

A Cross-Country Empirical Analysis of International Reserves*

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Abstract

We conduct a comprehensive cross-country empirical analysis of the determinants of international reserves. For the sample period of 1975 to 2004, we use data from more than 100 economies, including both developed and developing economies, to examine the effects on international reserves holding of three groups of determinants, namely, traditional macro variables, financial variables, and institutional variables. The focus is on the interplay of these variables and their changing roles in determining international reserves. With a large sample of economies, we compare the behavior of crisis-inflicted and non-crisis-inflicted economies and examine whether international reserves of these economies behave differently before and after crises. Further, the estimation results are used to compare and contrast the patterns of demand for international reserves of the developed and developing economies.

The estimation results show that the explanatory power of the determinants changes across different time periods and also vary between developed and developing economies. The compositions of the significant determinants within each one of the three groups of explanatory variables also display substantial variations across subsample periods and country groups. The behavior of crisis-inflicted economies can be identified only in some cases but not uniformly. Our results also suggest that, compared with a developing economy, a developed economy tends to hold a lower level of international reserves, *ceteris paribus*. The empirical results highlight the difficulty of using a single empirical model to explain holdings of international reserves and the challenge of devising a unified theory of demand for international reserves.

1. Introduction

The recent Asian financial crisis has rekindled considerable interest in issues related to international reserves. Although numerous studies have attempted to unravel the fundamental rationale for the reserve hoarding behavior – ranging from the transaction demand, precautionary motives, collateral asset argument, and mercantilist behavior, the debate on the determinants of international reserves is far from settled. The difficulty of explicating the reserve holding behavior is consistent with the anecdotal view that the role and functionality of international reserves has evolved along with developments in the global financial markets. Recent financial globalization and tremendous advancement in international capital markets has made reserve holding behavior increasingly susceptible to capital account transactions while recent financial crises have also increased the importance of the role of expectations, policy credibility, and institutional structures.

Each wave of balance of payments crises in the last four decades has brought new insights on the causes and consequences of crises. The recent Asian financial crisis in 1997-98 has revealed several new features that are unseen in the previous crises. The so-called “Third Generation” crisis models have highlighted balance sheet factors and the role of financial sector weaknesses as new determinants of currency crises, that were not explicitly incorporated in the previous two generations of crisis models.¹

Unarguably, the most unique feature of the East Asian financial crisis is that in the aftermath of the event, the economies in the region, mostly notably China, accumulated

¹ Leading examples of the Third Generation models include Krugman (1999), Corsetti, Pesenti and Roubini (1999), Chang and Velasco (1999) and Dooley (2000). In brief, the First Generation models focused on situations in which fundamentals, especially the soundness of budgetary situation, are inconsistent with preserving a fixed exchange rate (Krugman, 1979; Flood and Garber, 1984). The Second Generation models point out the role of coordination among speculators, the possibility of self-fulfilling crises and multiple equilibriums (Obstfeld, 1995, 1996).

international reserves rapidly and intensively. The first few years of the 21st century has witnessed an unprecedented growth of global reserves – over 76.2% between 2000 and 2004, but driven by a handful of economies. During the period, China, Japan, Korea, Malaysia and Taiwan have increased their reserve holdings by 268%, 137%, 107%, 103% and 126%, respectively (See Figure 1).²

The phenomenal reserve build-up has revived research interest in the determinants of international reserves in the literature. One strain of studies elaborates on the notion of buffer-stock and precautionary demand motivation and incorporates the crisis-induced costs of output and investment contractions (Aizenman *et al.* 2004, Lee, 2004). In a well-cited paper, Dooley *et al.* (2003, 2004a, b) resurrect the mercantilist view and suggest that reserve accumulation in East Asia is a consequence of export-oriented growth strategy and the absence of a well-functioning financial system in the region. Aizenman and Lee (2005), on the other hand, empirically confirm the mercantilist motivation, but find that, compared to precautionary demand, it accounts for a relative small amount of reserve hoarding. Other studies also highlight short-term external debts, financial development, and political and institution variables as “new” determinants of reserve adequacy.³

This new trend in the literature has raised two questions to our attention: To what extent do these new factors help us understand the observed reserve holdings? Have the determinants of reserve holding changed over time? Answering these two questions should also shed light on the question of what is the optimal level of international reserve holding that would reduce balance of payments vulnerability and help avert possible balance of payments crisis.

² Japan, China, and Taiwan are the three largest international reserves holders. During this period, Russia and India increased international reserves by 496% and 239%, respectively. Some developed countries also experienced a sharp increase such as Australia (102%) and Denmark (163%).

³ See, for example, Aizenman and Marion (2001, 2003, 2004), Greenspan (1999), and Alfaro, *et al.* (2003).

To explore these questions while uncovering the determinants of reserve holdings, we conduct an extensive empirical analysis using the data for more than 100 economies over the period of 1975 to 2004. In designing the empirical architecture, we account for some known results in the literature. For instance, previous studies have documented that the developed and developing economies display different demand for international reserves (Frenkel 1974). Other have evidenced that the nature of the demand for international reserves has changed in the presence of significant historical events such as the breakdown of the Bretton Woods system and oil crises (Bahmani-Oskooee, 1988; Frenkel, 1980; Lizondo and Mathieson 1987). Most recently, Aizenman *et al.* (2004) also identify structural changes in Korean reserve holding behavior after the East Asian crisis. Thus, in this paper, we sort the economies into two groups, the developed and developing economies, and investigate the determinants of the demand for international reserves in separate sample periods partitioned by crisis episodes.

In our regression results, we confirm that the demand for reserves of developed economies is different from that of developing economies. The (significant) explanatory variables are found to be quite different across different sample periods. We find statistically significant evidence that both the debt crisis of 1982 and the two crisis episodes in the 1990s – the Tequila crisis and the Asian crisis – changed the determination of reserves holding for developing economies, while only the two 1990s crises affected developed economies. Among the determinants of reserves holding, we find import propensity, a proxy to trade openness, as the only determinant that is significant throughout the entire sample period. However, its contribution in terms of the goodness of fit of the models has been declining over years for both developed and developing economies. Financial variables, especially those on external finances, are increasing their importance in explaining the behavior of reserves holding for both groups of

economies. Developed economies seem to retain premium in reserves holding compared to developing ones since the early 1980s, that allows the former economies to hold lower volumes of reserves, while developing economies must prepare more insurance to maintain their exchange rate regimes, to recover from a crisis, and to keep providing external finances. Lastly, we find little evidence that developing economies, especially emerging market economies in East Asia such as China, Hong Kong, Singapore, and Korea, are holding excessive reserves from historical perspectives.

The next session introduces the determinants tested in this study. The empirical framework is presented in Section 3, in which careful analysis on each sub-period and different groups of economies is provided. Section 4 compares the reserve holding behavior between developed and developing economies whereas Section 5 examines the optimality of reserves holding during the 1999 – 2004 period. Section 6 presents some concluding remarks.

2. A Brief Review on the Determinants of International Reserves⁴

We group the determinants of international reserves into three categories: traditional macro variables, financial variables, and institutional variables. The classification scheme is mainly determined for the sake of convenience and should not be interpreted too strictly.

The group of traditional macro variables includes propensity to import, volatility of real export receipts, reserve volatility, the opportunity cost of holding international reserves, real per capita GDP, and population. These variables are commonly considered as determinants in the

⁴ In this study, we measure the adequacy of international reserves as its ratio to gross domestic product (GDP). The scaling of reserves facilitates comparison across countries of different sizes. For brevity, we call the ratio international reserves. The reserves-to-imports ratio put forth in Triffin (1947) is another commonly used measure while other scaling variables include money (M2), imports, and short-term external debt. On the issue of how reserve adequacy appears different depending on the scaling variables, refer to Bird and Rajan (2003), Flood and Marion (2002), and de Beaufort Wijnholds and Kapteyn (2001).

1960s to 1980s. In the early stage of theorization, the demand for international reserves was mainly attributed to the need for accommodating excess demand for foreign currencies that may arise from trade or current account transactions, which were the dominant type of balance of payments activities before development of international capital markets. Heller (1966) argues that the demand for reserves should be negatively related to the marginal propensity to import because a higher propensity to import (m) implies a smaller marginal cost of balance of payments adjustment (i.e., $1/m$), and, thereby, a lower demand for international reserves. However, most empirical exercises – including Heller (1966) himself – use the average, not the marginal, propensity to import. Frenkel (1974b) argues that the average propensity to import, i.e., the imports-to-GDP ratio, captures trade openness and, therefore, should have a positive effect on the demand for reserves because of economies' precautionary holdings for possible external shocks through trade channels.⁵

The role of reserve volatility is illustrated in the buffer stock model of international reserves. Extending the model for cash holding, Frenkel and Jovanovic (1981) illustrate the effect of reserve volatility in a stochastic inventory control setting.⁶ In some studies, the volatility of real export receipts is used as an alternative proxy for the uncertainty of balance of payments (Kelly 1970).

The opportunity cost of holding international reserves, possibly measured by the difference between the local interest rate and the interest rate of the reserve asset, has been included in models that incorporate the costs and benefits of holding reserves.⁷ The effect of the

⁵ It must be also noted that Heller's argument is based on a Keynesian framework with fixed prices and a fixed exchange rate regime with no capital flows.

⁶ A similar model, which is the stochastic version of the one developed by Baumol (1952) and Tobin (1956), is used by Frenkel and Jovanovic (1980) to model cash holding.

⁷ Some early examples include Heller (1966) and Frenkel and Jovanovic (1981). The ideal proxy would be the difference in the yield between domestic government bond and US-dollar denominated bonds. However, due to

opportunity cost variable is quite inconspicuous in the empirical literature, mainly because of the difficulties in assigning a single interest rate for reserve assets while accounting for risks.

Real per capita GDP and population are included to capture the size effect on reserve holding as has been done in Aizenman et al. (2003), Edison (2003), and Lane et al. (2001). In view of the Baumol's square-root role for transaction demand, we expect these size variables to have a negative coefficient.

The second group of explanatory variables includes money supply, external debt, and capital flows. The use of money in explaining international reserves can date back to the 1950s. Courchene and Youssef (1967) appeal to the monetarist model of balance of payments (Johnson, 1958) to justify the use of money in their international reserve regression.⁸ More recently, de Beaufort Wijnholds and Kapteyn (2001) argue that money stock in the economy is a proxy for potential capital flight by domestic residents and, thus it can be used to assess the intensity of the "internal drain" of international reserves.⁹

The implications of external debts and capital flows on reserve holding have received considerable attention especially after the Asian financial crisis. While external capital flows can enhance economic growth by complementing domestic savings and/or financial intermediaries and helping make domestic financial markets efficient, a sudden reversal of capital flows can harm an economy through damaging domestic investment, triggering a crisis, and possibly causing significant output losses.¹⁰ Generally, developing economies, typically equipped with

lack of data availability, we use the differential between U.S. Treasury bill rates and domestic lending rates.

⁸ Johnson and the "global monetarists" argue that excess demand for money (that involves balance of payments surplus) needs to be complimented by an increase in international reserves whereas excess supply of money (balance of payments deficit) leads to a fall in reserve holding. Although this view is based on the international financial framework under the Bretton Woods system, unlike Triffin and other Keynesian observers who focused solely on current account flows, Johnson did not separate the current account from the capital account.

⁹ de Beaufort Wijnholds and Kapteyn (2001) refer to research on the Early Warning System, including Calvo (1996), and argue that the reserves-to-M2 ratio is a reasonable measure of reserve adequacy.

¹⁰ Edwards (2004) analyzes the sudden stop of capital inflows and current account performance in the last

inefficient and less developed financial sectors, are vulnerable to the adverse effect of capital reversal. Thus, countries with high exposure to external finances, whether debt, FDI, or portfolio finances, are often motivated to hold more international reserves to reduce vulnerability to financial crises and increase confidence in their currencies (Feldstein, 1999).¹¹

Besides the insurance motive to hold international reserves to cover (short-term) external liabilities, it can be also argued that economies may perceive international reserves as a substitute external finances. That is, economies may hold fewer reserves if they have secure access to international capital markets, in which case the correlation between external capital flows and reserves is negative. Dooley, et al. (2003, 2004a, 2004b), on the other hand, argue that in the current international financial framework (the “Bretton Woods II system”), emerging market economies accumulate reserves to secure FDI inflows from the center country, i.e., the United States. In other words, these countries in the “periphery” hold reserves to ensure importing financial intermediaries from abroad. In this view, capital inflows can positively correlated with reserve holdings.

Considering that the types, volumes, and directions of capital flows have evolved over time (Lane *et al.*, 2006), it can be expected that exposure to different types of capital flows can have different effects on the behavior of reserve holding. Hence, we empirically examine the effects of net external assets in debt financing, portfolio equity financing, and FDI, as well as the growth rates of debt, portfolio, and FDI liabilities.¹²

three decades. Caballero and Panageas (2004) argue that reserve accumulation is not the best insurance against sudden stops.

¹¹ In general, it has been argued that it is advisable to cover the one year amortized value of various types of liabilities over a wide range of possible outcome. Aizenman *et al.* (2004) find that Korean international reserves are more responsive to both capital flows and short-term external debts after the 1997 crisis. The role of short-term external debt is brought the center stage by the popular Greenspan-Guidotti-rule (Greenspan, 1999). The rule follows from the former Federal Reserve Chairman Alan Greenspan’s comments on Pablo Guidotti’s, a former Deputy Minister of Finance of Argentina, insight on the role of external debts in 1999.

¹² In this type of exercise, it is not appropriate to merely focus on the levels of liabilities for different types

The third group of variables to be tested includes institutional variables.¹³ For international reserves, it has been argued that institutional characters like corruption, political stability, trade openness, and capital controls affect reserve hoarding behavior. Aizenman and Marion (2003, 2004) show that reserve holdings are influenced by political uncertainty and corruption. In our empirical exercise, a selected group of institutional variables pertaining to (trade and financial) openness and political/societal conditions will be investigated.

