate intervention. After considering each of these potential determinants separately, we end the section by discussing their impact when they are both included in the analysis.

3.1 Exchange rate pass-through and exchange rate management of floaters

Estimating the exchange rate to price pass-through for a cross-section of countries is not a simple exercise. In theory, it would be necessary to model each country's price-setting mechanism. This would require a paper for each country rather a section of one paper for 30 countries. Here, we follow a methodology used for Australia by de Brower and Ericsson (1995) and for Mexico by Garcés Diaz (1999). These authors model domestic prices using a mark up equation of the kind:

$$P = \alpha W^{\theta} F^{\gamma}$$

Where P are domestic prices, W wages, F international prices in domestic currency (obtained by multiplying the exchange rate with and index of international prices)[16] and α, θ, and γ are three parameters representing mark up and the long run elasticities of wage and external prices. By taking the logs of the above equation it is possible to estimate the long-run relationship among wages, international prices, and local prices. Since we do not have monthly data for wages, we estimate the following long-run equation:

$$p = log(\alpha) + \gamma f \ ,$$

where lower case letters represent the log of the corresponding upper case variables defined above. Even though we are aware that the omission of wages may bias our estimates, we proceed with the analysis because we are more interested in ranking the countries rather that in the actual level of the pass-through. As the bias is likely to affect the coefficients in the same direction, the omission of wages

[15] For a discussion of the consequences of devaluation adjustment in the case of foreign currency liabilities see Calvo (1999a and b), Calvo and Reinhart (1999), Hausmann (1999a), Stein et al (1999), and Fernández-Arias and Talvi (1999).
[16] Most of the variation of F is due to exchange rate variation.

should not be too much of a concern. Furthermore, the fact that our coefficients for Australia and Mexico are very similar to those obtained by de Brower and Ericsson (1995) and Garcés Diaz (1999) gives us some confidence in our estimates.[17]

All the series we use can be described as having a unit root process. Hence, we need to study the long-run relationship between internal and external prices using cointegration analysis. As cointegration does not allow quantifying the short-run relationship among the variable of interest, we track the short run effect of a change in international prices by estimating the following error correction model:

$$dp_t = \phi(p_{t-1} + \gamma f_{t-1} + \alpha) + \varphi p_{t-1} + \lambda df_{t-1} + \varepsilon_t$$

We measure *p* using the log of the CPI and use two different definitions of *f*. In the first definition, we add the log of the US dollar exchange rate (the DM exchange rate in the case of Czech Republic, Greece, Poland, Sweden and Switzerland) to the log of an index of international commodity prices (from IFS). In the second definition, we substitute the index of commodity prices with the US CPI (the German CPI in the case of Czech Republic, Greece, Norway, Poland, Sweden and Switzerland). Table 2 reports the results of the estimations.

TABLE 2: Estimates of Inflation pass-through (1990-99)

Country	**Long Run**	**6 months**	**12 months**	**Long Run**	**6 months**	**12 months**
	Change in international prices in US$			**Change in US Prices**		
Australia	0.48	0.1	0.21			
Canada	0.11	-0.01	0.02	0.19	0.02	0.07
Colombia (1992-99)	1.58	0.16	0.38	1.79	0.05	0.12
Dominican Republic	1.38	0.08	0.25	1.38	0.25	0.58
Germany	0.97	0.04	0.07	0.49	0.05	0.09
Guatemala	0.86	0.12	0.28	1.6	0.62	1.12
India				0.92	0.06	0.07
Indonesia	0.92	0.29	0.49	0.89	0.26	0.43
Israel	0.55	0.12	0.16	0.56	0.14	0.19
Jamaica	0.41	0.29	0.31	1.01	0.11	0.22
Japan	0.09	0.03	0.04	0.08	0.02	0.04
Korea	0.59	0.11	0.18	0.34	0.07	0.1
Mexico	1.02	0.25	0.42	0.93	0.33	0.58
Paraguay	0.98	0.38	0.59	0.88	0.39	0.56
Peru (1992-99)				0.43	0.12	0.22
Philippines	1.16	0.13	0.3	0.74	0.07	0.15
Singapore	0.16	0.01	0.02			

[17] Our coefficient for Australia (0.48) is identical to the one obtained by de Brower and Ericsson. The coefficient for Mexico (0.98) is different from the one obtained by Garcés Diaz (0.63) because we use different time periods (1990-99 in this paper and 1985-98 in Garcés Diaz), When we estimate the equation for the 1985-1998 period we obtain a coefficient of 0.69, very close to the one obtained by Garcés Diaz.

South Africa	0.47	0.06	0.11	0.54	0.09	0.17
Thailand	0.19	0.02	0.03	0.59	0.04	0.06
UK	0.06	0.03	0.03	0.54	0.07	0.13
USA*	0.34	0.01	0.04			
	Change in international prices in DM			**Change in German Prices**		
Czech Rep.	2.63	0.02	0.03	1.17	0	0.02
Greece	0.11	0.14	0.14	0.23	0.14	0.15
Norway (1988-99)				0.32	0.05	0.09
Poland	0.47	0.48	0.47	0.8	0.57	0.62
Sweden	0.14	0.04	0.07	0.22	0.08	0.14
Switzerland				0.02	0.02	0.02

*International prices versus US effective nominal rate

Table 2 reports both the long-run (ie, the coefficient obtained form the cointegrating vector) and short-run pass-through. While both measures can be relevant, the long-run coefficient looses importance if the adjustment is very slow. Comparing the case of Germany to that of Greece can be instructive. In Germany the long-run coefficient is 0.97. Hence, a change in international prices will, in the long-run, completely translate into a change in domestic prices. Although the German pass-through seems very high, the speed of adjustment is very slow and the adjustment to the steady state requires more than 50 years. After ten years the change in domestic prices is still less than 50 percent of the exogenous shock. Greece, instead, has a relatively low pass through (0.23) but a very fast adjustment. If we compare the two countries we find that, for almost three years, a change in external prices has a stronger effect on Greek domestic prices than on German prices. To obtain a synthetic indicator of pass-through we compute the following weighted average of the long-run and short run adjustment.

$$PT = \left(\frac{PT_{1y}}{PT_{LR}} \right) PT_{LR} + \left(1 - \frac{PT_{1y}}{PT_{LR}} \right) PT_{1Y}$$

The rationale for using the above formula is to give more weight to the long-run pass-through in countries which adjust relatively quickly and more weight to the short-run pass-through in countries with a slow adjustment.

Figure 9 presents the value of our synthetic index of pass-through country by country. In general, Latin American and Caribbean countries are characterized by very high levels of pass-through. While we find many developing countries and emerging markets with low pass-through (South Africa, India, Thailand Czech Republic and Singapore), only two industrialized countries (Australia and Israel) have relatively high pass-through (although low by Latin American standards). The association between the pass-through and the level of development is clearly shown in Figure 10.

Figures 11, 12 and 13 show the relationship between pass-through and the three measures discussed in Section 2. Figure 11 shows a positive (but not statistically significant[18]) correlation between the level

[18] This is due to the fact that Singapore has both extremely high reserves and low pass-through. If we drop this outlier the correlation between reserves and pass-thorough becomes highly significant.

of reserves and pass-through. Despite of the lack of statistical significance of the correlation, the figure clearly suggests that, while countries with low pass-through may choose to have whatever levels of reserve they want, countries with high pass-through (with the only exception of the Dominican Republic) find it necessary to build war chests of international reserves in order to be able to defend their exchange rate.

Figures 12 and 13 show instead a negative correlation between pass-through and the relative volatility of exchange rate (statistically significant only when we look at the ratio between volatility of exchange rate and reserves) suggesting that countries with high pass-through tend to impose some limits on the volatility of their exchange rate.

All in all, through this simple univariate analysis, we find that exchange rate pass-through has some role in explaining the low volatility of exchange rate in emerging markets. The correlations are always in the right direction, although not always statistically significant. The limited effect of this variable will be confirmed in the next section when we evaluate the relative role of pass-through and of the currency denomination of external liabilities.

3.2 Foreign currency liabilities and exchange rate management of floaters

One of the difficulties of testing the importance of foreign currency liabilities for exchange rate management is that, to our knowledge, there is no good data on the importance of liabilities denominated in foreign currency for a large sample of countries. For this reason, rather than trying to use incomplete measures of foreign currency liabilities, we work with a different but related variable: an indicator that measures the extent to which countries can issue international securities in their own currency.

For this, we rely on data from the Bank for International Settlements database.[19] Unfortunately, the BIS does not provide information by country of issue broken down by currency. For this reason, we calculated the ratio between the amount of foreign securities issued in a given currency (regardless of the issuing country) and the amount of foreign securities issued by the corresponding country. The data corresponds to total foreign securities (money market and bonds) outstanding as of September 1999.

This is obviously a very rough proxy for the importance of foreign currency liabililities in a country. Foreign securities may be a small portion of the country's debt in foreign currency, and debt in foreign currency could be a small portion of a country's GDP.[20] Yet, we like this indicator because it is a very good measure of the ability of countries to borrow abroad in their own currency. The inability of a country to borrow in its own currency, we think, should be one of the main determinants of its stock of foreign currency liabilities.

Figure 14 presents the data country by country, while figure 15 presents averages by level of development. For many countries, and in particular for most developing countries, this indicator takes a value of 0, indicating that all foreign securities are denominated in foreign currency. In fact, out of the developing countries in our sample, South Africa, and to a lesser extent, Poland, are the only exceptions. Notice that several developed countries have a value greater than one, which indicates that

[19] www.bis.org/publ/index.htm, tables 13A and B, and tables 15 A and B

[20] In future versions of this paper, we intend to construct closer proxies for the importance of foreign currency liabilities.

other countries issue securities in those currencies.[21] Not surprisingly, the value corresponding to the United States is the largest. More than half of the issues of foreign securities denominated in dollars are issued by countries other than the United States.[22] Switzerland follows closely behind, followed in turn by Japan and New Zealand. It is a somewhat surprising, on the other hand, to find that Norway and Sweden issue most of their foreign securities in foreign currencies.

Figures 16, 17 and 18 present the relationship between this index and the three measures discussed in section 2: the level of reserves, the relative volatility of exchange rates and reserves, and the relative volatility of exchange rates and interest rates. Figure 16 shows a very strong negative association between the ability of a country to borrow in its own currency and the stock of international reserves. The correlation between the two variables is –0.53, and it is significant at the 1% level. It is interesting to divide the scatter diagram into four quadrants. For this, we consider countries to have an ability to borrow when their index is above 0.2. (i.e., Greece and those ranked above Greece in figure 16). Likewise, we define countries with high reserves as those in which the ratio of reserves to M2 is above 0.2. Out of the 11 countries with ability to borrow in their own currency, 9 have low level of reserves. The only exceptions are Poland and Greece. Out of the other 19 countries only three of them, Sweden, India and the Dominican Republic, keep low levels of international reserves. This suggests that countries that are unable to borrow in their own currency, which presumably have higher levels of foreign currency liabilities, find it important to keep large stock of reserves in order to defend their currency.

Figures 17 shows the relationship between the ability to borrow in the domestic currency and the relative volatility of exchange rates and reserves. The relationship is positive and quite strong. The correlation is 0.67, and significant at the 1% level. Here again, out of the 11 countries that borrow in their own currency, only 2, Greece and Poland, show a strong tendency to intervene in the foreign exchange market. In contrast, 15 out of 19 countries unable to borrow in their own currency intervene heavily in the foreign exchange market. Results are fairly similar when we consider intervention using interest rates instead of reserves (Figure 18). In this case, the correlation is 0.49, again significant at the 1% level.

In sum, our results suggest that the ability to borrow in domestic currency is an important determinant of the degree to which policymakers are able to show what Michael Mussa has called "benign neglect" regarding the behavior of the exchange rate. Those unable to borrow in their own currency (which will likely have larger stocks of foreign currency denominated liabilities) will take into consideration the possible effects of depreciations on those exposed to exchange rate risk when carrying out exchange rate and monetary policy.

3.3 Pass-through, foreign currency liabilities and "fear of floating"[23]

[21] More precisely, a value greater than one for a given country means that the stock of foreign securities denominated in a country's currency issued by other countries is greater than the stock of foreign securities issued in the country in question in currencies other than its own.

[22] This represents a lower bound, since part of the foreign securities issued by the US may be denominated in other currencies.

[23] The term "fear of floating" was coined by Guillermo Calvo (1999a and b) to indicate the fear of policymakers to let the exchange rate float freely. For an analysis of the determinants of "fear of floating" in a specific country, see the study on Peru by Morón et al (1999).

The previous sections focused on the role of the exchange rate pass-through and that of foreign currency liabilities when considered independently. Here we bring them together into the analysis of the differences in behavior among floaters. We analyze the reasons for these differences in two ways. First, we construct a contingency table to study the behavior of countries according to whether or not they are able to borrow abroad in their own currency, and whether or not they have high exchange rate pass-through. Second, we perform simple regression analysis including both potential factors together.