In addition to these three groups of explanatory variables, we will test four types of dummy variables to incorporate other nuanced characteristics of economies. The first group of dummies is those on the exchange rate regime. Frenkel (1980) and Flood and Marion (2002) report that exchange rate arrangement have effects on reserves holding.¹⁴ The general consensus is that countries with fixed exchange rates and crawling pegs have incentives to hold international reserves to fight against possible exchange rate market pressure. The second one is a set of geographical dummies, and its use is motivated by the folklore that economies in certain geographic region such as East Asia tend to hoard high levels of international reserves especially after the Asian crisis. The third one is those which identify currency crises-afflicted economies. The crisis dummy variable is designed to examine whether the behavior of crisis-affected economies is different from others. A dummy for the banking crisis based on Caprio and Klingebiel (2003) is also tested. The last one is an interactive dummy of the regional and crisis

of external finances. Recently, it has been witnessed that a large volume of capital is flowing from developing countries to developed countries – the so-called “Lucas paradox.” In such an environment, it is not only the liability side but also the asset side that matters for countries that rely upon external finances. Therefore, it is appropriate to measure external finances on net basis. Also, by using net assets, the results can be comparable to those of developed economies. Furthermore, the measure of debt finances in Lane *et al.*'s (2006) dataset includes both debt finances and bank loans due to data availability.

¹³ According to North (1991), “institutions are the humanly devised constraints that structure political, economic and social interactions. They consist of both informal constraints (sanctions, taboos, customs, traditions, and codes of conduct), and formal rules (constitutions, laws, property rights).”

¹⁴ Lane and Burke (2001), on the other hand, find no significant association between exchange rate regime and international reserves.

dummies in order to assess the spillover effect of crises. Specifically, the interactive dummy assumes a value of unity if the economy is located in a region which is inflicted by a crisis, evaluating the possibility that economies may alter their reserve holding behavior when their neighbors experience a crisis.

Further explanations on some of the explanatory variables are given in the next section. Appendix 1 provides a complete list of variables, definitions, and their sources.

3. Empirical Analysis

3.1 *The Empirical Specifications*

Let $R_{i,t}$ be the generic notation of economy i 's (nominal) international reserve holding at time t . The international reserve variable used in the following regressions is given by the scaled measure

$$r_{i,t} = R_{i,t} / GDP_{i,t}$$

where $GDP_{i,t}$ is economy i 's gross domestic product and both $R_{i,t}$ and $GDP_{i,t}$ are measured in US dollar. The three categories of international reserve determinants are denoted by $X_{i,t}$ ($= \{x_{i,k,t}; k = 1, \dots, N_x\}$) that contains the traditional macro variables; $Y_{i,t}$ ($= \{y_{i,k,t}; k = 1, \dots, N_y\}$) the financial variables; and $Z_{i,t}$ ($= \{z_{i,k,t}; k = 1, \dots, N_z\}$) the institutional variables.

We consider cross-sectional behavior for three non-overlapping sample periods; namely 1975-1981, 1983-1993, and 1999-2004. The sample periods exclude the years inflicted by the three major global financial crises; the Mexican debt crisis, the 1994 Tequila crisis, and the

1997-8 Asian financial crisis.¹⁵ For each of the three sample periods, we employ the period averages of $r_{i,t}$, $X_{i,t}$, $Y_{i,t}$, and $Z_{i,t}$ and label them r_i , X_i , Y_i , and Z_i , respectively. The use of period averages allows us to avert complexity that can arise from unknown and, possibly varying dynamics, and focus on the average medium-run behavioral relationship.

Table 1 reports some of the descriptive statistics for the variables to be tested. The developed and developing economies have comparable levels of international reserves in both the 1975-1981 and the 1983-1993 period. However, the average level of international reserves held by developing economies is more than double that of developed economies in the 1999-2004 period. Among the explanatory variables, the developed and developing economies usually show a discernable variation across the three sample periods. Among macroeconomic variables, while developed economies are experiencing an increase in volatilities in reserves holdings, developing economies are experiencing a decline, showing that in the last time period, developing economies are steadily increasing reserves holding. Interestingly, the opportunity cost of holding reserves has dramatically improved for developing economies in the last time period after experiencing extremely high inflation in the 1983-1993 period, but it is still much higher for developing economies than developed ones, fivefold of the latter, making one ponder the cause of the current high accumulation of reserves in these economies.

The financial variables, especially those on external financing, differentiate developing economies from developed ones. In net debt assets and net FDI assets, developing economies are constantly receivers of external financing.¹⁶ However, while the role of FDI is increasing for the last five years, that of debt financing has been diminishing, reflecting that financial crises may

¹⁵ In the exercise, we leave out the two years between the 1994 and the 1997-98 crises since the inter-crisis period is too short to constitute one sample period.

¹⁶ Negative net assets refer to economies that are net receivers of external finances.

have made developing economies shun away from external debt and lean toward FDI (see Lane et al., 2006). Interestingly, developing economies are even becoming net portfolio assets holders since the beginning of the 1980s, though their magnitudes are still small as a ratio to GDP. We must be careful about interpreting net financial assets figures for developed economies, because the United States has long been the destination of financial flows from the rest of the world. The negative figures for net portfolio and debt assets can be smaller if the U.S. were removed from the subsample. The net FDI assets figure can be interpreted in the same way, such that other developed economies than the U.S. can be considered to be providers of FDI while the U.S. is a big receiver, making the net figure only slightly positive.

As one can imagine, institutional variables show that developed economies have achieved high levels of institutional development and democracy already in earlier years. Although developing economies are on the catch-up trend, they are still lagged behind the developed economies. Lastly, it must be worthwhile noting that, while developed economies have constantly implemented financial liberalization since the 1970s, which can be observed with the *de jure* measure of financial openness, developing economies lowered the level of financial openness during the 1980s, though they rapidly reopened capital accounts after the mid-1990s (See Ito, 2006).

Using these variables, the effects of the selected determinants on international reserves are examined for each sample period. We sequentially use the following regression equations:

$$r_i = c + X_i' \alpha + \varepsilon_i, \quad (1)$$

$$r_i = c + X_i' \alpha + D_i' \delta + \varepsilon_i, \quad (2)$$

$$r_i = c + X_i' \alpha + Y_i' \beta + D_i' \delta + \varepsilon_i, \text{ and} \quad (3)$$

$$r_i = c + X_i' \alpha + Y_i' \beta + Z_i' \gamma + D_i' \delta + \varepsilon_i. \quad (4)$$

α , β , γ , and δ are coefficient vectors that are conformable to the associated explanatory variables. c and ε_i are the intercept and disturbance term, respectively.

Specification (1) is an international reserve demand equation of the 1970s vintage. The dummy variable D_i in specification (2) contains characteristic dummies such as geographic locations, crisis-affected economies,¹⁷ and different exchange rate regimes.¹⁸ Specification (3) includes Y_i that contains the financial variables considered in the recent discussion of demand for international reserves. The effects of institutional factors are studied in Specification (4). These four specifications allow us to gauge the relative contributions of these different groups of explanatory variables.

In total, there are 119 economies in our sample. Because the demand for international reserves is expected to differ between developed and developing economies, we group these economies into two categories; one with 21 developed economies and the other with 98 developing economies. The actual number of economies used in the empirical exercise varies among the three sample periods due to data availability, but is kept unchanged among the four specifications within the sample period for the sake of comparison.

¹⁷ The conventional exchange rate market pressure (EMP) index pioneered by Eichengreen *et al.* (1996) was used to identify currency crises for the countries for which data are available. The EMP index is defined as a weighted average of monthly changes in the nominal exchange rate, the international reserve loss in percentage, and the nominal interest rate. The weights are inversely related to the pooled variance of changes in each component over the sample countries, and adjustment is made for the countries that experienced hyperinflation following Kaminsky and Reinhart (1999). For the countries we cannot compute the EMP index (due to data limitation), the crisis dummies used in Glick and Hutchison (2001) and Kaminsky and Reinhart (1999) are used.

¹⁸ For the exchange rate regime dummy, we follow the Reinhart-Rogoff exchange rate regime index (2002). Reinhart and Rogoff's index ranges from 1 "no separate legal tender," through 14 "Freely falling" (with increasing flexibility of exchange rate movement) and considered to be "de facto" index in contrast to IMF's "de jure" exchange rate regime classification. In this paper, however, instead of relying upon the original nuance of regime classifications, we lump them into three categories, "floating," "Crawling Peg," and "Fixed/Pegged." A dummy is assigned for each of the three.

3.2 *Estimation Results*

3.2.1 *The 1975-1981 Sample*

The estimation results for developed economies and developing economies are reported in Tables 2-1 and 2-2, respectively, and those pertaining to the 1975-1981, 1983-93, and 1999-2004 periods are presented in Columns (1)-(4), (5)-(8), and (9)-(12), respectively, in each table. For brevity and better goodness of fit, insignificant explanatory variables are dropped from the regression models.

In Columns (1) – (4) of Table 2-1, two traditional macro variables, real per capita GDP and import propensity, are found to be significant for the 1975-81 period, explaining over 40% of variations in international reserves held by developed countries during this period. Their coefficient estimates are consistent with those predicted in the literature; the transaction demand for international reserves falls as the per capita real income level rises (Heller 1968); and the (average) import propensity, or the imports-to-GDP ratio, proxying for trade openness and the degree of external vulnerability, has the expected positive coefficient (Frenkel, 1974b).

It is also shown that, in retrospect, developed economies that experienced a currency crisis in 1982 were exposed to severe exchange rate pressure prior to the crisis, and thereby, held lower levels of reserves than the non-crisis economies.

The significant money effect (M2/GDP) is supportive of the monetary interpretation of balance of payments and is also consistent with the view that money supply is a proxy for internal drain of international reserves during crisis period. Nonetheless, we are not sure to what extent the internal drain interpretation is relevant for these developed economies. Interestingly, however, inclusion of M2 leads to the largest increase in the adjusted R-squares coefficient.

The positive coefficient on the Chinn-Ito capital account openness index underlines the precautionary motive of these economies to hold reserves to prepare against discrete fluctuations in capital flows that can be induced by capital account liberalization.¹⁹ This finding is reasonable considering that many developed economies implemented capital account liberalization policy in the late 1970s.

For developing economies (Columns (1)-(4) in Table 2-2), import propensity again enters significantly with the expected sign. In addition, reserve volatility, a proxy for balance of payments uncertainty, has the expected positive sign – the higher the level of reserve variability, the more motive for precautionary holding of international reserves. Interestingly, the two macroeconomics variables explain almost 60% of the variation of reserve holding among this group of economies.

Although we do not detect any commonalty among the economies that experienced the 1982 crisis, the experience of a crisis that occurred during the sample period is associated with a drop in holdings of international reserves.²⁰

The ratio of net debt assets to GDP is the only significant financial variable for developing economies in this period. The positive coefficient means that countries with negative net debt assets, i.e., net borrower countries, which is mostly the case for most developing economies during this time period, would hold fewer reserves as the amount of their net external debt increases – net debt assets decreases. This means that reserves are a substitute to external

¹⁹ The index is a reciprocal to regulatory restrictions on cross-border financial transactions and is based upon the IMF's categorical enumeration reported in *Annual Report on Exchange Arrangements and Exchange Restrictions (AREAER)*. A larger value of this measure means a higher level of capital market openness. See Chinn and Ito (2005) for a detailed discussion of the construction of the index. While one can regard this index as a *de jure* index on capital account openness, one can regard Lane et al's measure of financial integration (external assets + external liabilities / GDP) as *de facto* openness of capital account.

²⁰ The "Dummy for crisis during the period" assigns a value of unity to countries that experienced a crisis during the 1975-81 period, and therefore is a separate dummy from the one for a crisis country in 1982.

debt. Or, a higher level of external debt may increase the opportunity cost of holding reserves. Another possibility is that a higher level of external debt can increase default risk which may lead monetary authorities to lose reserves especially when they must defend their exchange rate regime.²¹ Given this result, we can conclude that indebted developing economies did not hold reserves with insurance motives during this period.²²

Three institutional variables, the indexes for anti-corruption measures, law and order, and *de facto* financial openness, are found to be significant contributors. The effect of (anti-)corruption on reserve holdings is opposite to the finding in Aizenman and Marion (2003, 2004) – our results indicate that more prevalence of stricter anti-corruption measures leads to a lower level of reserve holding. Our interpretation is that with tougher anti-corruption measures or lower degree of corruption, monetary authorities may not have precautionary motives to hold reserves to defend their monetary regimes.²³ Also, we find that the more law and order is established, the more reserves developing economies tend to hold. Clearly, this result indicates that better establishment of law and order would increase the returns to international reserves. The *de facto* financial openness indicates the exposure to external (financial) shocks. Even though the financial and institutional variables have received limited attention in the 1970s, their effects on reserve hoarding are well evidenced in these regressions.

²¹ This result is confirmed when the ratio of external debt to GDP available from the World Bank/BIS/OECD dataset on external debt is used instead. In this study, this dataset is used only as a supplement to the Lane et al. dataset. The reason for this is that the World Bank/BIS/OECD dataset has limited coverage of countries, focusing on those countries which have been indebted for a relatively long time period. Therefore, relying on this dataset leads to exclusion of some emerging market countries that are not necessarily constantly indebted countries such as Asian emerging market countries. Because our focus is placed on emerging market countries that currently hold high volumes of reserves, we decided not to use the World Bank's data. However, we refer to estimation results with this dataset whenever necessary.

²² However, neither the growth rate of debt liabilities nor the ratio of short-term external debt to GDP was found to be a significant determinant. Therefore, we can conclude that what matters is the level of external debt, not its growth rate, neither is the maturity of it.

²³ Aizenman and Marion find that greater political corruption reduce international reserve holdings, and explain the correlation by commenting that a greater level of corruption would reduce the return to holding international reserves. Their dataset covers 64 countries for 1980 through 1996.

3.2.2 *The 1983-1993 Sample*

The results for the 1983-1993 period are reported in Columns (5) – (8) in Table 2-1 and 2-2. For the developed economies (Table 2-1), import propensity is the only significant macro variable, and its magnitude is generally larger compared to the previous sample period. Furthermore, this macroeconomic variable now explains a much smaller proportion of the variation in the reserve holding behavior of this group of economies.

Interestingly, economies with a crawling peg exchange rate regime tend to hold more reserves. According to the “unstable middle” hypothesis, crawling peg regimes are more prone to currency crisis than the flexible or fixed exchange rate regimes (Willett, 2003). Therefore, this coefficient can be interpreted as capturing precautionary holdings. The significantly negative 1982 crisis dummy indicates that the crisis caused a hangover effect on crisis-afflicted economies.

The M2 variable continues to be the only significant financial variable for the developed economies in this period while its magnitudes are slightly larger. It must be noted that inclusion of this variable improves the goodness of fit much more significantly than the previous period.

Although the capital openness variable is no longer significant, two institutional variables on government characteristics enter significantly. Economies with plural electoral parliament systems tend to hold more reserves. Possibly, these economies may be subject to more democratic and/or stringent scrutiny on reserve adequacy. Also, developed economies with a leftist government tend to accumulate more reserves. This finding is contradictory to the common belief that a leftist government tends to spend more and, thus, incur current account deficits, thereby leading to a lower level of international reserves (Roubini and Sachs, 1989).