For the contingency table, we classify countries as being able to borrow in their own currency if the ratio of foreign securities in their currency to their total issues of foreign securities is above 0.2. Likewise, we classify countries as having high pass-through if the value of the index exceeds 0.4. This divides our sample of floaters into the four groups illustrated in table 3. For each group, we report the average values of our three dependent variables: the level of reserves, the relative volatility of exchange rates *vis a vis* reserves, and the relative volatility of exchange rates *vis a vis* interest rates. In order to account for the special characteristics of G-3 countries, we report the results both including and excluding these three countries, all of which belong to the lower-right quadrant.

Table 3
Contingency Table
(Threshold pass through = 0.4)

Ability to borrow in own currency

Pass-through		**NO**	**YES**
	HIGH	No. of countries = 6 RES/M2 = 0.25 Rel vol. ER/RES = 1.32 Rel vol ER/IR = 19.62	No. of countries = 1 RES/M2 = 0.45 Rel vol. ER/RES = 0.42 Rel vol ER/IR = 14.58
	LOW	No. of countries = 11 RES/M2 = 0.34 Rel vol. ER/RES = 1.36 Rel vol ER/IR = 17.06	<u>Including G-3</u> No. of countries = 9 RES/M2 = 0.09 Rel vol. ER/RES = 9.56 Rel vol ER/IR = 94.80 <u>Excluding G-3</u> No. of countries = 6 RES/M2 = 0.11 Rel vol. ER/RES = 5.56 Rel vol ER/IR = 41.40

The upper right cell should not be taken very seriously, since there is only one country in it, Poland. Once we consider this, the table shows quite clearly that the only countries that seem to behave differently are those in the lower-right quadrant, i.e. those with low pass through and with “desirable”

currencies. Whether G-3 countries are included or not in the analysis, countries in this quadrant have much lower stock of reserves, and show less of a tendency to intervene in foreign exchange markets through either changes in reserves or movements in interest rates. In all the variables considered, differences with other groups are statistically significant. Surprisingly, countries belonging to the two quadrants on the left look remarkably similar in every dimension, except perhaps for slight differences in the level of reserves. This suggests that if a country does not have the ability to borrow abroad in its own currency, it will tend to experience "fear of floating" regardless of the level of exchange rate pass-through. In addition (and again disregarding the case of Poland) the table suggests that the ability to borrow abroad is a very important determinant of "fear of floating" behavior.

While the threshold used for the "ability to borrow" index is comes naturally out of figure 11, the threshold used for the pass-through is more ad-hoc. For this reason, it makes sense to consider a different threshold and analyze whether the results are the same. In table 4, we consider a different threshold. A country is now classified as high pass through if the index is above 0.18. This value was chosen in order to have sufficient countries in each quadrant (we now have 4 countries at least in each). The contingency table now looks like this:

Table 4
Contingency Table
(Threshold pass-through =0.18)

Ability to borrow in own currency

		NO	**YES**
Pass-through	**HIGH**	No. of countries = 12 RES/M2 = 0.29 Rel vol. ER/RES = 1.06 Rel vol ER/IR = 20.02	No. of countries = 4 RES/M2 = 0.23 Rel vol. ER/RES = 2.54 Rel vol ER/IR = 38.15
	LOW	No. of countries = 5 RES/M2 = 0.37 Rel vol. ER/RES = 2.02 Rel vol ER/IR = 13.02	<u>Including G-3</u> No. of countries = 6 RES/M2 = 0.057 Rel vol. ER/RES = 12.71 Rel vol ER/IR = 119.2 <u>Excluding G-3</u> No. of countries = 3 RES/M2 = 0.058 Rel vol. ER/RES = 7.86 Rel vol ER/IR = 36.81

For the most part, this contingency table suggests a similar story. Among the top quadrants, the only variable that is significantly different is the relative volatility of exchange rates and interest rates. Intervention with reserves is also larger in the upper right side, but the difference is not statistically significant. In the comparison between the two left quadrants, the striking resemblance present in table

3 is gone, but none of the variables are significantly different. The lower right quadrant continues to be significantly different from all others in all dimensions, except that intervention with interest rates is similar to the quadrant above in the case in which G-3 countries are excluded. This reinforces the results of the previous table: floating countries that are unable to borrow abroad in their own currencies experience similar degree of aversion to exchange rate volatility. Table 4, in addition, suggests that pass-through is an important consideration for countries that are able to borrow abroad in their own currency, and that the value of this ability is somewhat limited when pass through is high. In sum, both determinants seem to a certain extent to be "necessary conditions" for floating freely, but the ability to borrow abroad appears to be more important, and more robust.

To test these hypotheses more formally, we run two sets of regressions where we explain the levels of reserves and the relative volatility of devaluation using the share of external debt in own currency and the pass-through from exchange rate to prices. The first column of table 5 shows that the ability of borrowing abroad is positively and significantly correlated with the volatility of the exchange rate and negatively correlated with the level of reserves. At the same time, the coefficient attached to the pass-through index, while having the expected sign (i.e., countries with high pass-through tend to intervene more in the management of the exchange rate, both with reserves and interest rates, and have higher levels of reserves), is never statistically significant. The second column of Table 5 checks if our results are driven by the difference between industrial and developing countries by augmenting the regression with an industrialized country dummy and finds no significant difference with respect to the results of the first column.

One problem with the regressions discussed above is that many countries do not have external liabilities in their own currency. The presence of many zeros in the first explanatory variables may cause non-linearities in its relationship with the volatility of the exchange rate and the level of reserves. To tackle this problem we substitute the share of external liabilities in own currency with a dummy that assumes value 1 when this share is bigger than 0.2. Column 3 of Table 5 shows that the positive relationship between exchange rate volatility and ability to borrow abroad in own currency and the negative relationship between the latter variable and the level of reserves are robust to this new specification. The coefficient looses its explanatory power when we augment the regression with the industrialized country dummy. It should be pointed out that this is due to the effect of one country (Poland) that even though it behaves like an emerging market seems to have a relative high share of its external debt in its national currency. If we drop Poland from the sample we find the usual result that countries that are not able to borrow abroad in their own currency tend to have low exchange rate volatility and high levels of reserves.

Table 5

	Volatility of exchange rate over volatility of reserves							
Ability to borr. own curr.	6.68	***	6.2	***				
	(3.74)		(3.09)					
Pass-Through	-1.8		-1.12		-3.74		-2.77	
	(-0.54)		(-0.31)		(-1.0)		(-0.68)	
Dummy for ability to borrow in own currency					6.41	**	5.26	*
					(2.41)		(1.69)	
Dummy Ind. Countries			1.56				2.22	
			(0.56)				(0.66)	
C	2.13		1.43		9.36	***	7.40	*
	(1.12)		(0.62)		(4.42)		(2.01)	
R^2	0.44		0.44		0.28		0.30	
Obs	27		27		27		27	
	Volat. of exchange rate over volatility of interest rate							
Ability to borr. own curr.	53.51	**	40.3	*				
	(2.50)		(1.72)					
Pass-Through	-12.15		7.46		-21.58		-2.64	
	(-0.30)		(0.17)		(-0.5)		(-0.06)	
Dummy for ability to borrow in own currency					63.71	**	41.3	
					(2.20)		(1.21)	
Dummy Ind. Countries			42.9				43.07	
			(1.32)				(1.19)	
C	27.17		8.02		90.96	***	52.83	
	(1.19)		(0.30)		(3.9)		(1.34)	
R^2	0.25		0.31		0.22		0.26	
Obs	27		27		27		27	
	Reserves over M2							
Ability to borr. own curr.	-0.16	**	-0.11	*				
	(-2.85)		(-1.93)					
Pass-Through	-0.042		-0.11		-0.01		-0.08	
	(-0.40)		(-0.99)		(-0.13)		(-0.71)	
Dummy for ability to borrow in own currency					-0.19	**	-0.11	
					(-2.47)		(-1.26)	
Dummy Ind. Countries			-0.14				-0.15	
			(-0.174)				(-1.60)	
C	0.32		0.38	***	0.13	**	0.26	**
	(5.39)		(5.65)		(2.14)		(2.58)	
R^2	0.27		0.35		0.22		0.3	
Obs	27		27		27		27	

4. **Conclusions** (to be written)

References

De Brouwer, Gordon and Neil Ericsson (1995), "Modelling Inflation in Australia," Reserve Bank of Australia Research Discussion Paper 9510.

Calvo, Gulliermo (1999a), "On Dollarization," mimeo, University of Maryland at College Park.

Calvo, Gulliermo (1999b), "Capital Market and the Exchange Rate, with Special Reference to the Dollarization Debate in Latin America," mimeo, University of Maryland at College Park.

Calvo, Gulliermo and Carmen Reinhart (1999), "Capital Flow Reversals, The Exchange Rate Debate, and Dollarization," *Finance and Development*, September 1999.

Fernández-Arias, Eduardo and Ernesto Talvi, (1999), "Devaluation or Deflation? Adjustment Under Liability Dollarization," mimeo, Inter-American Development Bank.

Frieden, Jeff, Piero Ghezzi and Ernesto Stein (1999), "The Political Economy of Exchange Rate Policy in Latin America", mimeo, Inter-American Development Bank.

Garcés Diáz, Daniel (1999), "Determinación del Nivel de Precios y la Dinámica Inflacionaria en México," Banco de México, Documento de Investigación Económica.

Hausmann, Ricardo (1999a), "Should There Be Five Currencies or One Hundred and Five?" *International Affairs*, 116: 65-79.

Hausmann, Ricardo (1999b), "Latin America: No Fireworks, NoCrisis?" mimeo, Inter-American Development Bank.

Levy Yeyati, Eduardo and Federico Sturzenegger (1999), "Classifying Exchange Rate Regimes: Deeds vs. Words," mimeo, Universidad Torcuato di Tella.

McKinnon, R. (1963), "Optimum Currency Areas". *American Economic Review*. 53: 717-725.

Morón, Eduardo, Edwin Goñi, and Arturo Ormeño (1999), "Central Bankers' Fear of Floating: The Peruvian Evidence," mimeo, Universidad del Pacifico.

Stein, Ernesto, Ernesto Talvi, Ugo Panizza, and Gustavo Marquez (1999), "Evaluando la Dolarización: Una Aplicación a Países de América Central y del Caribe," mimeo, Inter-American Development Bank.

Appendix

Table 1A: Absolute and relative volatilities, and country rankings

	Devaluation		Reserves		Interest Rate		Rel. Volatilities ER/Res		Rel. Volatilities ER/IR	
Country	(1) Std. Dev.	Ranking	(2) Std. Dev.	Ranking	(3) Std. Dev.	Ranking	(1)/(2)	Ranking	(1)/(3)	Ranking
Australia	0.030	12	0.0043	26	0.0003	25	6.91	5	90.21	3
Brazil	0.067	3	0.0231	16	0.0056	3	2.92	8	12.13	24
Canada	0.017	24	0.0050	24	0.0007	22	3.37	7	23.46	12
Chile	0.015	26	0.0357	8	0.0019	11	0.42	25	7.96	27
Colombia	0.029	13	0.0317	11	0.0035	7	0.93	19	8.48	26
Czech	0.034	8	0.0269	14	0.0024	8	1.26	16	13.97	20
Dominican Rep.	0.024	18	0.0152	19	0.0021	9	1.58	14	11.57	25
Germany	0.027	14	0.0095	23	0.0002	29	2.84	9	157.91	2
Greece	0.023	19	0.0587	3	0.0009	21	0.39	28	25.02	9
Guatemala	0.013	28	0.0320	10	0.0005	24	0.42	26	24.94	10
India	0.015	27	0.0124	22	0.0041	6	1.21	17	3.70	29
Indonesia	0.194	1	0.0899	1	0.0083	1	2.15	13	23.38	13
Israel	0.026	16	0.0342	9	0.0012	19	0.76	21	21.38	15
Jamaica	0.005	30	0.0200	17	0.0020	10	0.27	30	2.75	30
Japan	0.044	6	0.0014	28	0.0001	30	30.45	1	377.26	1
Korea	0.064	4	0.0477	5	0.0045	4	1.35	15	14.14	19
Mexico	0.030	11	0.0358	7	0.0043	5	0.84	20	6.99	28
New Zealand	0.033	9	0.0026	27	0.0014	18	12.68	4	23.78	11
Norway	0.019	21	0.0537	4	0.0016	14	0.36	29	12.34	23
Paraguay	0.019	20	0.0316	12	0.0016	15	0.62	23	12.38	22
Peru	0.016	25	0.0315	13	0.0012	20	0.51	24	13.13	21
Philippines	0.054	5	0.0234	15	0.0014	17	2.32	11	38.50	8
Poland	0.026	15	0.0630	2	0.0018	12	0.42	27	14.58	18
Singapore	0.030	10	0.0437	6	0.0015	16	0.69	22	20.00	16
South Africa	0.036	7	0.0147	20	0.0016	13	2.47	10	22.80	14
Sweden	0.019	22	0.0196	18	0.0003	26	0.98	18	62.59	5
Switzerland	0.011	29	0.0049	25	0.0003	27	2.27	12	40.43	7
Thailand	0.087	2	0.0132	21	0.0058	2	6.62	6	15.16	17
United Kingdom	0.025	17	0.0014	29	0.0005	23	17.95	3	46.54	6
United States	0.018	23	0.0009	30	0.0003	28	19.38	2	69.63	4