Nonetheless, it is possible that this argument may be relevant to developing economies rather than developed economies since the former has limited access to international financing.

Developing economies in this sample period also seem to be driven by a different set of determinants compared to the previous period (see Columns (5) – (8) in Table 2-2). While import propensity enters again and continue to account for a large portion of the goodness of fit, they reacted differently to the debt crisis in 1982 from developed economies. Instead of getting a hangover from the crisis, developing economies reacted to the crisis proactively; they increased the level of reserves holding in the aftermath of the crisis. These economies also reacted in the same manner to the banking crisis. Hence, the proactive reaction is much greater for the economies that experienced a twin crisis in 1982.

Net debtor developing economies would still have lower levels of reserves, but by a much smaller degree compared to the previous sample period. Instead, these economies are now sensitive to the growth of their debt liabilities and increased reserves holding as their debt grew faster, presumably as insurance against default risk. This is a sharp contrast from the previous period when net debtor economies were not evidenced to have insurance motives to hold reserves. These findings suggest that the effect of being heavily indebted was quite significant during the debt crisis period.

Among the institutional variables, the less likely military forces are to be involved in politics, the fewer reserves developing economies may hold, which can be interpreted in the same way as the effect of anti-corruption measures in the previous period. The law and order index continues to be a positive contributor to reserve holding.

3.2.2 *The 1999-2004 Sample*

Import propensity is again found to be a significant determinant of reserve holdings for developed economies during the 1999 – 2004 period as shown in Columns (9) – (12) of Table 2-1, but interestingly enough, its sign is now opposite compared to the previous two periods.²⁴ One possible reason for this is the smallness of the sample driving this result. Another is Heller's story that trade openness reduces the balance of payments adjustment cost, so that countries would face less necessity to hold reserves. However, given that these economies are not exposed to the same sort of balance of payments constraints as those under the Bretton Woods system, further investigation may be necessary to account for the change in the estimated sign for this coefficient. In this period, a new macro variable, the volatility of export receipts, is found to affect reserves holding negatively. One possible explanation for this is that countries with volatile flows of income from exports tend to experience more uncertainty in trade proceedings and thereby drainage of international reserves especially when their import demand is relatively more stable than export receipts.

Two financial variables, net debt assets and net portfolio assets, enter significantly for the first time, and improves the goodness of fit of the model significantly, signifying the importance of external financing for this group in this globally liberalized environment. Developed creditor economies such as Japan and Germany would increase their reserve holdings as they provide more debt and/or portfolio financing to the rest of the world, whereas developed debtor countries such as the United States and the United Kingdom would perceive a substitutive relationship between international reserves and external debt and/or portfolio financing. It is especially interesting that despite the existence of increasingly developed and integrated

²⁴ We suspected the possibility of multicollinearity between import propensity and other variables leading to this result, which may more likely arise with a small sample size as we have with this group. However, we are unable to detect any sign of multicollinearity involving the import propensity variable.

international financial markets – this trend accelerated especially after the Asian crisis, creditor developed economies are motivated to hold higher volumes of reserves as insurance protection for their increased levels of outward external financing.

The positive coefficient for the *de jure* capital account openness variable is consistent with the previous findings for external finance variables. It appears that the more fractionalized the government is, the more reserves it tends to hold, which can be interpreted as that factions within the government may entail check-and-balance functions that prevent drainage of international reserves and/or excess absorption policy that may easily worsen current account balances.

For developing economies in this time period (Table 2-2), import propensity remains to be a significantly positive determinant of international reserves holding, but the magnitude is now considerably smaller than the previous time period. The opportunity cost of holding international reserves, proxied by the difference between the U.S. Treasury bill rate and the domestic lending rate, is now found to discourage developing economies to hold reserves.²⁵ Interestingly, these two macroeconomic variables explain only 24% of the variations in reserves holdings among developing economies in this time period, a significant decline from the previous two periods.

The economies that experienced a currency crisis during the time of the Asian crisis and those with a crawling peg exchange rate system tend to hold more reserves, evidencing the insurance or precautionary motives of reserve holdings.²⁶ Among the financial variables, M2 and net portfolio assets external debt are significant factors. Especially, the finding that net

²⁵ This result is contrary to the recent argument that emerging market economies accumulate international reserves in recent years *despite* their high opportunity costs due to the relative decline of U.S. Treasury bills' yields.

²⁶ However, the dummy for the economies in the region where there are economies experienced a crisis in 1997-98 turned out to be insignificant, indicating there is no contagious hoarding of reserves.

portfolio assets becomes a significant factor is interesting; creditor developing economies tend to hold more reserves as insurance while debtor economies may hold less because external portfolio flows function as a substitute for reserves holding. This is a consistent behavior to developed economies' though the magnitude is much larger than the latter. These findings signify recent development of developing economies' accessibility to international financial markets where some developing economies have now become important external finance providers.

In this time period, none of the institutional variables is found to be significant determinants of reserves holding behavior, despite the recent contention that legal and institutional development is an important determinant for cross-border financial flows (such as Alfaro et al., 2003).

3.3 Stability of Estimated Coefficients

We have shown that different factors are driving developed and developing economies to hold international reserves in different time periods, with the prior that the global crises have significantly affected these economies' behaviors. In this subsection, we provide formal evidence on the rationale for the use of the partitioned sample periods by testing the instability of the estimated equations. Specifically, we pool the cross-sectional data from the two sample periods and test parameter constancy over the different sample periods, i.e., between the 1975 – 1981 and 1983 – 1993 periods and between the 1983 – 1993 and 1999 – 2004 periods for both developed and developing groups of economies. Also, we test the stability of the estimated coefficients by the group of explanatory variables, namely, that of macroeconomic variables, characteristic dummies, financial variables, and institutional variables.

The results of the Wald tests on the coefficient stability are shown in Table 3. The test results show that the debt crisis of 1982 does not have any impact on the determination of the

reserves holding behavior for developed economies. However, the 1990s crises, the Tequila crisis and the Asian crisis, do seem to have affected these economies' behavior of holding reserves. Between the 1983 – 93 and the 1999 – 2004 sample periods, the structural change in the effects of the reserve holding determinants is detected in all groups of the explanatory variables.

For developing economies, both the debt crisis and the Asian crisis or the Tequila crisis affected the determination of reserve holdings. While the debt crisis did not affect the macroeconomic aspect of the determinants, it did change the effects of the characteristics dummies, financial variables, and institutional variables. The Asian crisis or the Tequila crisis, on the other hand, significantly changed the way the behavior of reserves holding reacts to the characteristics dummies and financial variables for these economies.

Given that there are 5 years of gap between the 1983-1993 and 1999-2004 sample periods, one may find the detected structural breaks not surprising. To further investigate which of the 1990s' crises is the driving factor of the coefficient instability, we also test parameter constancy between the 1983-1993 and 1995-2004 periods as well as between the 1983-1996 and 1999-2004 periods – the Tequila crisis of 1994 and the Asian crisis of 1997-98 are tested as the candidate structural breaks, respectively. This exercise shows (not reported) that, for the group of developed economies, both the Tequila and Asian crises significantly affected the coefficients.²⁷ The estimated coefficients for the developing economies are significantly affected by the Asian crisis, but not by the Tequila crisis.²⁸ These findings justify the use of the partitioned sample

²⁷ In the case of the Tequila crisis, all groups of the explanatory variables except for the financial variable group show parameter instability. In the case of the Asian crisis, all groups are significantly affected.

²⁸ The parameter instability is detected for the group of financial variables when the equations for the 1983 – 1993 period are compared with those for the 1995-2004, but not for the entire set of explanatory variables. For the 1983-96 vs. 1999-2004 comparison, since none of the institutional variables is found to be significant for the 1983-96 period, the parameter constancy for the group of institutional variables is not tested. In this comparison, parameter instability is detected for the groups of macro variables and financial variables, and the entire set of explanatory variables. The estimation results are available from authors upon request.

periods as we had in the previous subsection. Furthermore, we can conclude that, while both 1990s' crises episodes were significant events for developed economies, the Asian crisis was more so for developing economies than the Tequila crisis.

3.4 *Contribution of the Determinants*

In this subsection, we take a closer look at the development of the roles of the reserve holding determinants. Specifically, we show how the “dominant” variables in terms of contributing to the goodness of fit have changed over time, and how much of the variations in reserve holdings can be explained by each of the determinants.

Figure 2 show incremental contributions of the reserve determinants to the goodness of fit for each regression model (left three sets of bars for industrialized economies and right for developing economies). For example, the macroeconomic variable group explains 44% of the variations in reserve holding for developed economies during the 1975-81 period, the overall adjusted R-squares improves by including the characteristics dummies and the financial variables by 7% and 26%, respectively, and so forth.

By examining the figure, the contributions of the macroeconomic variables in terms of the goodness of fit have been declining over time for developed economies while those of financial variables have been rising over time. For the group of developing economies, we can make a similar observation although the change in the contributions is more of a recent phenomenon. The contributions of the institutional variables are increasing slightly for developed economies, but it cannot be observed for developing economies. The relative fall in the importance of the macroeconomic variables and the relative rise in the financial variables is consistent with the recent global-scale trend of development and liberalization in international

financial markets.

Panels of figures in Figure 3 show how much of the variations in reserve holding can be explained by the determinants. In the figures, the lines connecting the diamonds and squares are the actual values of the period average ratio of reserves to GDP for each period and the predicted values based on the models for each sample period. The multi-colored and textured columns decompose the models' predictions into the contributions of the different explanatory variables for each sample period. The sum of the contributions is equal to the models' predicted values while positive and negative contributions net out.

Panel A shows the decomposition for the group of developed economies, and Panel B for that of developing economies.²⁹ First of all, we can see that for both subsamples, each sample period's model predicts well. Also, the panels confirm that the contributions of the determinants vary over sample periods and between developed and developing economies. For developed economies, import propensity is constantly a significant contributor, though its sign reverses in the last sample period. Money supply is a significant determinant for reserves holding in the first two sample periods, but ceases to be one in the last period. In the last five years, (de jure) capital account openness and export volatility are the largest contributors.

Among developing economies, import propensity is again a consistent determinant of reserve holding and its contribution is the highest in the middle sample period. In the first sample period, de facto openness of capital accounts and net debt assets are big contributors, while money supply becomes the largest contributor in the last sample period.

Panels C and D show the results of the same exercise for Asian emerging market economies. In Panel C, we can see that the Chinese reserve holding in the last five years is not as

²⁹ The actual values for the group average as well as the values used for predictions are weighted average for each of the subgroups whose weight is based on nominal GDP in U.S. dollars.

high as the model predicts. Also, the high reserve holding in this period is a reflection of high money growth and, to a much lesser degree, the openness of the economy. Among the group of emerging market Asian economies – Hong Kong, Indonesia, Korea, Malaysia, Philippines, Singapore, and Thailand, while the characteristics of the determinants' contributions are generally consistent with that of the developing economies, the contribution of trade openness is quite large in the 1983-93 period, and money supply and the Asian crisis along with trade openness are large contributors in the post-Asian crisis period.³⁰ These characteristics are somewhat different from Latin American or oil exporting countries, shown in Panels E and F, respectively. Also, for the last sample period, despite the oft-discussed claim of excessive reserves holding, these economies do not appear to be holding unnecessarily high volumes of reserves. This issue will be analyzed more carefully in a later subsection.

4. Differences in Reserves Holding Behavior between Industrialized and Developing economies

What would happen to its international reserve holding if a developing economy acted as if it were a developed economy or *vice versa*? Suppose the estimated demand for international reserves of developing economies is given by

$$r_{i,dp} = \hat{c}_{dp} + W_i' \hat{\alpha}_{dp} + \hat{\varepsilon}_{i,dp} \equiv \hat{r}_{i,dp} + \hat{\varepsilon}_{i,dp}, \quad (5)$$

and the one of developed economies is

$$r_{i,dd} = \hat{c}_{dd} + W_i' \hat{\alpha}_{dd} + \hat{\varepsilon}_{i,dd} \equiv \hat{r}_{i,dd} + \hat{\varepsilon}_{i,dd}, \quad (6)$$

where “^” indicates parameter estimates and subscripts “*dp*” and “*dd*” denote developing and developed economies, respectively. What if a developed economy acted as though it were a

³⁰ The relatively large contribution of money supply is also evidenced in each economy when we create the same figures for each of the emerging market Asian economies. In the case of Singapore, however, net portfolio assets are also found to be another large positive contributor to the determination of reserve holding.

developing economy? Using the estimates for developing economies in equation (5), we can “predict” the reserves ratios for developed economies, which we denote as $\tilde{r}_{i,dd}$. Conversely, we can apply the estimates for the developed economies’ regression models to developing economies and predict the reserves ratios $\tilde{r}_{i,dp}$ when developing economies acted as if they were developed economies. The point of this exercise is that by comparing $\hat{r}_{i,dd}$ and $\tilde{r}_{i,dd}$, and $\tilde{r}_{i,dp}$ and $\hat{r}_{i,dp}$, we may be able to obtain some insights or implications, possibly advantages or disadvantages, of being a developing or developed economy in terms of reserve holding.

First, we calculate the predicted values for developing economies using the estimation results for developed economies and repeat for each of the three sample periods. In Figure 4, we plot for each country the actual (period average of) reserves ratio to GDP; predicted values using the developing economies’ model; and predicted values using the developed economies’ model for the 1975-1981 sample period.³¹ Panel A illustrates the predicted values using the estimates for the macroeconomic variables only. Panels B, C, and D show the predicted values based on macroeconomic variables and characteristic dummies; all groups of explanatory variables except for institutional variables, and all the explanatory variables, respectively. Countries are aligned according to per capita real GDP (in U.S. dollars) from the left to the right. Figures 5 and 6 repeat for the other two sample periods, and Table 4 summarizes the results for countries and country groups of our interest.

Panel D of Figure 4 shows that the deviation of predicted values using the developed economies’ model from both actual values and predicted values using the developing economies’ model increases as the per capita income level goes down. Considering that this pattern is found

³¹ Missing variables are replaced by the subsample averages of the variables.

even when only macroeconomic variables are used (Panel A), we can conjecture that the deviation in Panel D is due to the scale factor, or the estimate on per capital income, found only for developed economies which makes developing economies responsive to the level of per capita income. This result may indicate that if developing economies were placed in an environment developed economies were facing in the late 1970s, economies with lower per capita income would be required to hold much more reserves. At least, we can interpret this result that developing and developed economies were facing a different international financial environment, and that the scale factor could have been quite expensive if developing economies had to face the same environment. Table 4 reports that the extent of the deviation is much less for Latin American countries and oil exporting countries than other developing economies (see Column (6)).