Figure 1

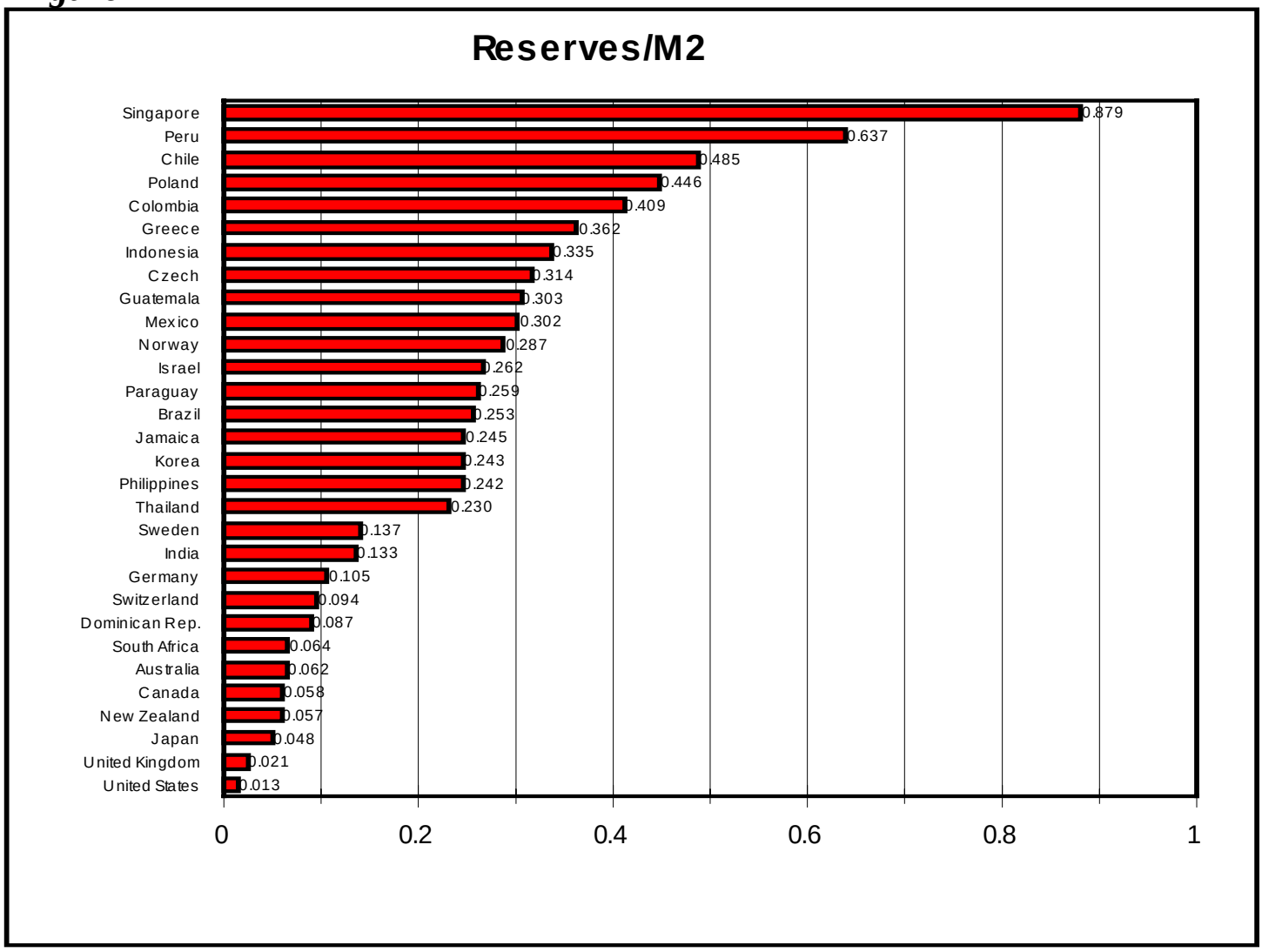

Reserves/M2
Singapore 0.879
Peru 0.637
Chile 0.485
Poland 0.446
Colombia 0.409
Greece 0.362
Indonesia 0.335
Czech 0.314
Guatemala 0.303
Mexico 0.302
Norway 0.287
Israel 0.262
Paraguay 0.259
Brazil 0.253
Jamaica 0.245
Korea 0.243
Philippines 0.242
Thailand 0.230
Sweden 0.137
India 0.133
Germany 0.105
Switzerland 0.094
Dominican Rep. 0.087
South Africa 0.064
Australia 0.062
Canada 0.058
New Zealand 0.057
Japan 0.048
United Kingdom 0.021
United States 0.013
0
0.2
0.4
0.6
0.8
1

Figure 2

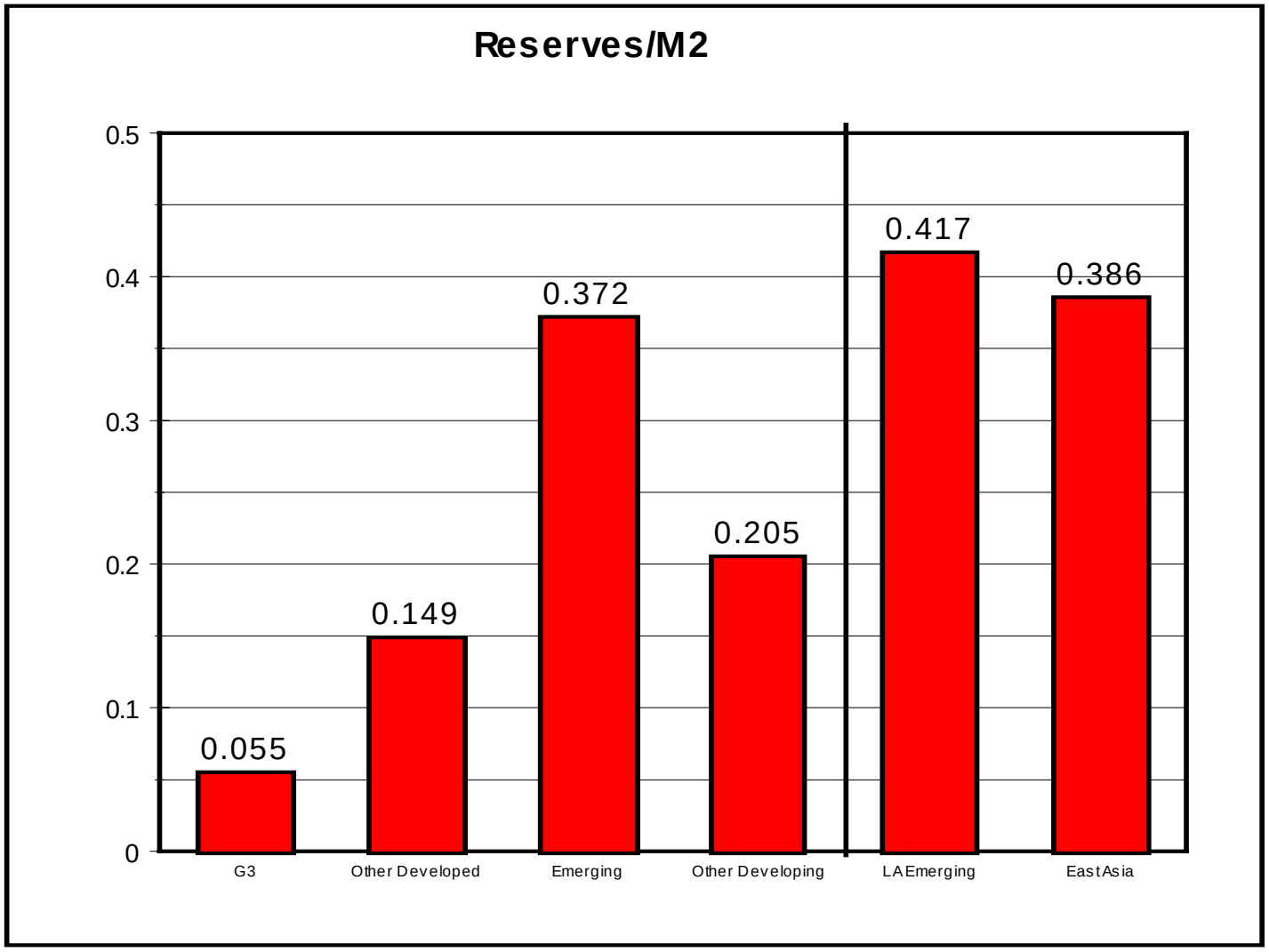

Reserves/M2
0.5
0.4
0.3
0.2
0.1
0
0.055
0.149
0.372
0.205
0.417
0.386
G3
Other Developed
Emerging
Other Developing
LA Emerging
East Asia

Figure 3

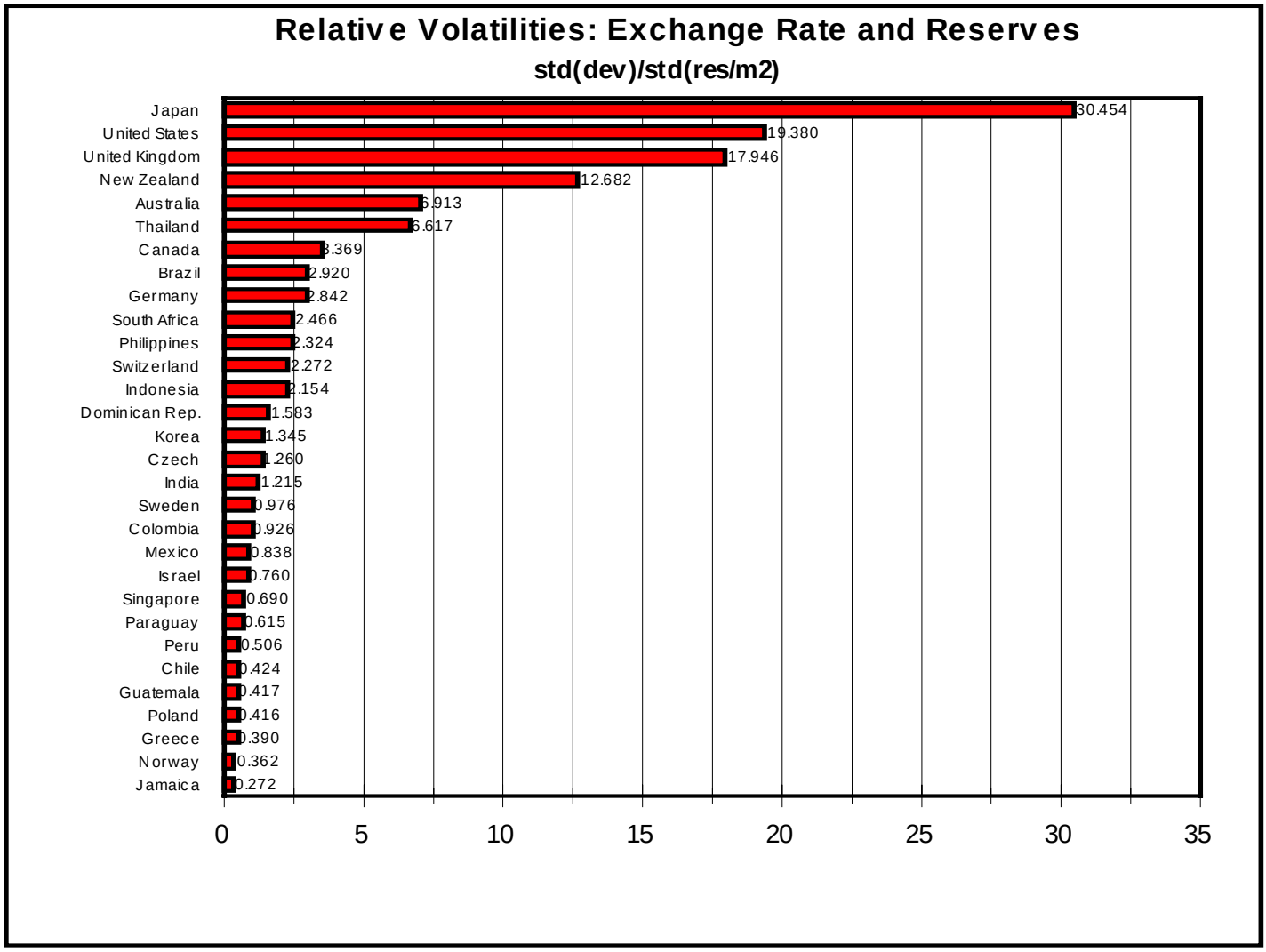

Relative Volatilities: Exchange Rate and Reserves
std(dev)/std(res/m2)
Japan 30.454
United States 19.380
United Kingdom 17.946
New Zealand 12.682
Australia 6.913
Thailand 6.617
Canada 3.369
Brazil 2.920
Germany 2.842
South Africa 2.466
Philippines 2.324
Switzerland 2.272
Indonesia 2.154
Dominican Rep. 1.583
Korea 1.345
Czech 1.260
India 1.215
Sweden 0.976
Colombia 0.926
Mexico 0.838
Israel 0.760
Singapore 0.690
Paraguay 0.615
Peru 0.506
Chile 0.424
Guatemala 0.417
Poland 0.416
Greece 0.390
Norway 0.362
Jamaica 0.272
0
5
10
15
20
25
30
35