In Figure 5, across different levels of per capita income, predictions with all explanatory variables often undershoot both actual values and predicted values with the developing economies' estimates. Panel C indicates that this pattern is driven by financial variables. Considering that money stock enters the developed economies' model, if developing economies acted like developed economies, providing liquidity in the economy, whether for routine macroeconomic policy or as reaction to internal drain, would not require these economies to hold as higher levels of reserves as they would. Table 4 shows that this generalization is most applicable to the group of Latin American economies, which experienced high money supply growth mainly due to internal drain.

During the post-Asian crisis period (Figure 6), the predictions with the developed economies' estimates again undershoot the predicted and actual values of reserves ratios, and that is seen in all panels. This result may indicate that in all aspects of explanatory variables,

developing economies need to react to their economic and other conditions more actively, i.e. to hold more reserves than developed economies would if they were facing the same conditions. In short, developing economies are not able to enjoy the premium as developed ones enjoy. For example, the fact that the estimated coefficients on both net debt assets and net portfolio assets for developed economies (shown in Table 2-1) are smaller than those of M2 and net portfolio assets for developing economies means that developing economies, which are now portfolio creditors on average, would only need lower levels of reserves if they could act as developed economies.³² According to Table, 4, Asian high reserve holding economies would not have to hold high volumes of reserves if they could act as developed economies. Interestingly, the extent of “over”-holding of reserves is quite remarkable for these economies.

In Figures 7 through 9, we repeat the same exercise for the developed economies. the results are also summarized in Table 5. Generally, in all sample periods, except for the 1983-93 sample period, developed economies would have to hold higher levels of reserves if they were restrained to face their economic environment as developing ones. This observation is applicable in terms of all groups of explanatory variables, indicating again that developed economies are given premium so that they would not have to hold as much reserves as developing economies would across all aspects of the determinants of reserves holding.

5. Optimality of Reserves Holdings during the 1999-2004 period

Lastly, we ask one of the most actively debated questions in current international finance. That is, are developing economies, especially emerging market ones in East Asia, holding an excessive amount of reserves? Table 6 reports an predicted amount of reserve holding for the countries and country groups of our interest for the 1999 – 2004 period using the

³² It is also true that because developing economies have more closed financial markets and less fractionalized governments, they would need lower levels of reserves holding.

estimates from the regressions from the current and past sample periods. If one bases the prediction on the post-Asian crisis model, Emerging Asian economies (excluding China), especially Indonesia, Korea, Malaysia, and Thailand, Latin American economies, and oil exporting countries seem to be holding more reserves than the model predicts. When the 1983-93 period's model is used, there are even more countries that appear to be holding more reserves than model predictions. However, according to the model for the pre-debt crisis period, most of the economies appear to be accumulating fewer reserves than what is "optimal." High reserves holding economies such as China and Hong Kong do not seem to be holding "excess" reserves based on the 1999-2004 or 1975-81 models. Generally speaking, even among the economies that are found to be holding more reserves than what the models predict to be optimal, the volumes of "excess" reserves are not so high in most of the cases.

6. Concluding Remarks

We examined the determinants of reserves holding for the last three decades. With an observation that both theoretical arguments and empirical findings about the determinants of reserves holding are far from settled, we have tested a wide range of determinants, grouped into three categories: traditional macroeconomic variables, financial variables, and institutional variables. Also, with an anecdotal notion that currency crises may have left significant impacts on reserves holding behavior, we divided the whole time period of 1975-2004 into three different ones based on the three biggest crisis episodes, the Mexican debt crisis, the Tequila crisis, and the Asian crisis. We expected that the role of explanatory variables changed over time by the group or individually, and found consistent evidence to our priors.

We found that the determinants of reserves holding have been different between developed and developing economies throughout the sample period, and changed over different time periods as well. With the Wald tests, we showed that the two crises in the 1990s, but not the debt crisis of 1982, significantly changed the determination of reserve holding for developed economies in all aspects of groups of explanatory variables. For developing economies, we

showed that their reserves holding behavior changed as a result of the debt crisis of 1982 and the Asian crisis. While the debt crisis had a significant effect on the responsiveness of reserve holding behavior to all groups of explanatory variables except for macro variables, the Asian crisis changed the way developing economies react to macroeconomic factors and external finances.

We found import propensity, a proxy to trade openness, is the only significant determinant throughout the entire time period. Interestingly, the contribution of macroeconomic variables diminished over years for both developed and developing economies in terms of the goodness of fit of the models. Financial variables, especially those on external finances, on the other hand, are found to be increasing their importance in explaining the behavior of reserves holding for both groups of economies.

Developed economies seem to retain premium in reserves holding compared to developing ones since the early 1980s, that allows the former economies to hold fewer reserves. Conversely, developing economies must prepare more insurance by holding reserves so as to maintain their exchange rate regimes, to recover from a crisis, and to keep providing external finances. Simply putting, developed economies are being rewarded for being developed in international financial markets in the form of not having to hold large volumes of reserves.

Lastly, regarding the question of whether developing economies, especially emerging market economies in East Asia, are holding excessive reserves, we find some evidence consistent with the claim, but except for high reserve holding economies such as China, Hong Kong, and Singapore. Also, even among the economies that seem to be holding excess reserves, the extent of excess holding is found not to be so high.

Data Appendix

We draw the data used in this paper from a number of different sources. Below is a list of the variables used in the analysis, descriptions of these variables and the source(s) from which the primary data for constructing these variables were taken. The original data are from annual frequency over the 1970-2004 period, covering 119 countries (21 developed economies and 98 developing economies).

Variables	Definitions	Sources
<i>Dependent variables</i>		
R_GDP	total reserves (including gold) to current GDP	WDI
R_EXG_GDP	total reserves (excluding gold) to current GDP	WDI
R_GDP_PPP	total reserves (including gold) to current PPP	WDI
<i>Variables in “X” – “Macro variables”</i>		
RYPC_US	GDP per capita in constant US dollars	WDI
POP	population	WDI
PIMP	import propensity	IFS
RES_VOL	reserve volatility	IFS
EXP_VOL	Volatility of export receipts	IFS
DIFINT	opportunity cost of holding reserves	WDI, IFS
<i>Variables in “Y” – “Financial variables”</i>		
M2Y	M2 to current GDP	WDI, IFS
NET_DEBT	Net debt assets / current GDP	LM
NET_FDI	Net FDI assets / current GDP	LM
NET_PORTFOLIO	Net portfolio equity assets / current GDP	LM
D_DEBT_LIAB	Growth rate of debt liabilities / current GDP	LM
D_FDI_LIAB	Growth rate of FDI liabilities / current GDP	LM
D_PORTFOLIO_LIAB	Growth rate of portfolio liabilities / current GDP	LM
<i>Variables in “Z” – “Institutional variables”</i>		
KAOPEN	KA-openness	Chinn-Ito (2005)
DEFACTO_FININT	De facto financial openness = (Total external assets and liabilities) / current GDP	LM
TRADEOPEN	De jure trade openness	WDI
CORRUPT	Corruption [0, 6]	ICRG
BQ	Bureaucratic quality [0, 6]	ICRG
LAO	Law and Order [0, 6]	ICRG
POLIRISK	Political Risk Rating [0, 100]	ICRG
MIP	Military in Politics [0, 6]	ICRG
DEMO	Democratic Accountability [0, 6]	ICRG

LEFT	Dummy for left-wing government	DPI2004
PLURAL	Dummy for parliament with Plural electoral system	DPI2004
GOVFRAC	Government fractionalization [0, 1]	DPI2004
POLCONV	Political constraint (democracy) index	Henisz (2000)
POLITY2	Polity (democracy) index	Polity IV
SMKC	Stock market capitalization / GDP	BDL
SMTV	Stock market total values / GDP	BDL
SMTO	Stock market turnover	BDL
<i>Dummies (“D”)</i>		
ER_CRAWL	Dummy for the crawling peg ExR	Reinhart and Rogoff (2002)
ER_FIX	Dummy for the fixed ExR	Reinhart and Rogoff
EUROPE	Dummy for Western Europe	
ECA	Dummy for Eastern & Central Europe	
EA	Dummy for East Asia	
PACIFIC	Dummy for Pacific countries	
SA	Dummy for South Asia	
SSA	Dummy for Sub Sahara Africa	
LAC	Dummy for Latin America and Caribbean	
MENA	Dummy for Middle East and North Africa	
CRISIS	Dummies for countries that experience a currency crisis	Based on calculations of EMP
BANKCRISIS	Dummies for countries that experience a banking crisis	Caprio and Klingebiel (2003)
OIL	Dummy for oil exporting countries	

Notes: These are sources for basic data used to construct the corresponding variables. BDL: Beck, Demirgüç-Kunt, and Levine; CI: Chinn and Ito (2005); DPI2004: Database of Political Institutions, Beck et al. (2001); Henisz: Henisz (2000); ICRG: *International Country Risk Guide*; IFS: IMF’s *International Financial Statistics*; IMF: Other IMF databases; LM: Lane and Milesi-Ferretti (2006); Polity IV: Polity IV project (2004); and WDI: *World Development Indicators*.

Country List

	Country name	cn	ccode
	<u>Developed economies</u>	(21)	
1	Australia	193	AUS
2	Austria	122	AUT
3	Canada	156	CAN
4	Denmark	128	DNK
5	Finland	172	FIN
6	France	132	FRA
7	Germany	134	DEU
8	Greece	174	GRC
9	Iceland	176	ISL
10	Ireland	178	IRL
11	Italy	136	ITA
12	Japan	158	JPN
13	Netherlands	138	NLD
14	New Zealand	196	NZL
15	Norway	142	NOR
16	Portugal	182	PRT
17	Spain	184	ESP
18	Sweden	144	SWE
19	Switzerland	146	CHE
20	United Kingdom	112	GBR
21	United States	111	USA
	<u>Developing economies</u>	(98)	
22	Albania	914	ALB
23	Algeria	612	DZA
24	Argentina	213	ARG
25	Armenia	911	ARM
26	Azerbaijan	912	AZE
27	Bahrain	419	BHR
28	Bangladesh	513	BGD
29	Belarus	913	BLR
30	Bolivia	218	BOL
31	Bosnia and Herzegovina	963	BIH
32	Botswana	616	BWA
33	Brazil	223	BRA

34	Bulgaria	918	BGR	77	Malawi	676	MWI
35	Burkina Faso	748	BFA	78	Malaysia	548	MYS
36	Cameroon	622	CMR	79	Mali	678	MLI
37	Chad	628	TCD	80	Mauritius	684	MUS
38	Chile	228	CHL	81	Mexico	273	MEX
39	China	924	CHN	82	Moldova	921	MDA
40	Colombia	233	COL	83	Morocco	686	MAR
41	Congo, Rep.	634	COG	84	Mozambique	688	MOZ
42	Costa Rica	238	CRI	85	Nicaragua	278	NIC
43	Cote d'Ivoire	662	CIV	86	Niger	692	NER
44	Croatia	960	HRV	87	Nigeria	694	NGA
45	Cyprus	423	CYP	88	Oman	449	OMN
46	Czech Republic	935	CZE	89	Pakistan	564	PAK
47	Dominican Republic	243	DOM	90	Panama	283	PAN
48	Ecuador	248	ECU	91	Papua New Guinea	853	PNG
49	Egypt, Arab Rep.	469	EGY	92	Paraguay	288	PRY
50	El Salvador	253	SLV	93	Peru	293	PER
51	Estonia	939	EST	94	Philippines	566	PHL
52	Ethiopia	644	ETH	95	Poland	964	POL
53	Gabon	646	GAB	96	Russian Federation	922	RUS
54	Georgia	915	GEO	97	Saudi Arabia	456	SAU
55	Ghana	652	GHA	98	Senegal	722	SEN
56	Guatemala	258	GTM	99	Singapore	576	SGP
57	Haiti	263	HTI	100	Slovak Republic	936	SVK
58	Honduras	268	HND	101	Slovenia	961	SVN
59	Hong Kong, China	532	HKG	102	South Africa	199	ZAF
60	Hungary	944	HUN	103	Sri Lanka	524	LKA
61	India	534	IND	104	Sudan	732	SDN
62	Indonesia	536	IDN	105	Swaziland	734	SWZ
63	Israel	436	ISR	106	Tajikistan	923	TJK
64	Jamaica	343	JAM	107	Tanzania	738	TZA
65	Jordan	439	JOR	108	Thailand	578	THA
66	Kenya	664	KEN	109	Togo	742	TGO
67	Korea, Rep.	542	KOR	110	Trinidad and Tobago	369	TTO
68	Kuwait	443	KWT	111	Tunisia	744	TUN
69	Kyrgyz Republic	917	KGZ	112	Turkey	186	TUR
70	Lao PDR	544	LAO	113	Uganda	746	UGA
71	Latvia	941	LVA	114	Ukraine	926	UKR
72	Lebanon	446	LBN	115	United Arab Emirates	466	ARE
73	Libya	672	LYB	116	Uruguay	298	URY
74	Lithuania	946	LTU	117	Venezuela, RB	299	VEN
75	Macedonia, FYR	962	MKD	118	Zambia	754	ZMB
76	Madagascar	674	MDG	119	Zimbabwe	698	ZWE

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Table 1: Summary Statistics

<i>Period</i> <i>Group</i>	1975-1981		1983-93		1999-2004	
	Developed	Developing	Developed	Developing	Developed	Developing
Reserves / GDP	0.10	0.11	0.10	0.12	0.07	0.18
<i>X (macro) variables</i>						
Population in millions	35.56	34.18	35.97	35.50	39.83	46.44
Reserve volatility	0.10	0.11	0.05	0.05	0.09	0.01
Real GDP per capita in US \$ (in log)	9.56	7.19	9.76	7.15	10.04	7.34
Propensity to Import	0.31	0.40	0.29	0.35	0.33	0.42
Volatility of Export receipts	0.03	0.25	0.03	0.03	0.02	0.01
Opportunity cost of holding reserves	0.04	0.09	0.06	3.26	0.03	0.16
<i>Y (financial) variables</i>						
M2 / GDP	0.56	0.29	0.66	0.39	0.80	0.47
Net portfolio assets /GDP	0.00	0.00	-0.01	0.02	-0.10	0.02
Net debt assets /GDP	-0.11	-0.23	-0.19	-0.47	-0.15	-0.35
Net FDI assets /GDP	-0.01	-0.12	-0.02	-0.13	0.03	-0.25
<i>Z (institutional) variables</i>						
Leftist government (0/1)	0.38	0.23	0.33	0.25	0.48	0.23
Parliament w. Plural elect. sys. (0/1)	0.52	0.76	0.52	0.84	0.57	0.70
Democracy index [0, 1]	0.74	0.15	0.77	0.26	0.76	0.45
De jure KA-openness, Chinn-Ito [-1.8, 2.6]	0.36	-0.16	1.21	-0.41	2.48	0.33
De facto KA-openness	0.79	1.08	1.36	1.83	3.97	1.85
Corruption index [0, 6]	5.29	2.75	5.35	3.03	4.48	2.40
Law and order [0, 6]	5.41	2.59	5.48	2.81	5.50	3.46
Bureaucratic quality [0, 6]	3.68	1.59	3.70	1.80	3.80	1.94
Political risk [0, 100]	86.07	50.96	81.84	52.82	86.68	64.32
Military in power [0, 6]	5.58	3.01	5.66	3.17	5.79	3.54
Democratic accountability [0, 6]	5.79	2.76	5.62	2.99	5.70	3.69
Government fractionalization [0, 1]	0.23	0.11	0.27	0.17	0.28	0.25

NOTES: Reserve volatility and export volatility are normalized by the period average of reserves and exports, respectively. The variables for leftist government and parliament with plural electoral system are dummy variables. For political variables such as the indexes for corruption, law and order, bureaucratic quality, political risk, military in power, and democratic accountability, higher values indicate better conditions. For example, a higher value of corruption index indicates an environment where anti-corruption measures are more implemented and enforced. The democracy index is also known as the political constraint index, and refers to a more democratic system as the value is higher. The KA openness variable ranges between -1.8 and +2.6. A higher value indicates a more open capital account. See Data Appendix for more details on data definitions.