Figure 4

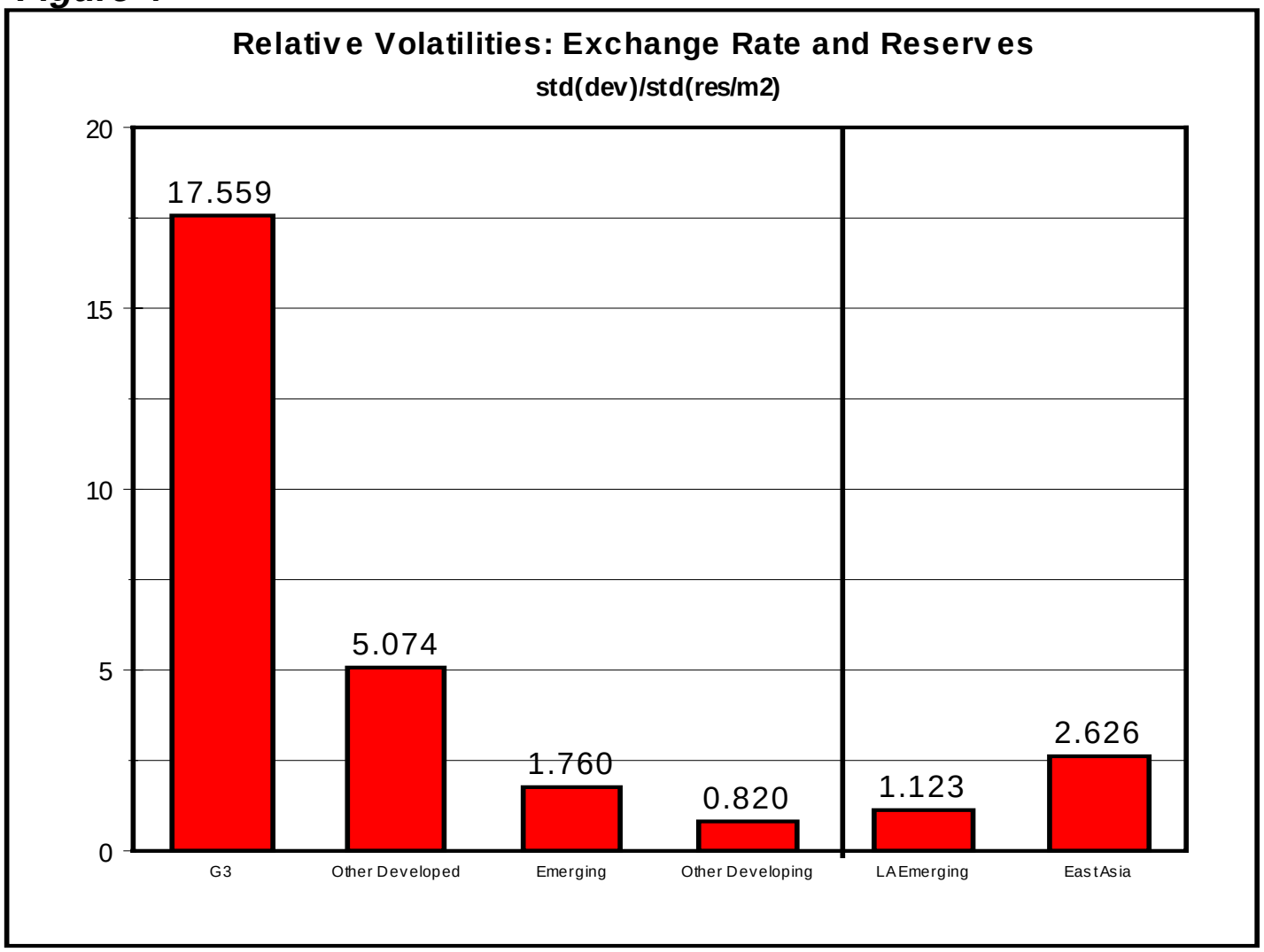

Relative Volatilities: Exchange Rate and Reserves
std(dev)/std(res/m2)
20
15
10
5
0
17.559
5.074
1.760
0.820
1.123
2.626
G3
Other Developed
Emerging
Other Developing
LA Emerging
East Asia

Figure 5

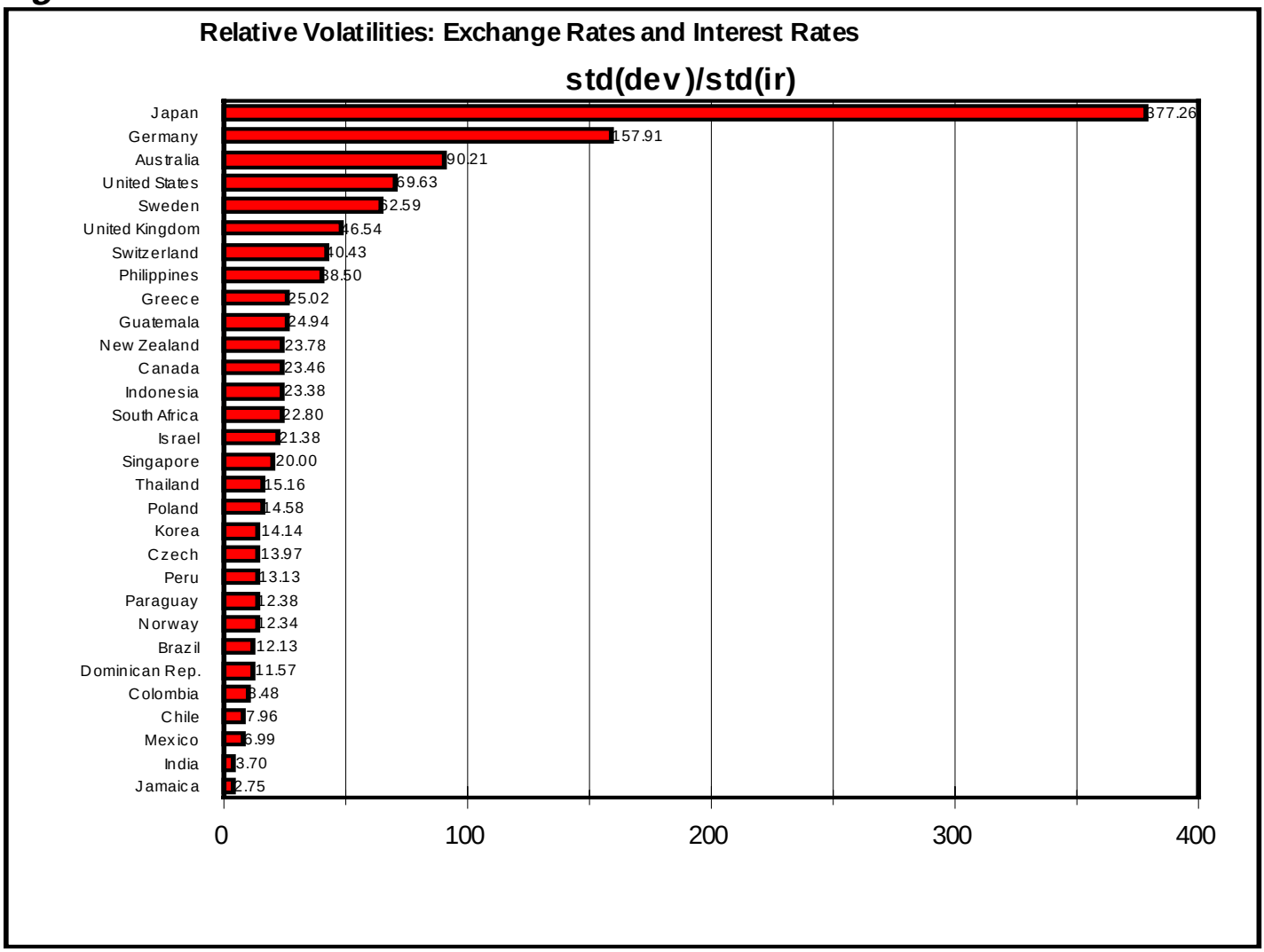

Relative Volatilities: Exchange Rates and Interest Rates
std(dev)/std(ir)
Japan 377.26
Germany 157.91
Australia 90.21
United States 69.63
Sweden 62.59
United Kingdom 46.54
Switzerland 40.43
Philippines 38.50
Greece 25.02
Guatemala 24.94
New Zealand 23.78
Canada 23.46
Indonesia 23.38
South Africa 22.80
Israel 21.38
Singapore 20.00
Thailand 15.16
Poland 14.58
Korea 14.14
Czech 13.97
Peru 13.13
Paraguay 12.38
Norway 12.34
Brazil 12.13
Dominican Rep. 11.57
Colombia 8.48
Chile 7.96
Mexico 6.99
India 3.70
Jamaica 2.75
0
100
200
300
400

Figure 6

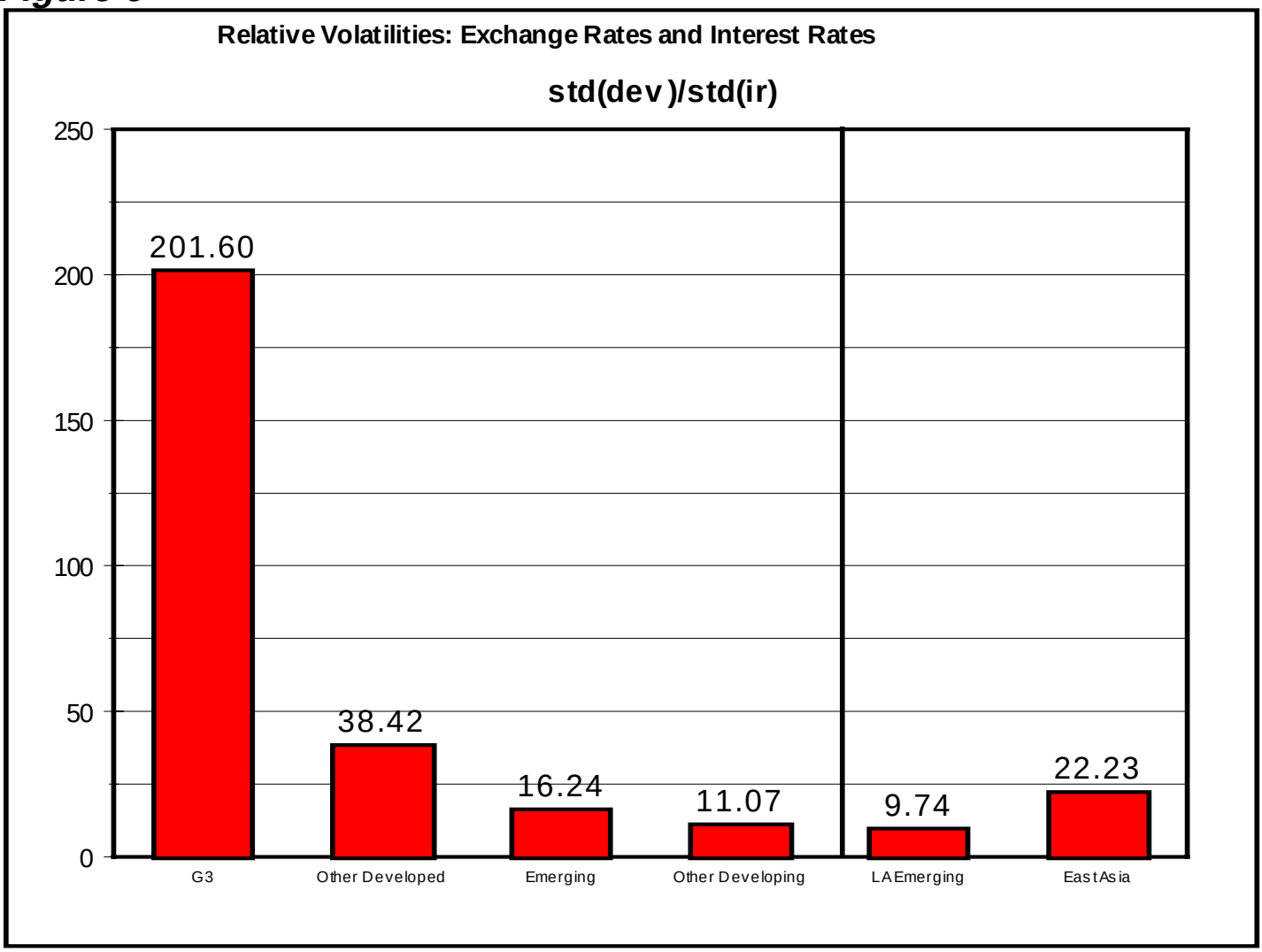

Relative Volatilities: Exchange Rates and Interest Rates
std(dev)/std(ir)
250
200
150
100
50
0
201.60
38.42
16.24
11.07
9.74
22.23
G3
Other Developed
Emerging
Other Developing
LA Emerging
East Asia

Figure 7

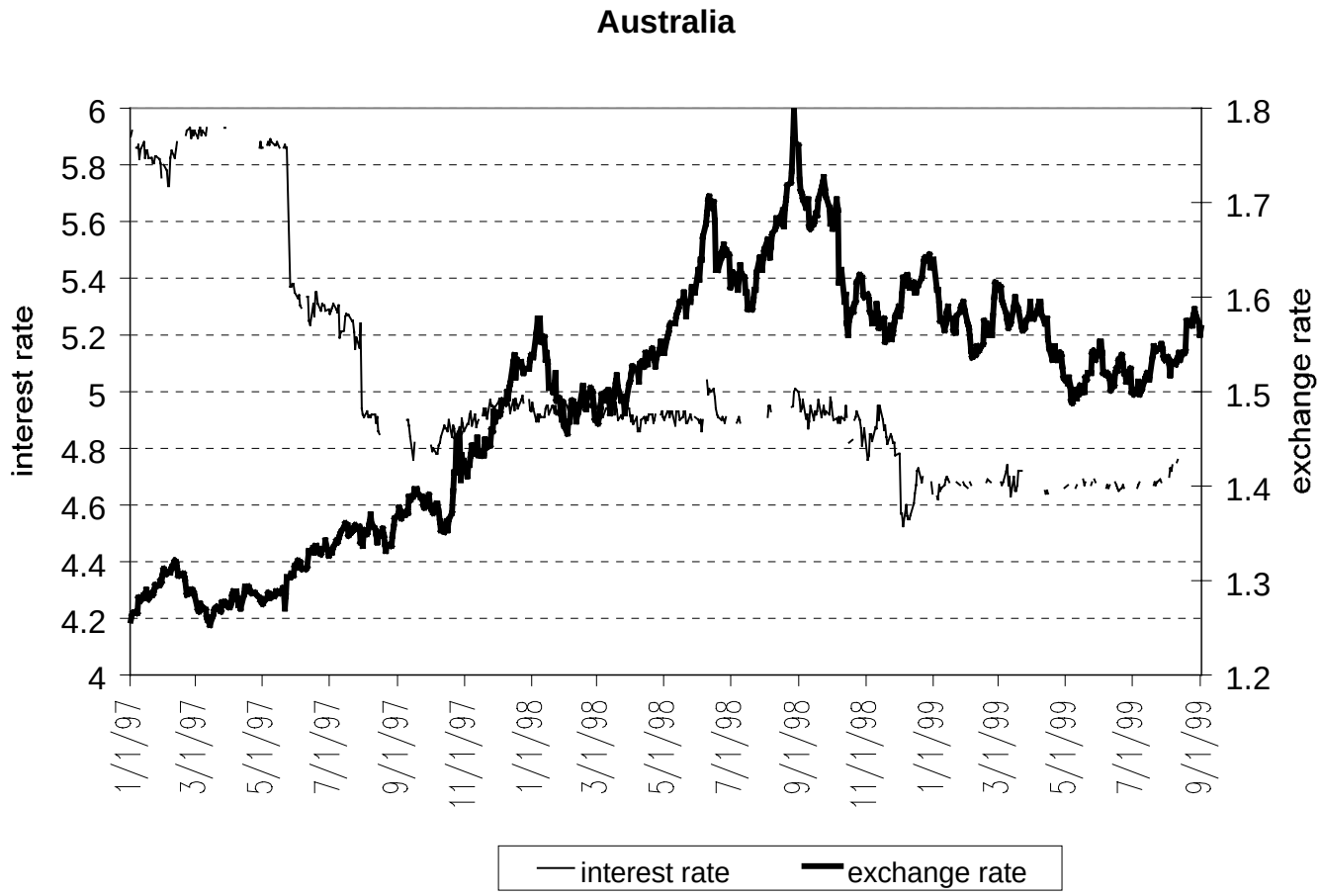

Australia
interest rate
exchange rate
6
5.8
5.6
5.4
5.2
5
4.8
4.6
4.4
4.2
4
1.8
1.7
1.6
1.5
1.4
1.3
1.2
1/1/97
3/1/97
5/1/97
7/1/97
9/1/97
11/1/97
1/1/98
3/1/98
5/1/98
7/1/98
9/1/98
11/1/98
1/1/99
3/1/99
5/1/99
7/1/99
9/1/99
interest rate
exchange rate

Figure 8

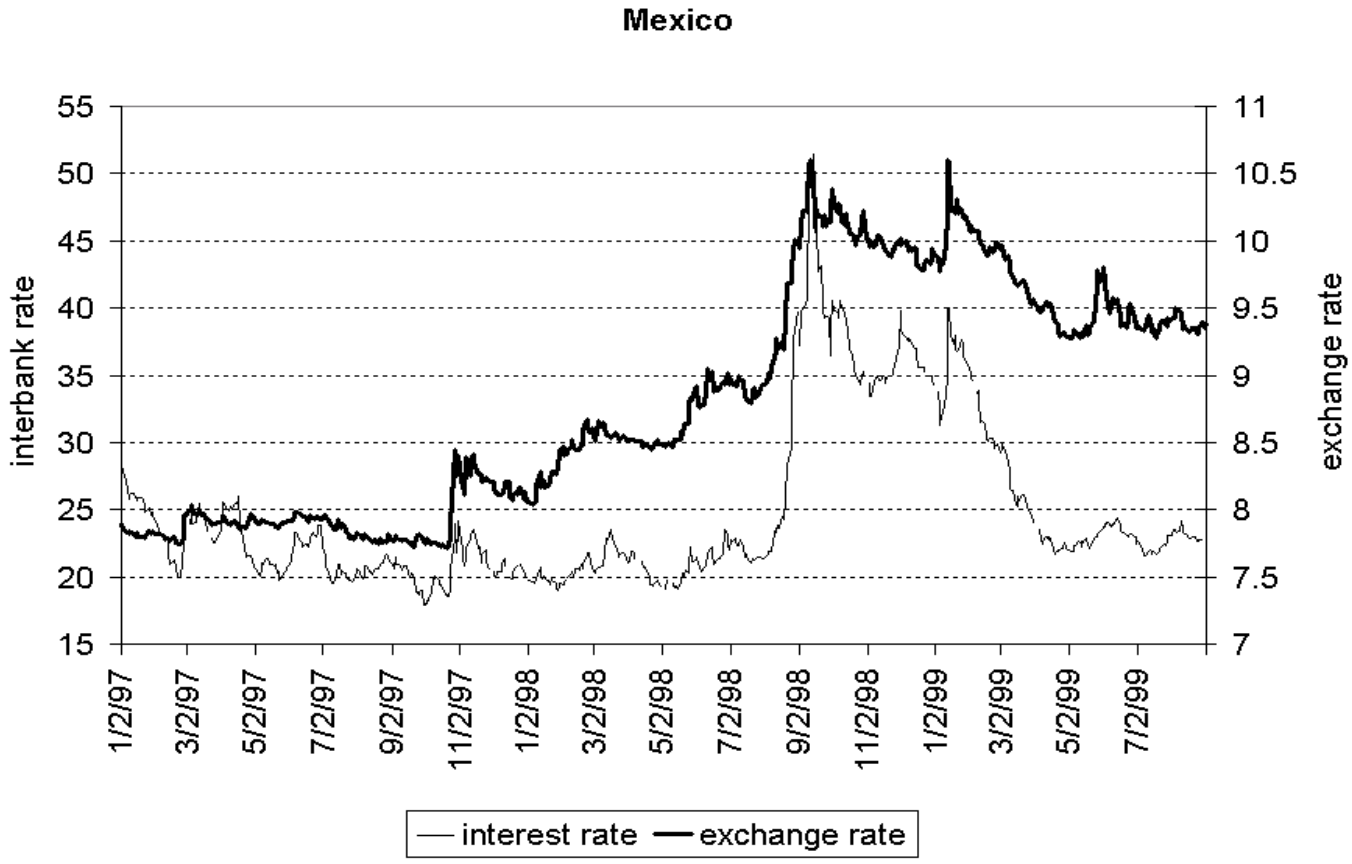

Mexico
interbank rate
exchange rate
55
50
45
40
35
30
25
20
15
11
10.5
10
9.5
9
8.5
8
7.5
7
1/2/97
3/2/97
5/2/97
7/2/97
9/2/97
11/2/97
1/2/98
3/2/98
5/2/98
7/2/98
9/2/98
11/2/98
1/2/99
3/2/99
5/2/99
7/2/99
interest rate
exchange rate

Figure 9

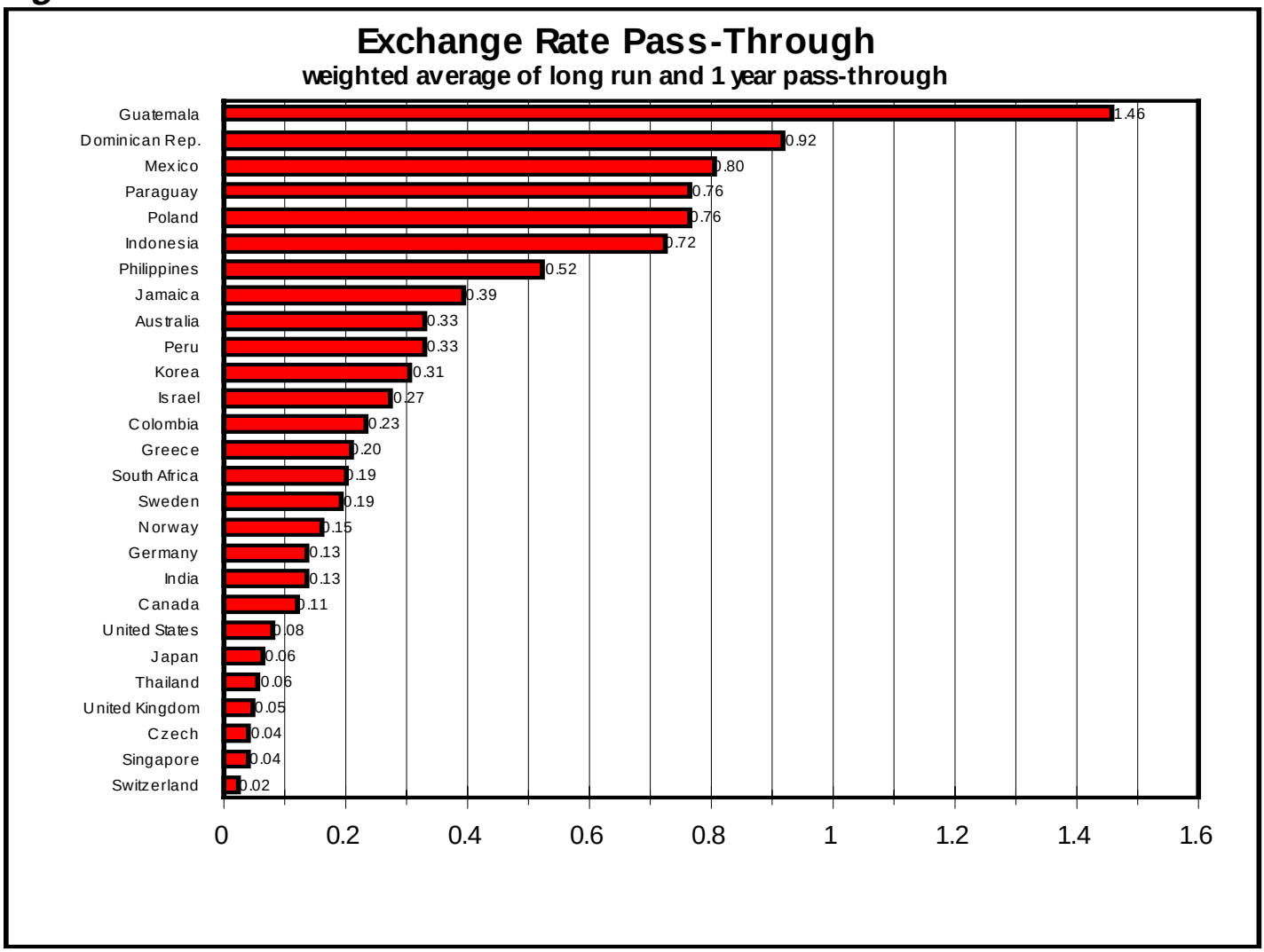

Exchange Rate Pass-Through
weighted average of long run and 1 year pass-through
Guatemala 1.46
Dominican Rep. 0.92
Mexico 0.80
Paraguay 0.76
Poland 0.76
Indonesia 0.72
Philippines 0.52
Jamaica 0.39
Australia 0.33
Peru 0.33
Korea 0.31
Israel 0.27
Colombia 0.23
Greece 0.20
South Africa 0.19
Sweden 0.19
Norway 0.15
Germany 0.13
India 0.13
Canada 0.11
United States 0.08
Japan 0.06
Thailand 0.06
United Kingdom 0.05
Czech 0.04
Singapore 0.04
Switzerland 0.02
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6