Table 2-1: Estimation Results for Developed economies (IDC), 1975 – 1981, 1983 – 1993, 1999 – 2004

	Dependent variable: Reserves (inc. gold) / GDP, Developed Economies											
	1975 – 1981				1983 – 1993				1999 - 2004			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Real GDP per capita	-0.105 [0.052]*	-0.129 [0.050]**	-0.096 [0.032]***	-0.118 [0.036]***								
Import Propensity	0.203 [0.067]***	0.139 [0.072]*	0.363 [0.073]***	0.394 [0.070]***	0.361 [0.111]***	0.284 [0.092]***	0.314 [0.103]***	0.443 [0.106]***	-0.086 [0.047]*	-0.092 [0.045]*	-0.215 [0.075]**	-0.217 [0.039]***
Export Volatility									-0.019 [0.008]**	-0.023 [0.006]***	-0.036 [0.007]***	-0.034 [0.006]***
Crisis in 1982		-0.061 [0.036]*	-0.044 [0.028]	-0.050 [0.021]**		-0.047 [0.041]	-0.040 [0.021]*	-0.093 [0.016]***				
Crawling Peg ERR						0.043 [0.035]	0.058 [0.021]**	0.101 [0.015]***				
Western Europe									0.038 [0.016]**	0.041 [0.013]***	0.028 [0.013]*	
Japan									0.1018 [0.012]***	0.0623 [0.019]***	0.054 [0.017]***	
M2 / GDP			0.200 [0.053]***	0.200 [0.051]***			0.268 [0.071]***	0.265 [0.054]***				
Net Debt Assets										0.091 [0.029]***	0.083 [0.015]***	
Net Portfolio Assets										0.114 [0.045]**	0.108 [0.018]***	
KA-openness				0.012* [0.007]								0.023 [0.012]*
Pluralist parliament								0.068 [0.018]***				
Leftist government								0.036 [0.014]**				
Government Fractionalization												0.067 [0.026]**
Constant	1.022 [0.505]*	1.285 [0.501]**	0.796 [0.311]**	1.000 [0.347]**	-0.001 [0.023]	0.004 [0.023]	-0.191 [0.055]***	-0.290 [0.038]***	0.129 [0.029]***	0.102 [0.021]***	0.188 [0.036]***	0.120 [0.025]***
Observations	19	19	19	19	21	21	21	21	21	21	21	21
Adj. R-squared	0.44	0.51	0.76	0.80	0.208	0.193	0.701	0.79	0.1	0.23	0.65	0.79

Robust standard errors in brackets. * significant at 10%; ** significant at 5%; *** significant at 1%

Table 2-2: Estimation Results for Developing economies (LDC), 1975 – 1981, 1983 – 1993, 1999 – 2004

	Dependent variable: Reserves (inc. gold) / GDP, Developing Economies											
	1975 – 1981				1983 – 1993				1999 - 2004			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Import Propensity	0.327 [0.028]***	0.345 [0.027]***	0.348 [0.020]***	0.145 [0.057]**	0.374 [0.067]***	0.364 [0.058]***	0.375 [0.050]***	0.367 [0.052]***	0.266 [0.120]**	0.265 [0.106]**	0.113 [0.042]***	
Reserve Volatility	0.032 [0.007]***	0.026 [0.008]***	0.015 [0.008]*	0.009 [0.005]*								
Opp. cost of holding reserves									-0.330 [0.118]***	-0.329 [0.110]***	-0.160 [0.063]**	
Crisis during period		-0.054 [0.017]***	-0.046 [0.015]***	-0.059 [0.014]***								
Crisis in 1982						0.019 [0.014]	0.03 [0.016]*	0.028 [0.017]*				
Banking crisis in 1982						0.048 [0.019]**	0.036 [0.017]**	0.035 [0.017]**				
Sub Sahara Africa						-0.032 [0.016]**	-0.031 [0.015]**	-0.029 [0.015]*				
Crisis in 1997-98										0.072 [0.040]*	0.038 [0.023]*	
Crawling peg										0.041 [0.040]	0.061 [0.034]*	
M2 / GDP											0.181 [0.036]***	
Net Debt Assets			0.163 [0.057]***	0.376 [0.052]***			0.04 [0.013]***	0.037 [0.012]***				
Growth in debt liabilities							0.259 [0.134]*	0.24 [0.136]*				
Net Portfolio Assets											0.659 [0.070]***	
Anti-corruption				-0.021 [0.006]***								
De facto KA				0.233 [0.054]***								
Openness				0.012 [0.005]**				0.019 [0.007]***				
Law and Order								-0.009 [0.005]*				
Military in Politics												
Constant	-0.035 [0.012]***	-0.021 [0.014]	0.033 [0.025]	0.043 [0.014]***	-0.024 [0.021]	-0.024 [0.021]	-0.013 [0.020]	-0.033 [0.026]	0.136 [0.066]**	0.108 [0.068]	0.054 [0.027]*	
Observations	53	53	53	53	69	69	69	69	74	74	74	
Adj. R-squared	0.59	0.63	0.7	0.87	0.59	0.65	0.72	0.73	0.24	0.25	0.59	

Robust standard errors in brackets. * significant at 10%; ** significant at 5%; *** significant at 1%

**Table 3: Wald Tests on the Stability of the Estimated Coefficients
across Different Time Periods**

	Developed economies (IDC)		Developing economies (LDC)	
	1975-81 vs. 1983-93	1983-93 vs. 1999-2004	1975-81 vs. 1983-93	1983-93 vs. 1999-2004
Level dummy	F(1, 20) = 1.34 (0.261)	F(1, 13) = 5.37 (0.037)	F(1, 76) = 3.60 (0.062)	F(1, 55) = 1.72 (0.196)
Macro variables (X)	F(2, 20) = 1.28 (0.299)	F(2, 13) = 9.36 (0.003)	F(2, 76) = 0.30 (0.739)	F(2, 55) = 1.12 (0.335)
Dummies (D)	F(2, 20) = 1.33 (0.288)	F(4, 13) = 3.05 (0.056)	F(4, 76) = 2.07 (0.094)	F(5, 55) = 5.06 (0.001)
Financial variables (Y)	F(1, 20) = 0.00 (0.990)	F(3, 13) = 2.46 (0.109)	F(2, 76) = 6.94 (0.002)	F(4, 55) = 17.26 (0.000)
Institutional Variables (Z)	F(3, 20) = 0.81 (0.503)	F(4, 13) = 3.50 (0.038)	F(4, 76) = 2.21 (0.076)	F(2, 55) = 0.45 (0.637)
All interactives and the dummy	F(9, 20) = 1.24 (0.327)	F(14, 13) = 13.18 (0.000)	F(13, 76) = 4.28 (0.000)	F(14, 55) = 3.12 (0.001)

NOTE: *p*-values in brackets. Figures in bold indicate 10% significance level.

Table 4: What if Developing Economies Acted as if They were Developed Economies

	Actual	Estimates using LDC estimates	Errors (2) - (1)	Estimates using IDC estimates	Errors (4) - (1)	Differences (4) - (2)
	(1)	(2)	(3)	(4)	(5)	(6)
1975 - 1981						
Indonesia	5.6%	8.5%	2.9%	43.6%	38.0%	35.1%
Korea	4.9%	8.3%	3.5%	24.6%	19.8%	16.3%
Malaysia	20.7%	19.9%	-0.8%	36.0%	15.3%	16.1%
Philippines	10.0%	12.5%	2.6%	32.8%	22.8%	20.3%
Singapore	57.8%	56.2%	-1.7%	75.5%	17.7%	19.3%
Thailand	11.3%	8.2%	-3.1%	39.7%	28.4%	31.5%
LDC	7.6%	8.3%	0.7%	23.8%	16.2%	15.5%
Emerging Asia	10.7%	12.4%	1.7%	37.5%	26.8%	25.1%
Latin America	7.3%	7.8%	0.5%	9.8%	2.5%	2.0%
Oil Countries	18.0%	17.8%	-0.1%	27.4%	9.4%	9.6%
1983 - 1993						
China	7.8%	5.4%	-2.4%	5.3%	-2.5%	-0.1%
Indonesia	7.3%	7.6%	0.2%	-0.5%	-7.8%	-8.0%
Korea	4.5%	8.4%	4.0%	10.7%	6.2%	2.3%
Malaysia	23.8%	23.5%	-0.3%	23.8%	0.1%	0.3%
Philippines	6.4%	9.8%	3.4%	9.3%	2.9%	-0.5%
Singapore	70.8%	61.0%	-9.8%	78.7%	7.9%	17.7%
Thailand	12.8%	13.7%	0.9%	9.7%	-3.1%	-4.0%
LDC	8.5%	7.7%	-0.8%	1.1%	-7.4%	-6.6%
Emerging Asia	12.2%	13.6%	1.4%	13.2%	1.0%	-0.4%
Latin America	6.7%	5.6%	-1.1%	-12.7%	-19.3%	-18.2%
Oil Countries	15.9%	13.2%	-2.7%	4.1%	-11.8%	-9.1%
1999 - 2004						
China	23.5%	37.7%	14.2%	-6.0%	-29.5%	-43.7%
Hong Kong	69.2%	70.4%	1.2%	-5.2%	-74.4%	-75.6%
Indonesia	16.6%	14.0%	-2.5%	8.2%	-8.4%	-5.8%
Korea	22.3%	16.5%	-5.8%	3.3%	-19.0%	-13.2%
Malaysia	40.6%	27.2%	-13.4%	-5.2%	-45.8%	-32.4%
Philippines	20.2%	21.9%	1.6%	2.1%	-18.1%	-19.7%
Singapore	95.3%	98.7%	3.4%	2.5%	-92.8%	-96.1%
Thailand	29.0%	25.2%	-3.8%	2.3%	-26.7%	-22.9%
LDC	19.8%	21.9%	2.1%	2.2%	-17.7%	-19.8%
Emerging Asia	34.7%	31.0%	-3.7%	2.0%	-32.7%	-29.0%
Latin America	9.6%	7.1%	-2.5%	5.2%	-4.4%	-1.9%
Oil Countries	27.0%	21.6%	-5.4%	8.0%	-19.0%	-13.6%

Note: China is not included in the 1975-81 sample, neither is Hong Kong in the 1975-81 and 1983-93 samples. The “Emerging Asia” group does not include China.

Table 5: What if Developed Economies Acted as if They were Developing Economies

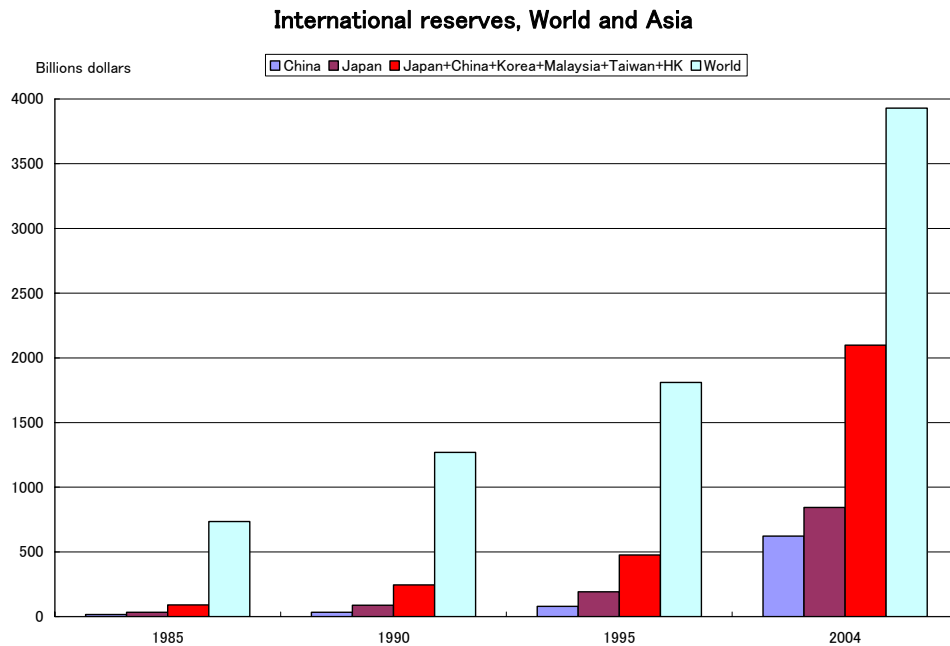
	Actual	Estimates using IDC estimates	errors (2) - (1)	Estimates using LDC estimates	Errors (4) - (1)	Differences (4) - (2)
	(1)	(2)	(3)	(4)	(5)	(6)
<i>1975 - 1981</i>						
U.K.	5.4%	4.4%	-1.0%	46.7%	41.3%	42.3%
Germany	10.3%	9.8%	-0.5%	37.7%	27.4%	27.9%
Japan	3.4%	5.5%	2.1%	15.0%	11.6%	9.5%
IDC	5.5%	5.0%	-0.5%	34.8%	29.3%	29.8%
<i>1983 - 1993</i>						
U.K.	4.8%	7.2%	2.4%	10.8%	6.0%	3.6%
Germany	8.2%	5.2%	-3.0%	11.1%	2.9%	6.0%
Japan	2.8%	9.2%	6.4%	4.7%	1.9%	-4.6%
IDC	5.3%	5.2%	-0.1%	8.6%	3.2%	3.3%
<i>1999 - 2004</i>						
U.K.	2.8%	4.8%	2.0%	21.3%	18.6%	16.5%
Germany	4.2%	3.1%	-1.1%	28.1%	23.9%	25.0%
Japan	11.6%	11.6%	0.0%	25.8%	14.2%	14.2%
IDC	4.8%	4.4%	-0.4%	21.4%	16.6%	17.0%

Table 6: Predictions using Past Estimations, 1999 – 2004

	Actual	Est. Using the 1999-04 model	Errors (2)-(1)	Est. Using the 1983-93 model	Errors (4)-(1)	Est. Using the 1975-81 model	Errors (6)-(1)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
<i>Developed Economies</i>							
U.K.	2.8%	4.8%	2.0%	24.3%	21.6%	17.4%	14.6%
Germany	4.2%	3.1%	-1.1%	15.1%	10.9%	11.7%	7.6%
Japan	11.6%	11.6%	0.0%	16.5%	4.9%	8.1%	-3.5%
IDC	4.8%	4.4%	-0.4%	9.5%	4.7%	5.9%	1.2%
<i>Developing Economies</i>							
China	23.5%	37.7%	14.2%	16.5%	-7.0%	157.4%	133.9%
Hong Kong	69.2%	70.4%	1.2%	63.5%	-5.7%	368.0%	298.8%
Indonesia	16.6%	14.0%	-2.5%	9.2%	-7.4%	7.2%	-9.4%
Korea	22.3%	16.5%	-5.8%	18.0%	-4.3%	53.3%	31.0%
Malaysia	40.6%	27.2%	-13.4%	38.8%	-1.8%	58.4%	17.8%
Philippines	20.2%	21.9%	1.6%	20.5%	0.3%	15.6%	-4.6%
Singapore	95.3%	98.7%	3.4%	60.7%	-34.6%	262.6%	167.3%
Thailand	29.0%	25.2%	-3.8%	23.8%	-5.2%	29.9%	0.9%
LDC	19.8%	21.9%	2.1%	15.4%	-4.4%	71.3%	51.5%
Emerging Asia	34.7%	31.0%	-3.7%	28.0%	-6.7%	98.2%	63.5%
Latin America	9.6%	7.1%	-2.5%	8.2%	-1.5%	26.8%	17.2%
Oil Countries	27.0%	21.6%	-5.4%	9.3%	-17.7%	38.8%	11.8%

NOTES: Prediction errors with positive (negative) signs in Columns (3), (5), and (7) indicate that under(over)-holding of reserves. The “Emerging Asia” group does not include China.

Figure 1: International Reserves including gold



Source: World Development Indicator, IFS, and Milesi-Ferretti (2006).

NOTE: The figures for Taiwanese and Hong Kong reserves do not include gold.

Figure 2: Incremental contribution of the determinants to the goodness of fit

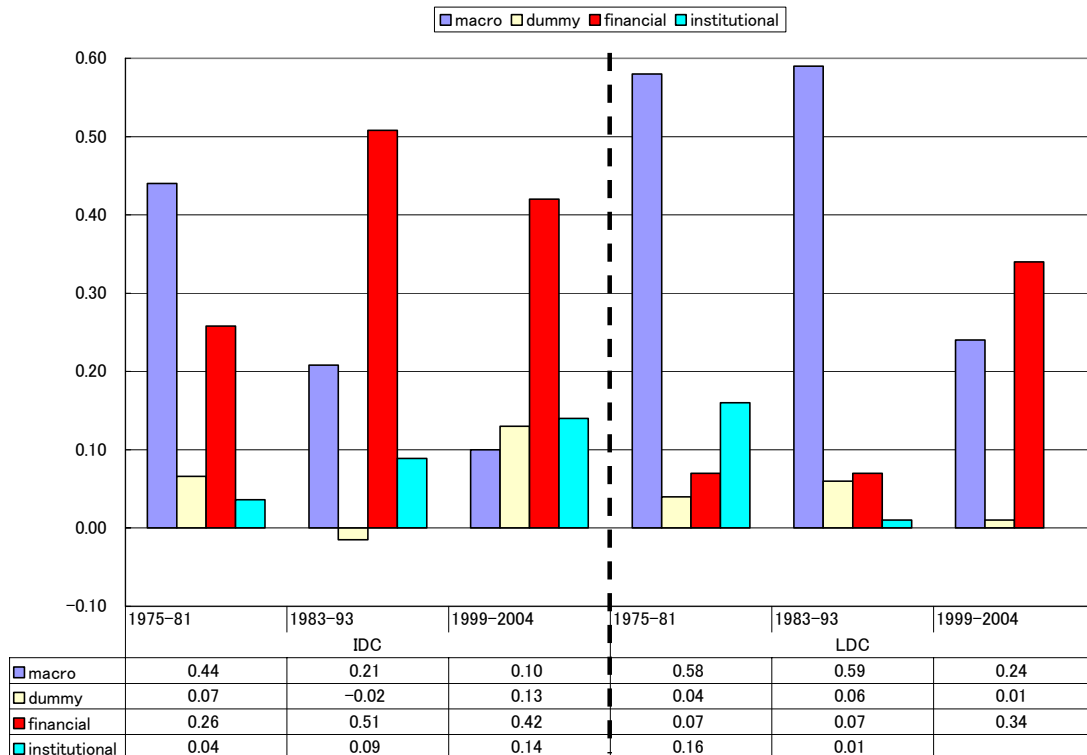
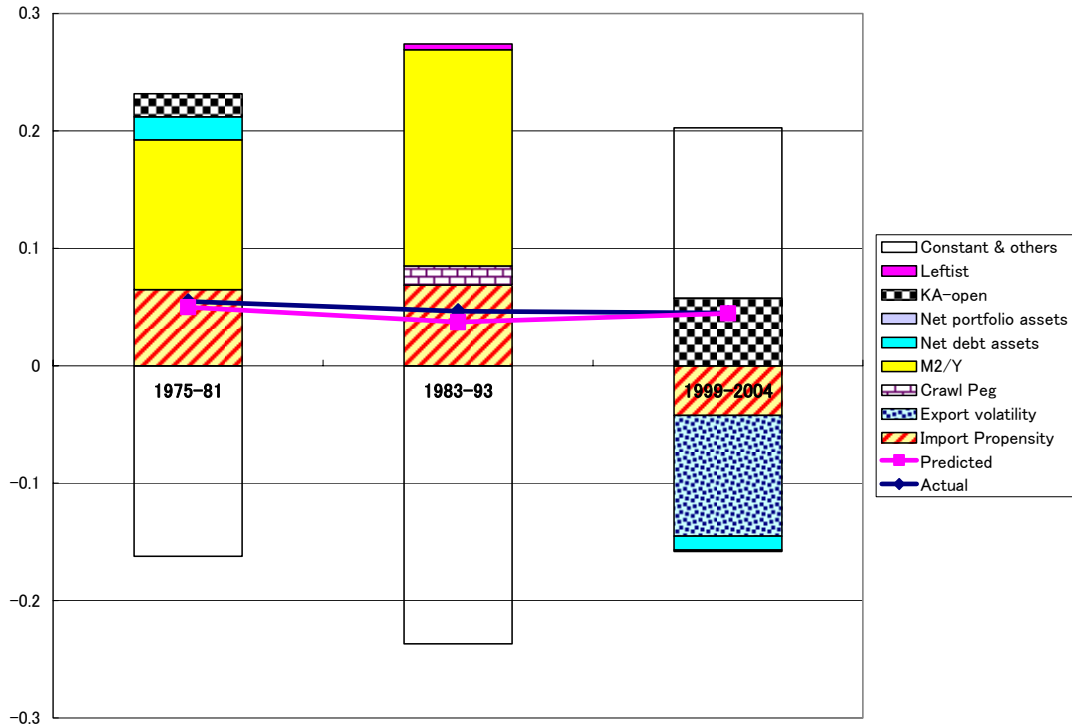


Figure 3: Actual and Predicted Values of the Reserve Ratios and Contributions of the Determinants

A: Developed Economies



B: Developing Economies

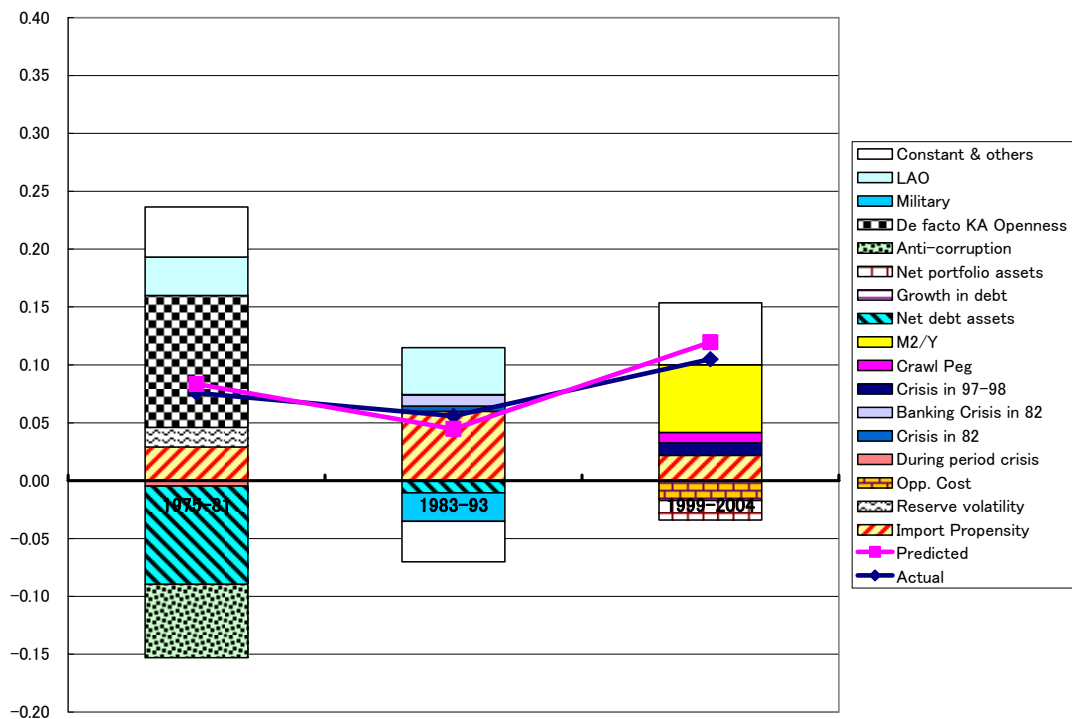
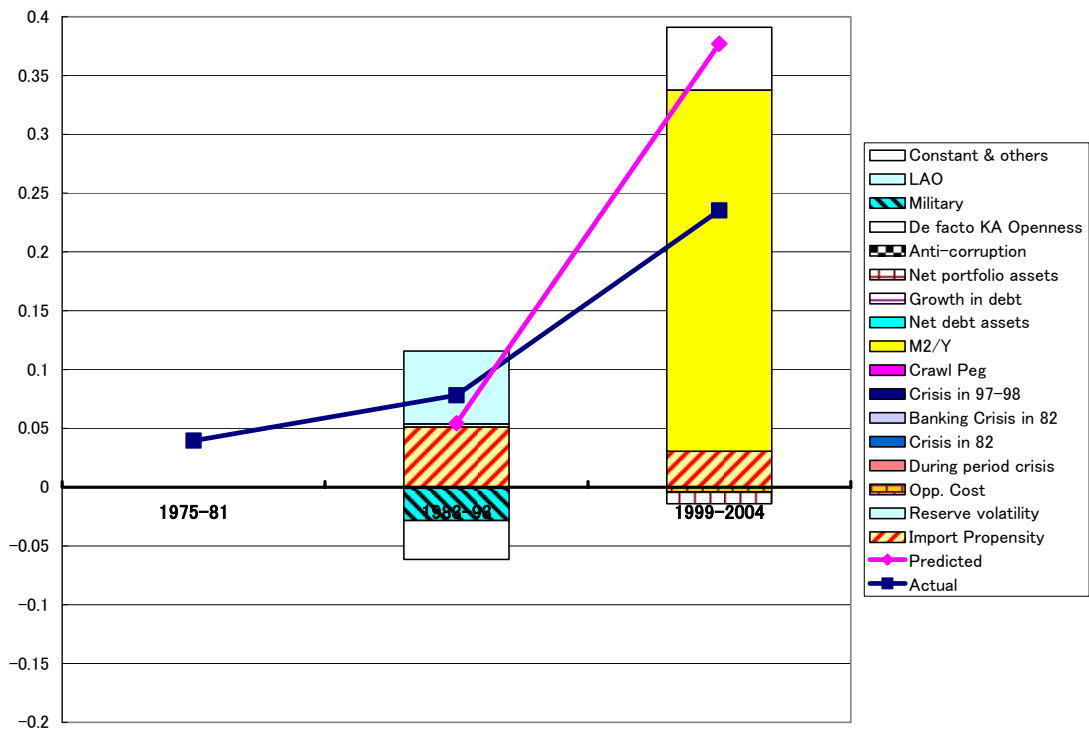