Figure 10

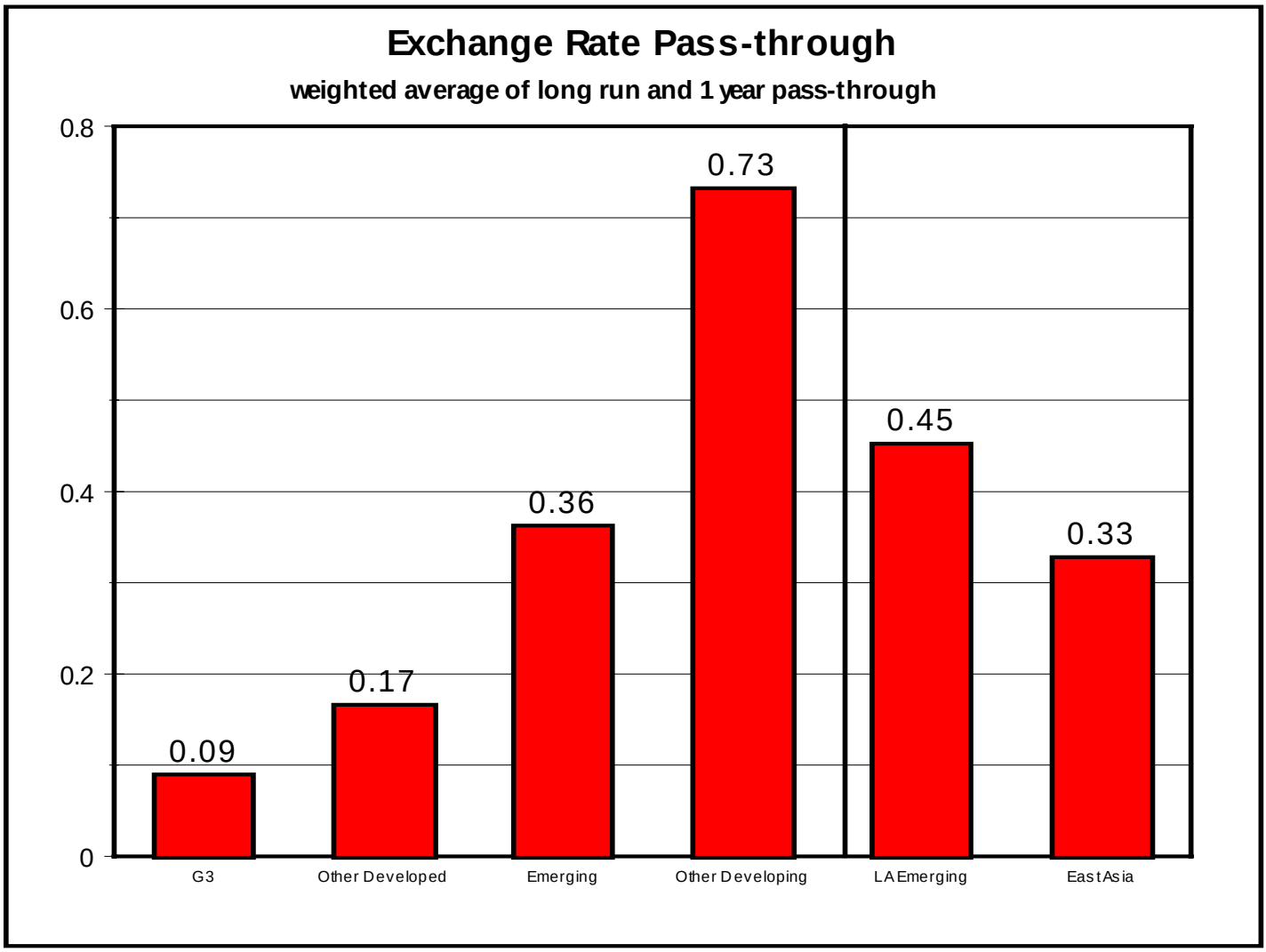

Exchange Rate Pass-through
weighted average of long run and 1 year pass-through
0.8
0.6
0.4
0.2
0
0.09
0.17
0.36
0.73
0.45
0.33
G3
Other Developed
Emerging
Other Developing
LA Emerging
East Asia

Figure 11

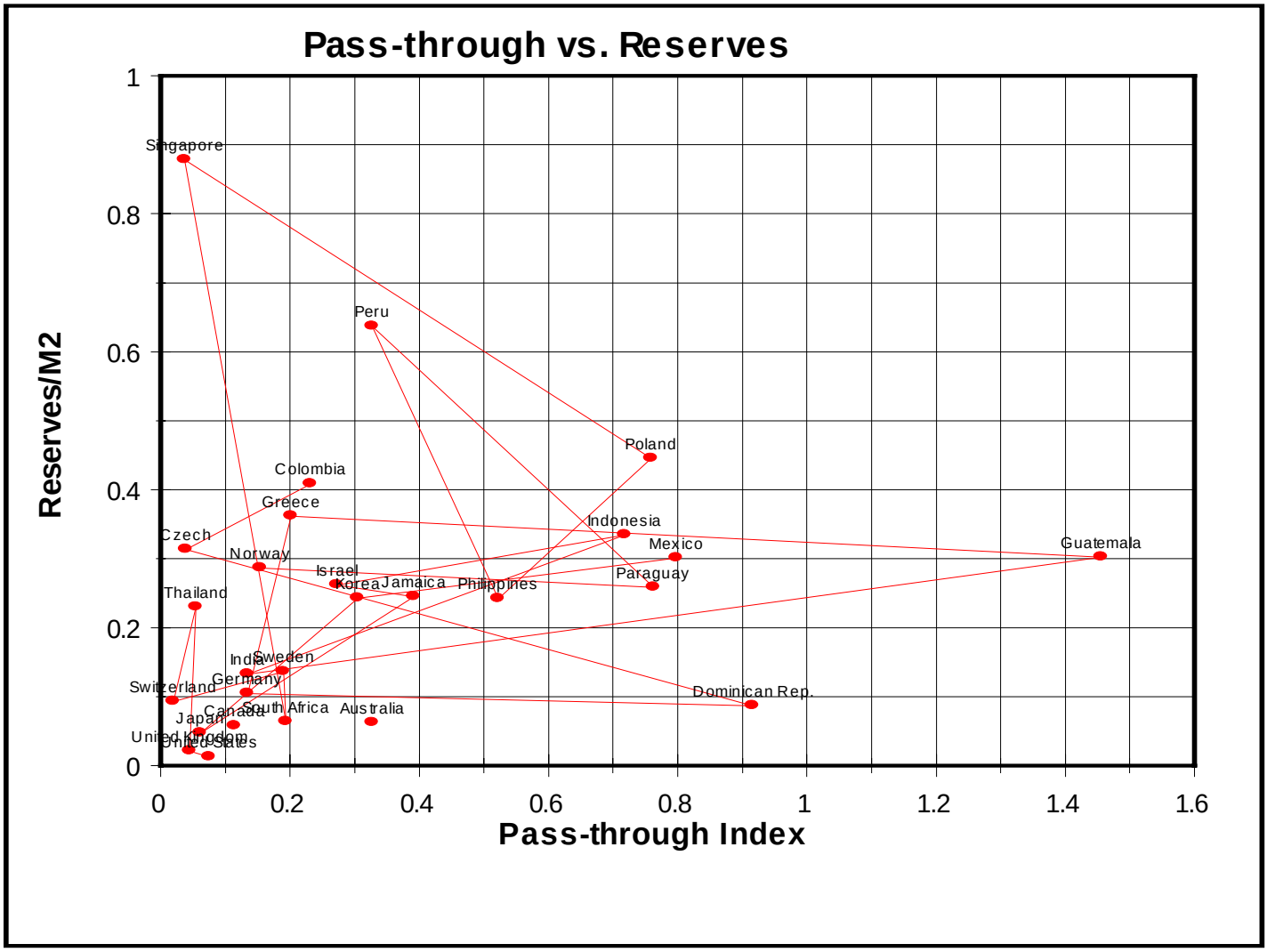

Pass-through vs. Reserves
Reserves/M2
Pass-through Index
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
Singapore
Peru
Poland
Colombia
Greece
Indonesia
Czech
Mexico
Guatemala
Norway
Israel
Korea
Jamaica
Philippines
Paraguay
Thailand
India
Sweden
Germany
Switzerland
Dominican Rep.
Canada
South Africa
Australia
Japan
United Kingdom
United States

Figure 12

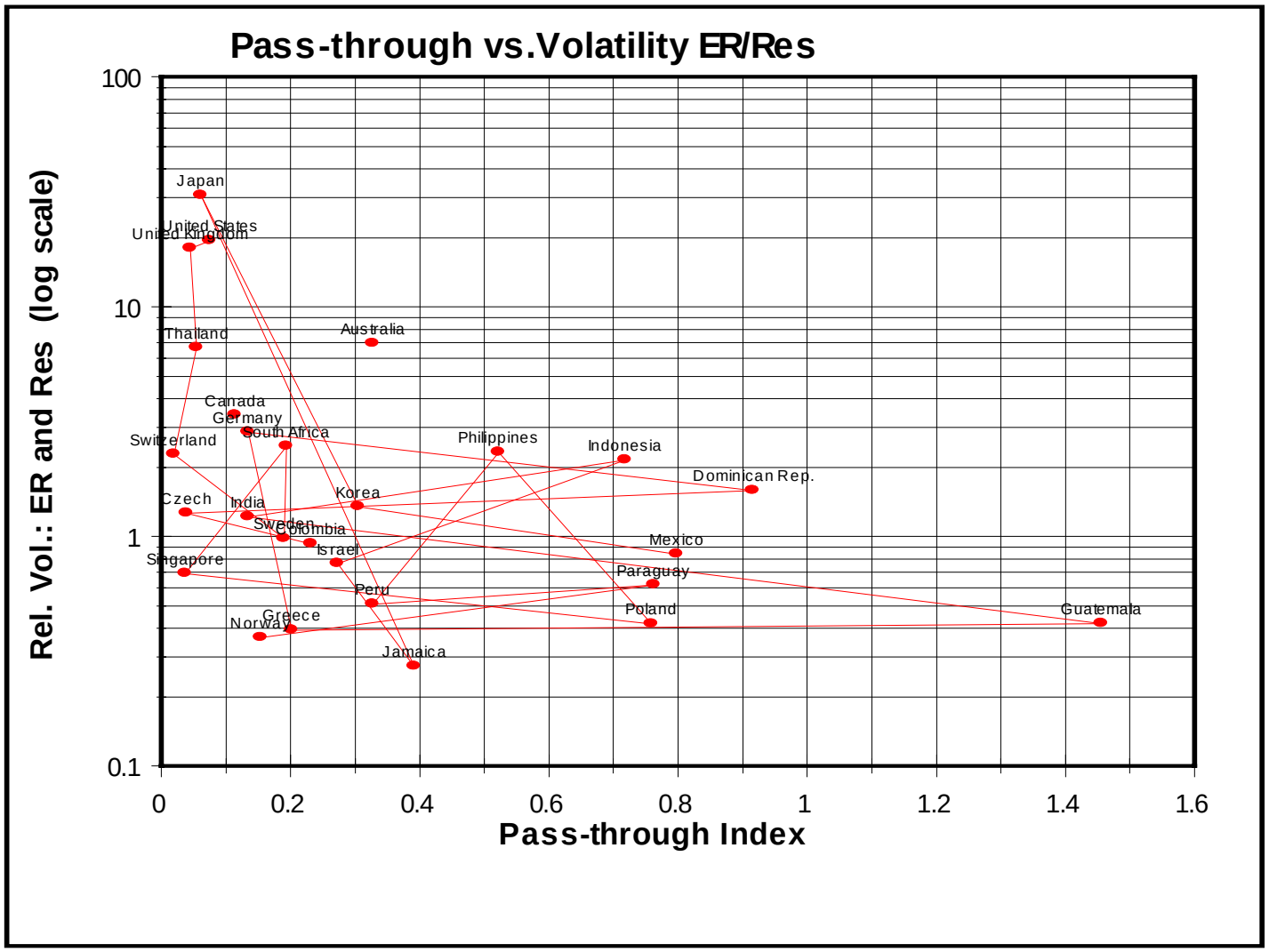

Pass-through vs.Volatility ER/Res
Rel. Vol.: ER and Res (log scale)
100
10
1
0.1
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
Pass-through Index
Japan
United States
United Kingdom
Thailand
Australia
Canada
Germany
South Africa
Switzerland
Philippines
Indonesia
Dominican Rep.
Korea
Czech
India
Sweden
Colombia
Israel
Mexico
Singapore
Paraguay
Peru
Poland
Guatemala
Greece
Norway
Jamaica

Figure 13

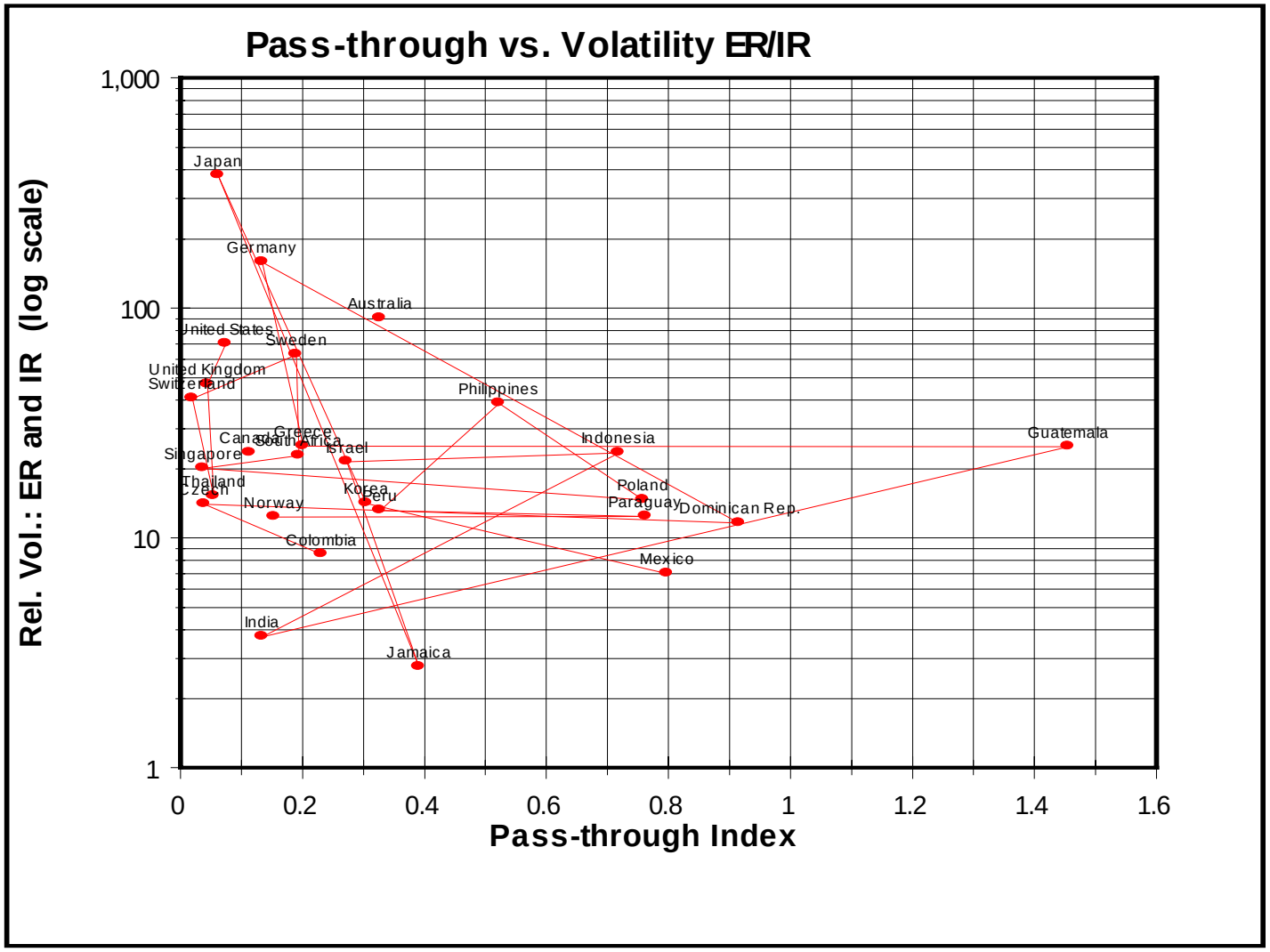

Pass-through vs. Volatility ER/IR
Rel. Vol.: ER and IR (log scale)
1,000
100
10
1
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
Pass-through Index
Japan
Germany
Australia
United States
Sweden
United Kingdom
Switzerland
Philippines
Indonesia
Guatemala
Canada
Greece
South Africa
Israel
Singapore
Thailand
Czech
Korea
Peru
Poland
Paraguay
Dominican Rep.
Norway
Colombia
Mexico
India
Jamaica

Figure 14

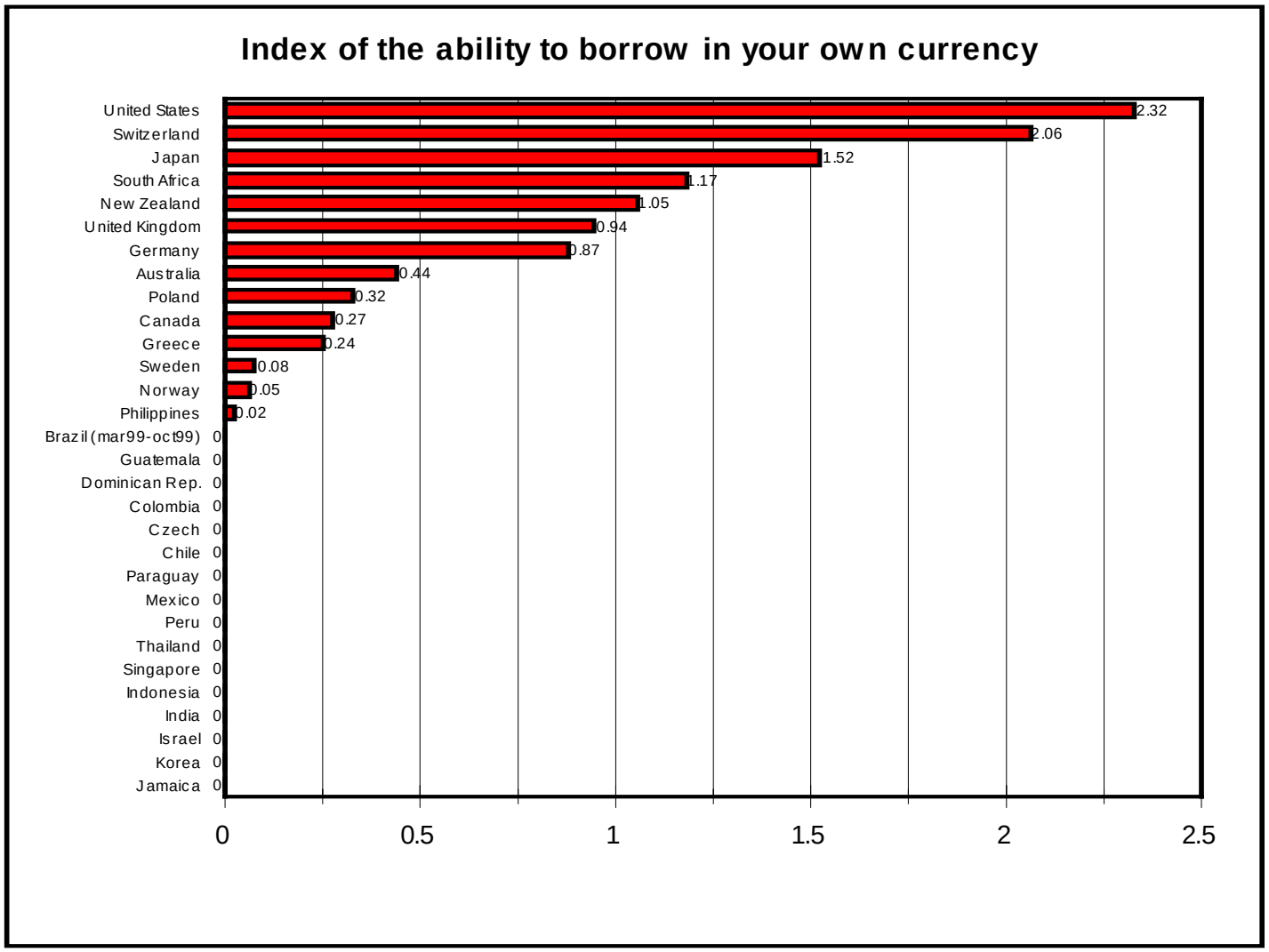

Index of the ability to borrow in your own currency
United States 2.32
Switzerland 2.06
Japan 1.52
South Africa 1.17
New Zealand 1.05
United Kingdom 0.94
Germany 0.87
Australia 0.44
Poland 0.32
Canada 0.27
Greece 0.24
Sweden 0.08
Norway 0.05
Philippines 0.02
Brazil (mar99-oct99) 0
Guatemala 0
Dominican Rep. 0
Colombia 0
Czech 0
Chile 0
Paraguay 0
Mexico 0
Peru 0
Thailand 0
Singapore 0
Indonesia 0
India 0
Israel 0
Korea 0
Jamaica 0
0
0.5
1
1.5
2
2.5

Figure 15

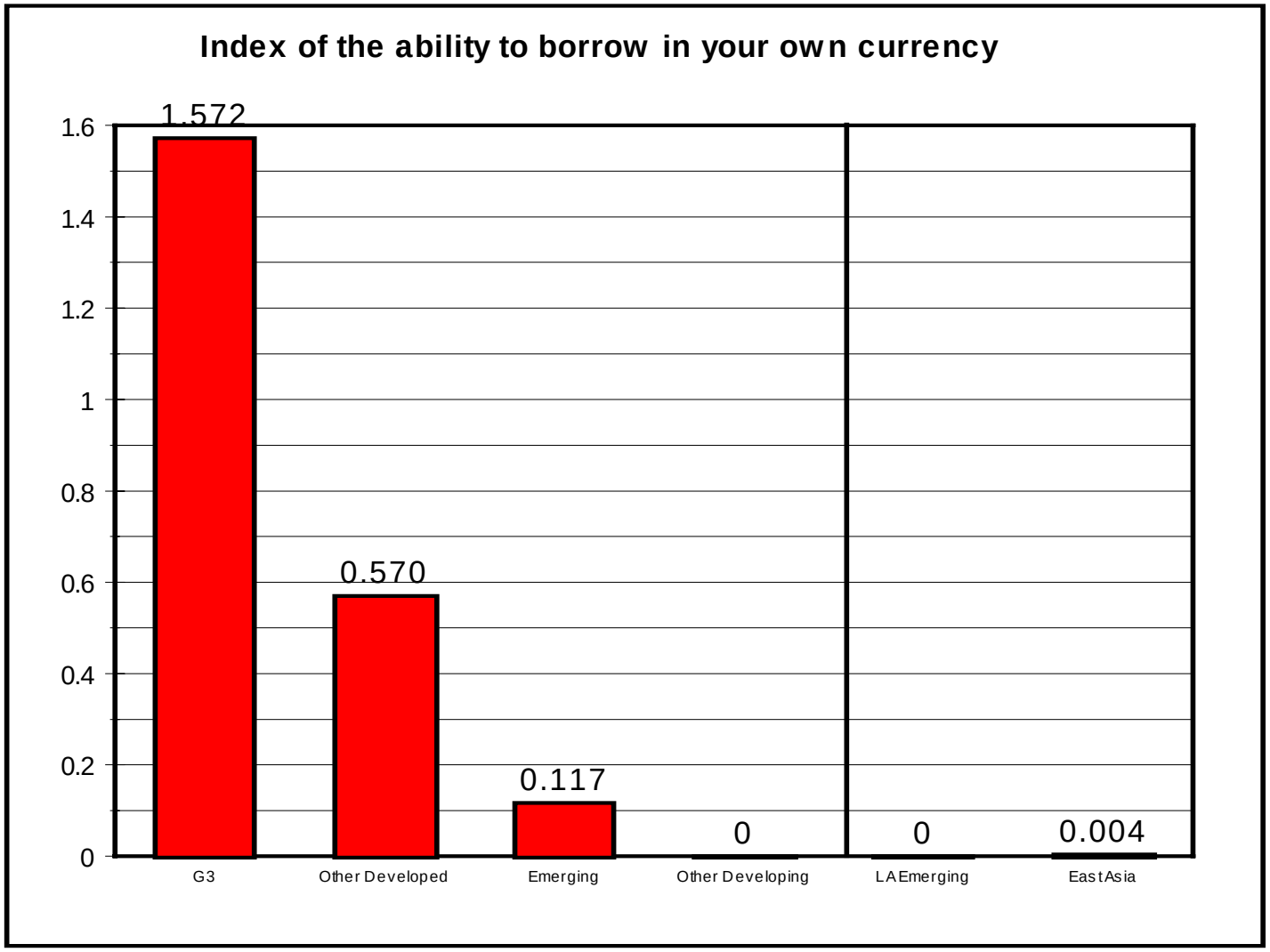

Index of the ability to borrow in your own currency
1.572
0.570
0.117
0
0
0.004
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
G3
Other Developed
Emerging
Other Developing
LA Emerging
East Asia