Figure 3: continued
C: China



D: Emerging Asia excluding China

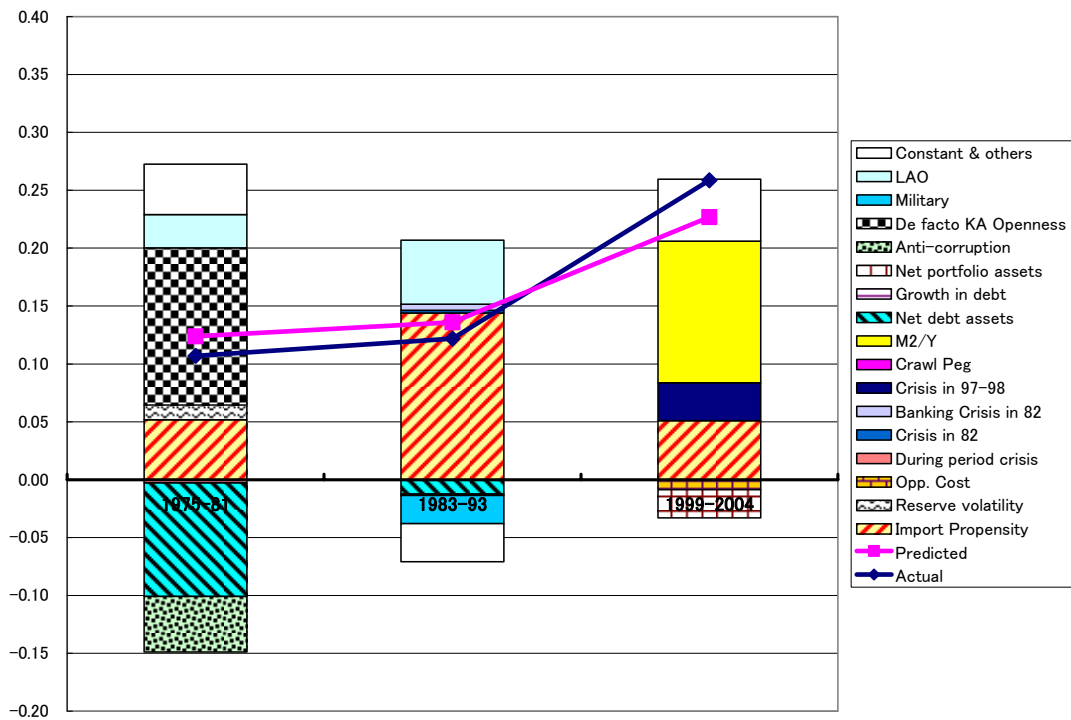
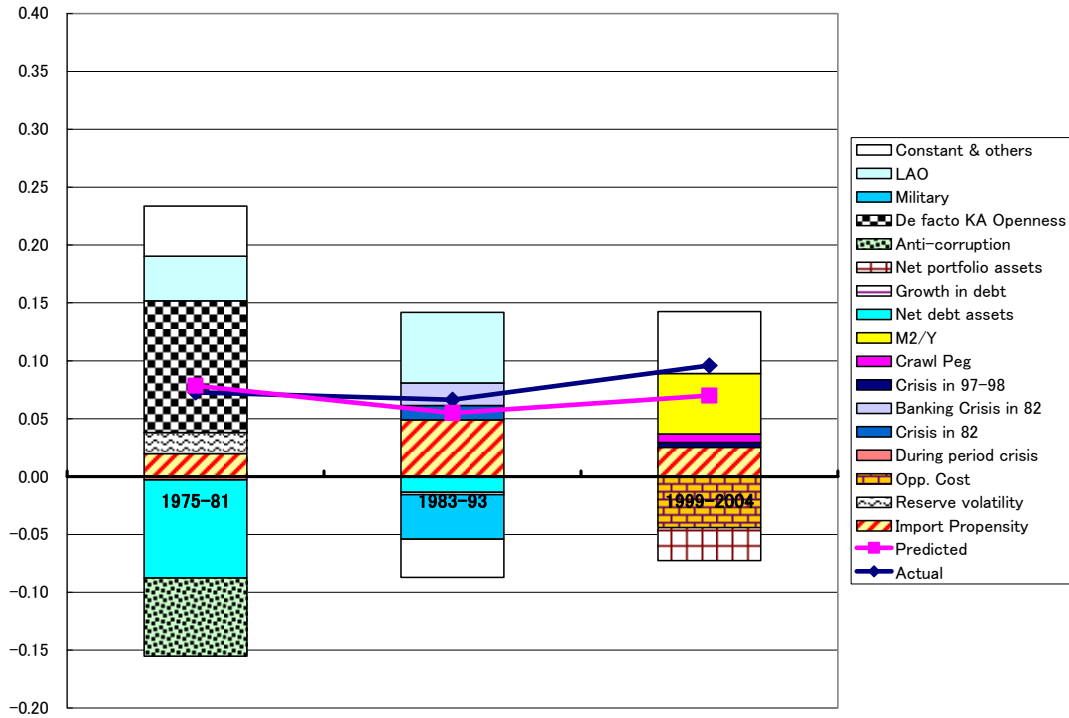


Figure 3: continued
E. Latin American Countries



F. Oil Exporting Countries

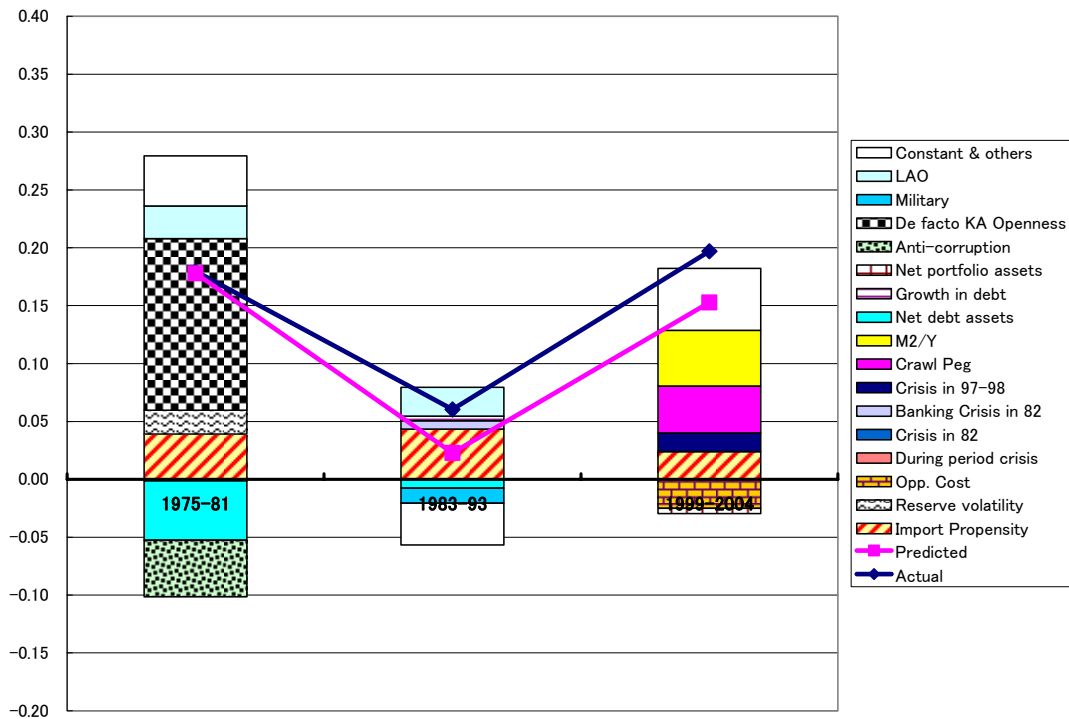
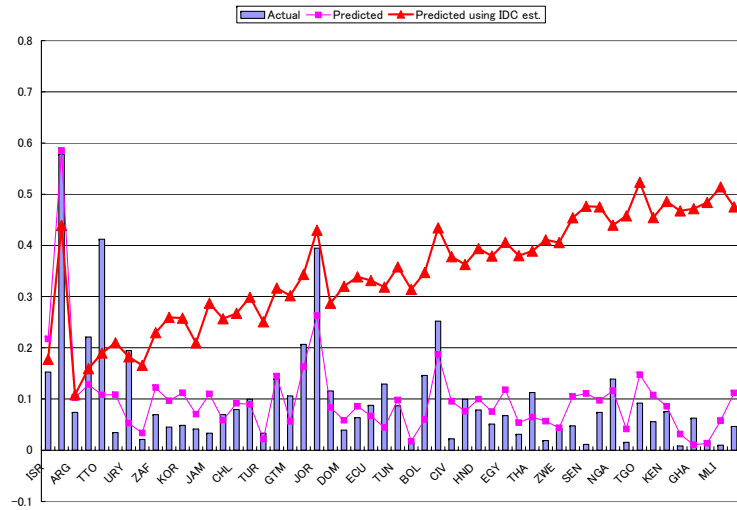
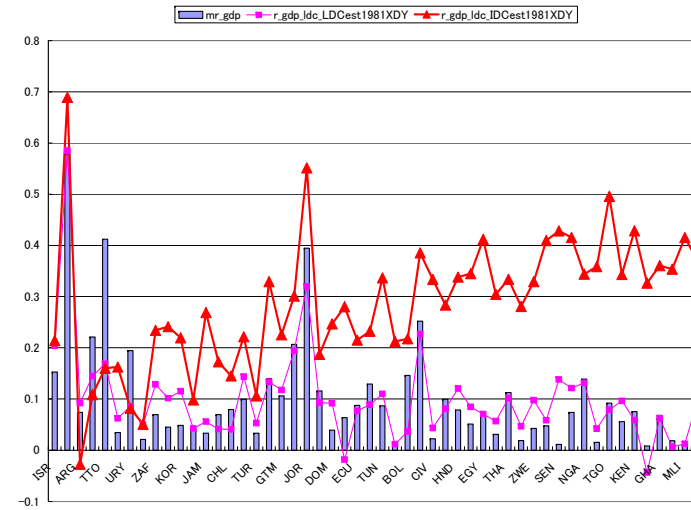


Figure 4: What if Developing Economies Acted as if They were Developed Economies? 1975 – 81

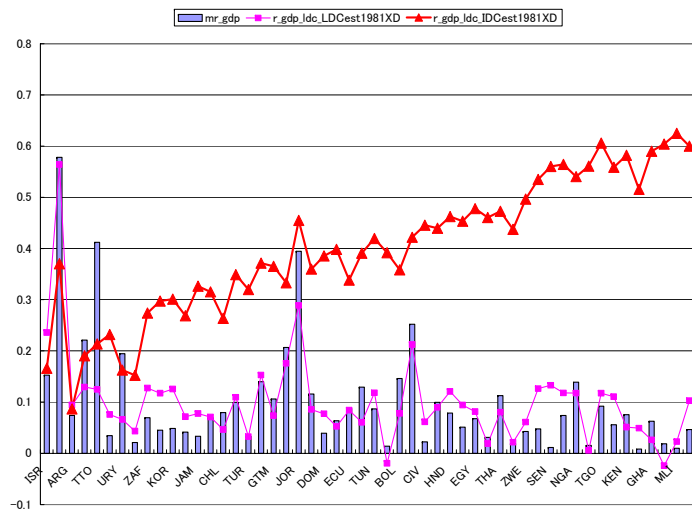
A: Predictions with macro variables



C: Predictions with macro vars, dummies, and fin. vars.



B: Predictions with macro variables and dummies



D: Predictions with all variables

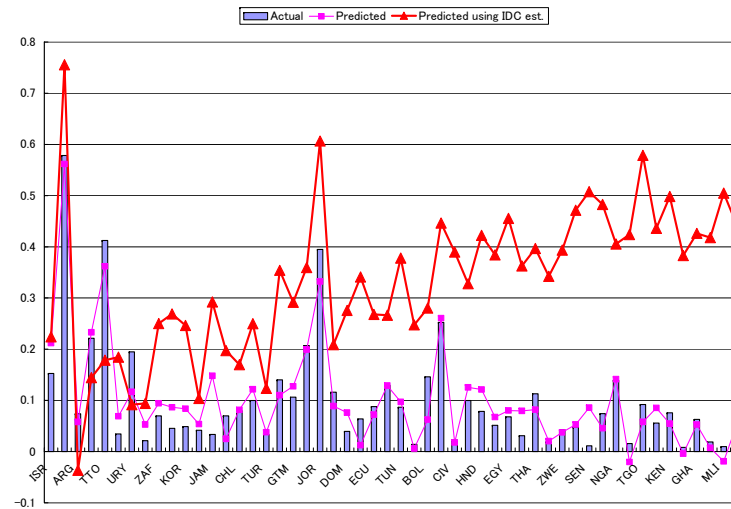
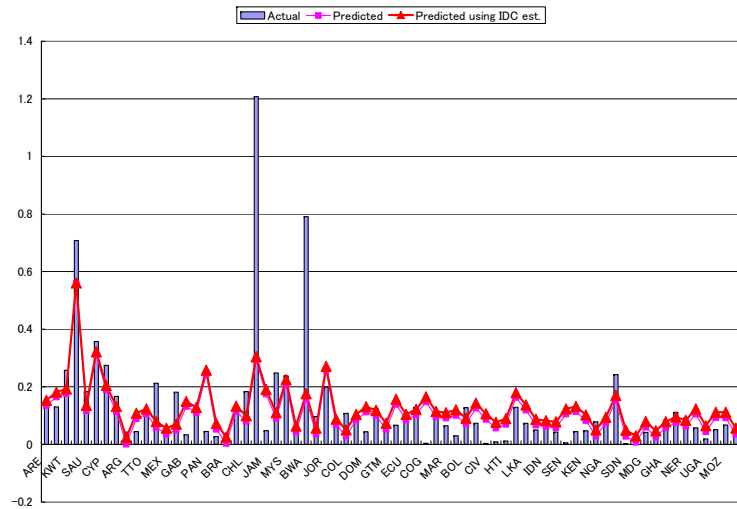
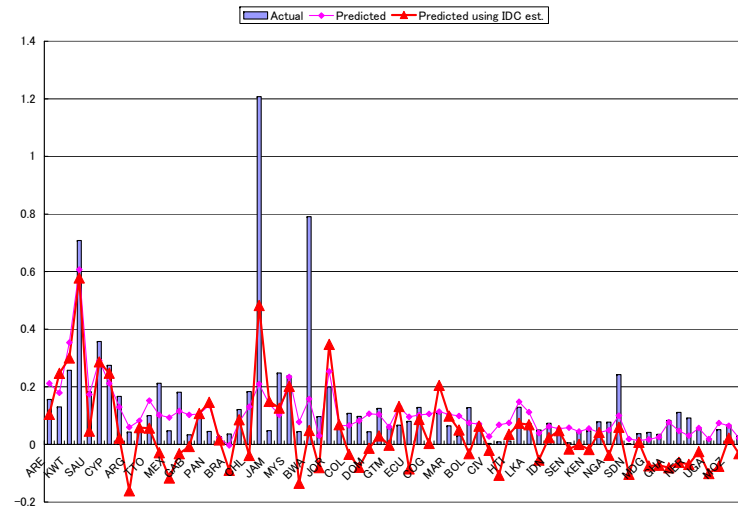


Figure 5: What if Developing Economies Acted as if They were Developed Economies? 1983 – 93

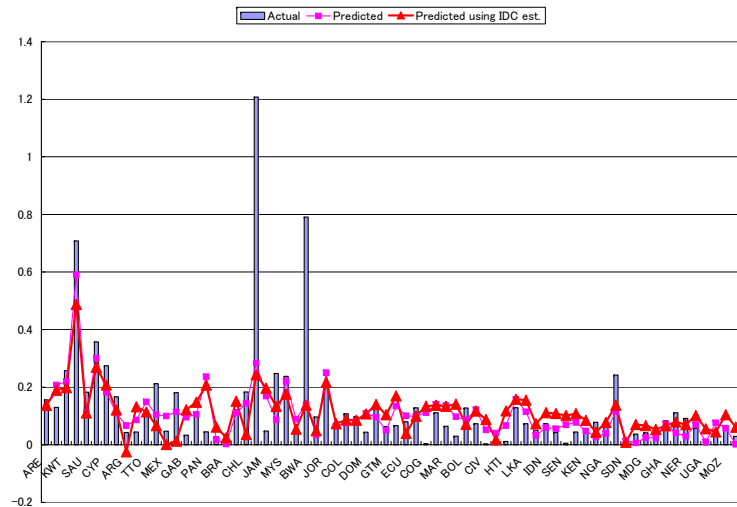
A: Predictions with macro variables



C: Predictions with macro vars, dummies, and fin. vars.