Figure 16

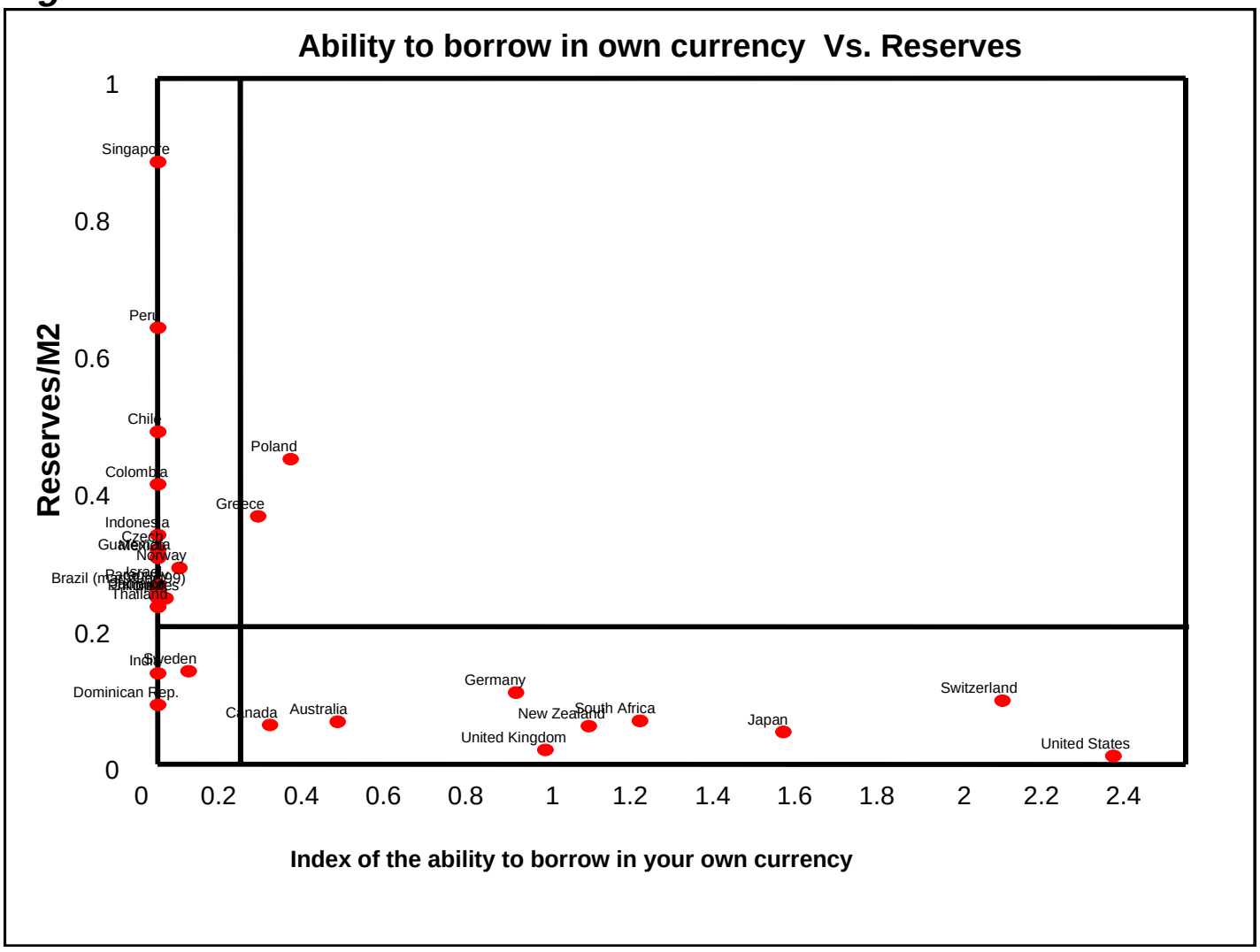

Ability to borrow in own currency Vs. Reserves
Reserves/M2
1
0.8
0.6
0.4
0.2
0
Singapore
Peru
Chile
Poland
Colombia
Greece
Indonesia
Czech
Norway
Brazil
Thailand
India
Sweden
Dominican Rep.
Canada
Australia
Germany
New Zealand
South Africa
United Kingdom
Japan
Switzerland
United States
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8
2
2.2
2.4
Index of the ability to borrow in your own currency

Figure 17

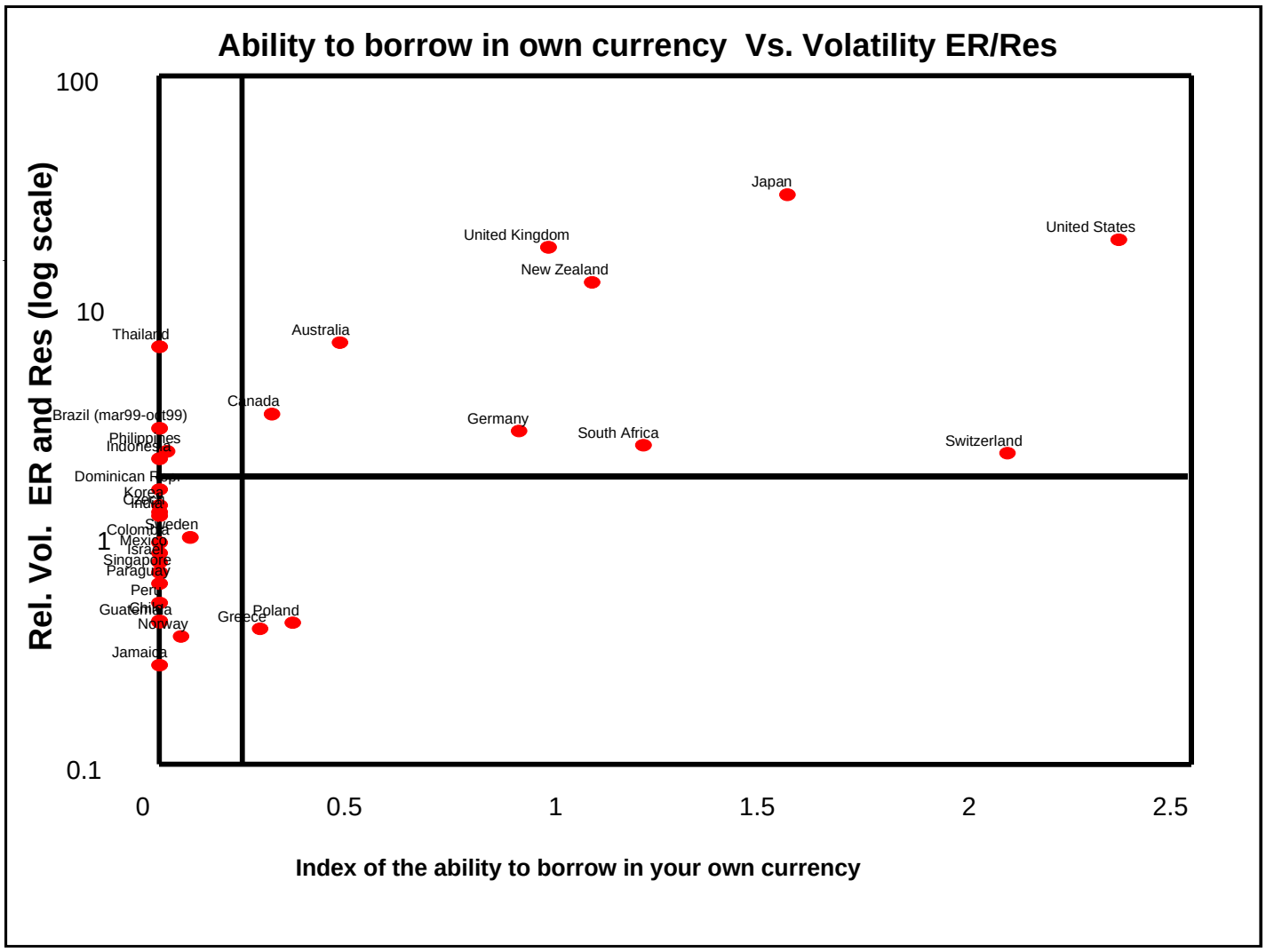
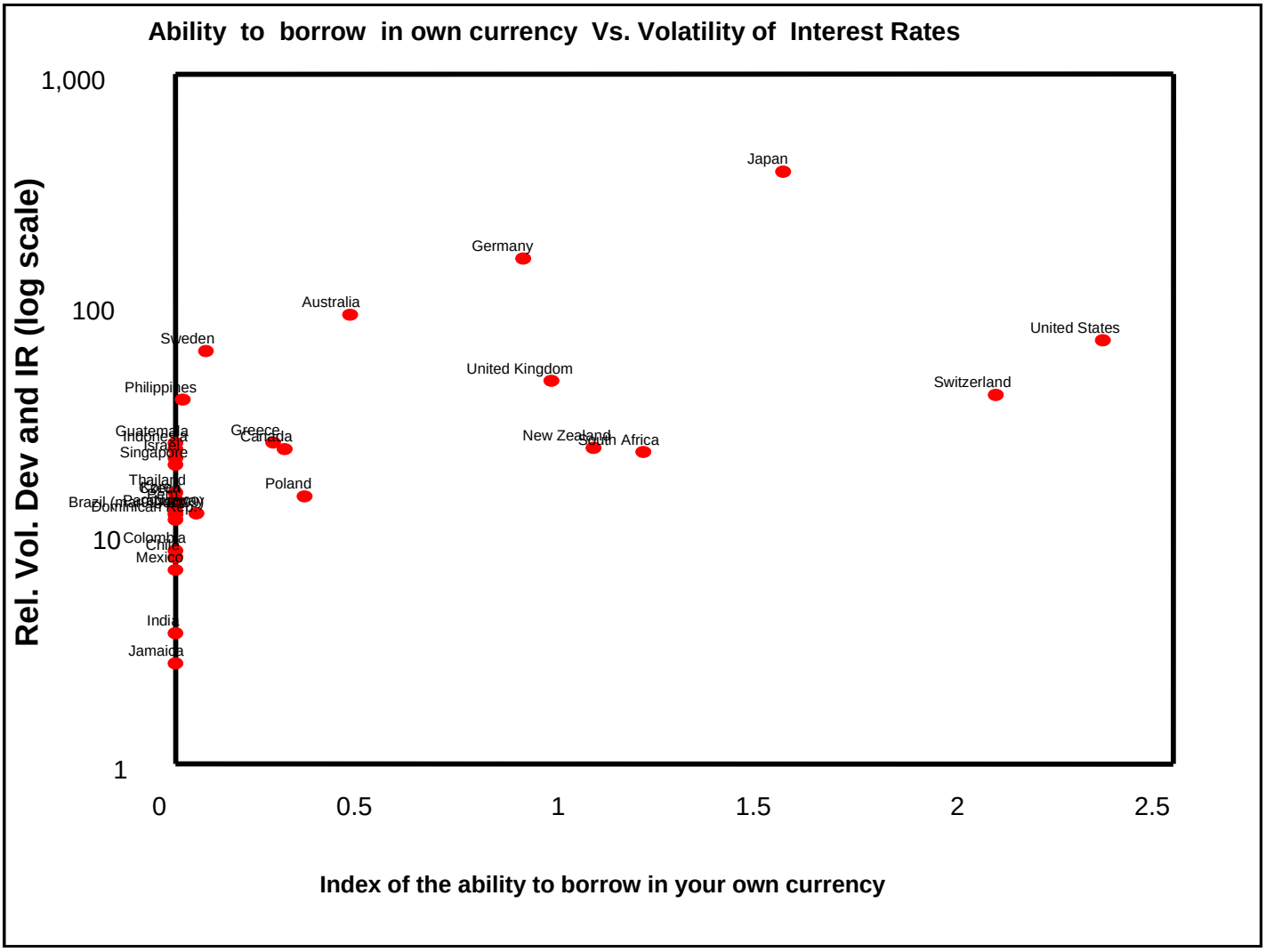

Ability to borrow in own currency Vs. Volatility ER/Res
Rel. Vol. ER and Res (log scale)
100
10
1
0.1
0
0.5
1
1.5
2
2.5
Index of the ability to borrow in your own currency
Japan
United States
United Kingdom
New Zealand
Australia
Thailand
Canada
Brazil (mar99-oct99)
Germany
South Africa
Switzerland
Philippines
Indonesia
Dominican Rep.
Korea
Czech
India
Sweden
Colombia
Mexico
Israel
Singapore
Paraguay
Peru
Guatemala
China
Poland
Greece
Norway
Jamaica

Figure 18


Ability to borrow in own currency Vs. Volatility of Interest Rates
1,000
100
10
1
Rel. Vol. Dev and IR (log scale)
Japan
Germany
Australia
United States
Sweden
United Kingdom
Switzerland
Philippines
Greece
Canada
New Zealand
South Africa
Singapore
Thailand
Poland
Colombia
Mexico
India
Jamaica
0
0.5
1
1.5
2
2.5
Index of the ability to borrow in your own currency