B: Predictions with macro variables and dummies



D: Predictions with all variables

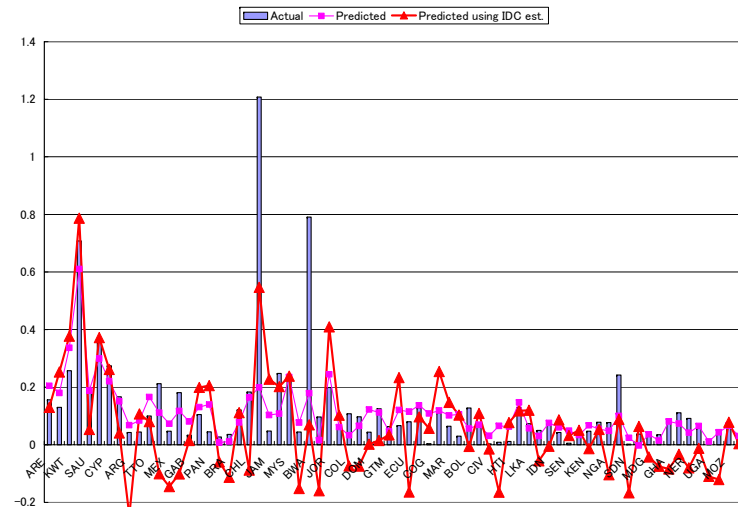
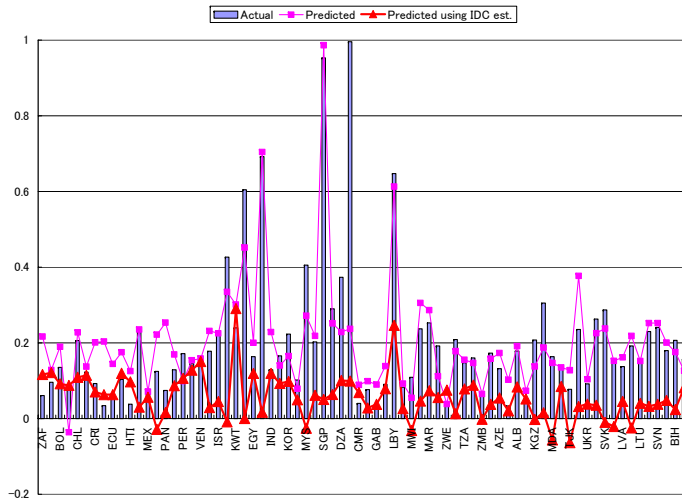
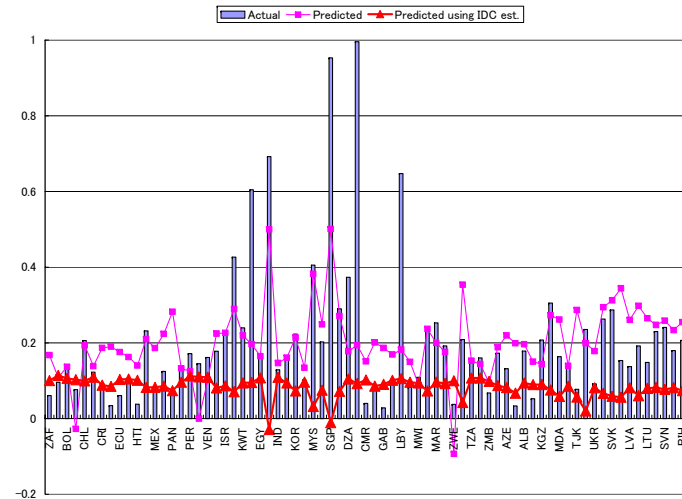


Figure 6: What if Developing Economies Acted as if They were Developed Economies? 1999 – 2004

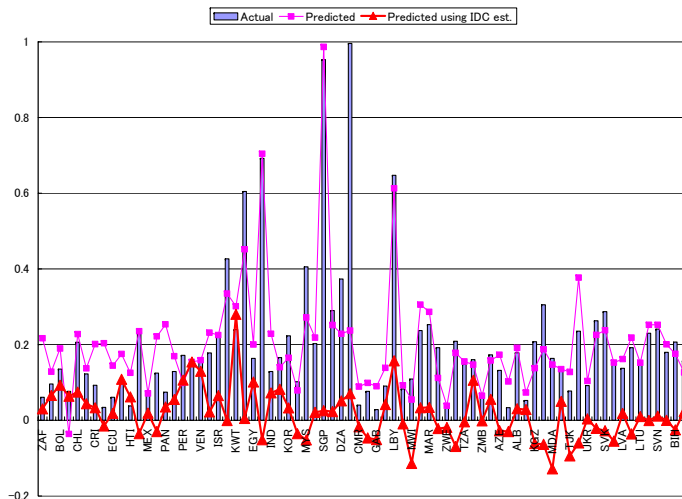
A: Predictions with macro variables



C: Predictions with macro vars, dummies, and fin. vars.



B: Predictions with macro variables and dummies



D: Predictions with all variables

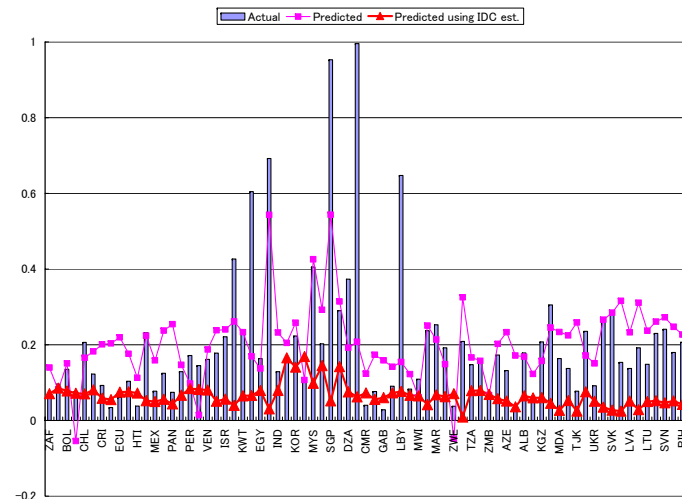
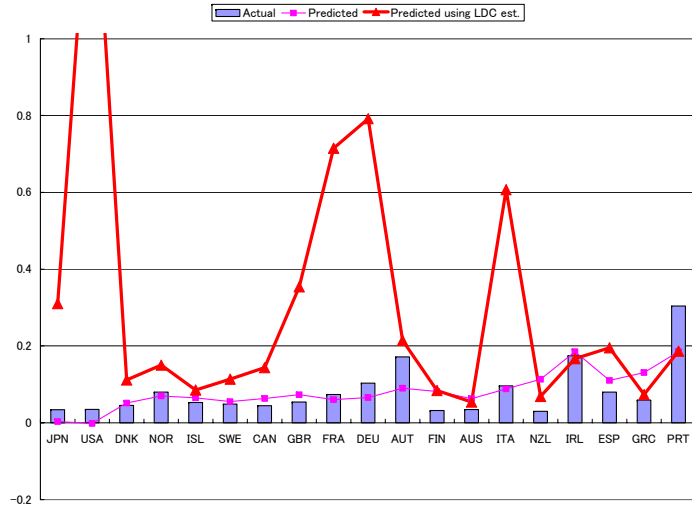
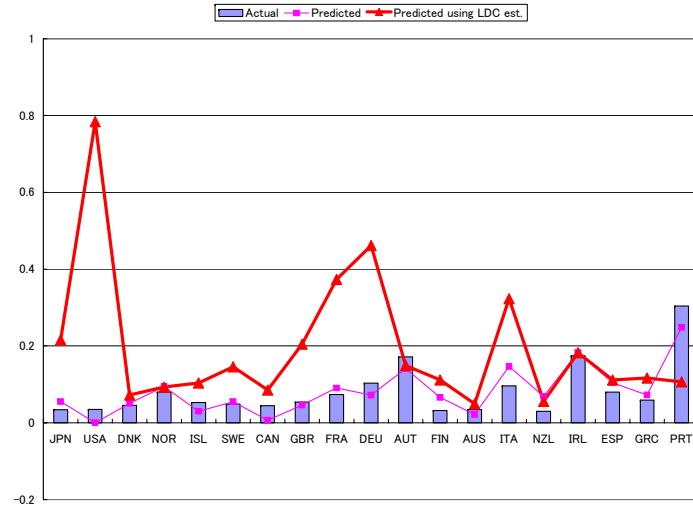


Figure 7: What if Developed Economies Acted as if They were Developing Economies? 1975 – 81

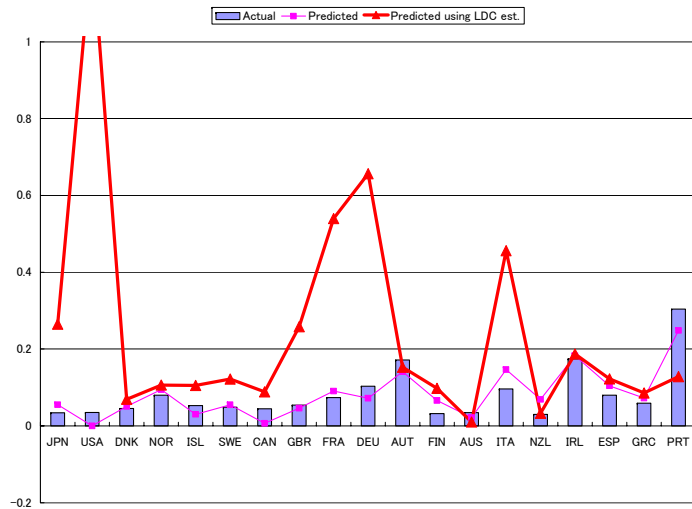
A: Predictions with macro variables



C: Predictions with macro vars, dummies, and fin. vars.



B: Predictions with macro variables and dummies



D: Predictions with all variables

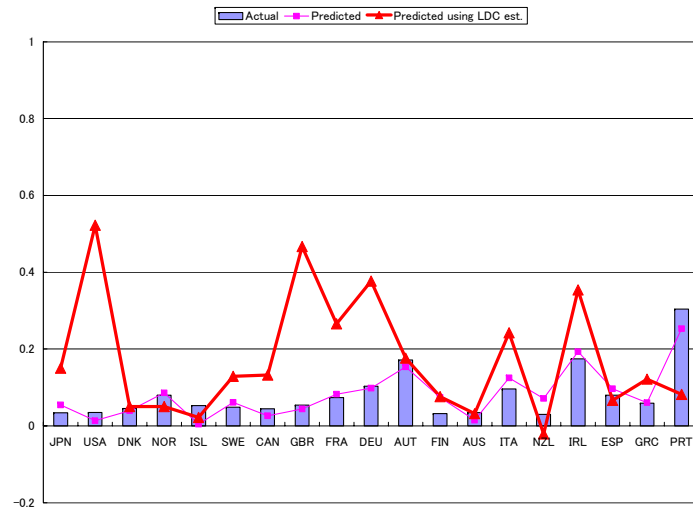
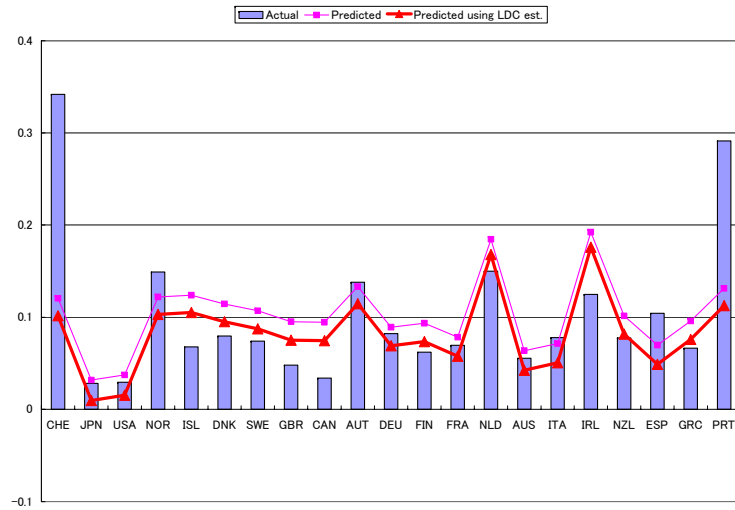
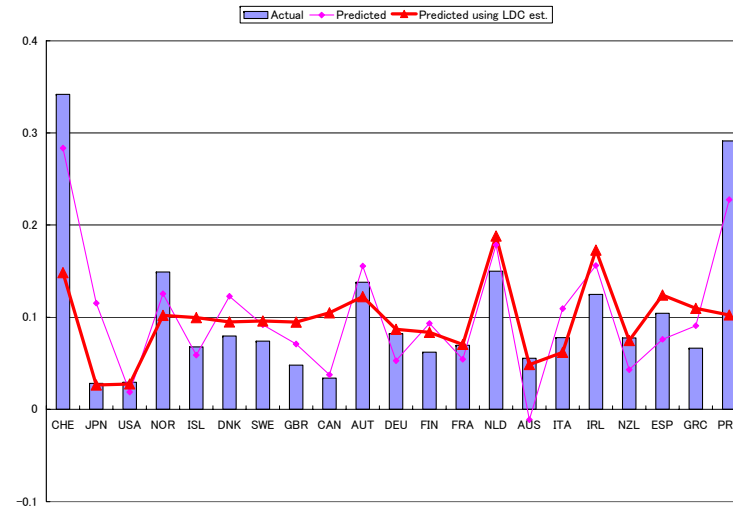


Figure 8: What if Developed Economies Acted as if They were Developing Economies? 1983 – 1993

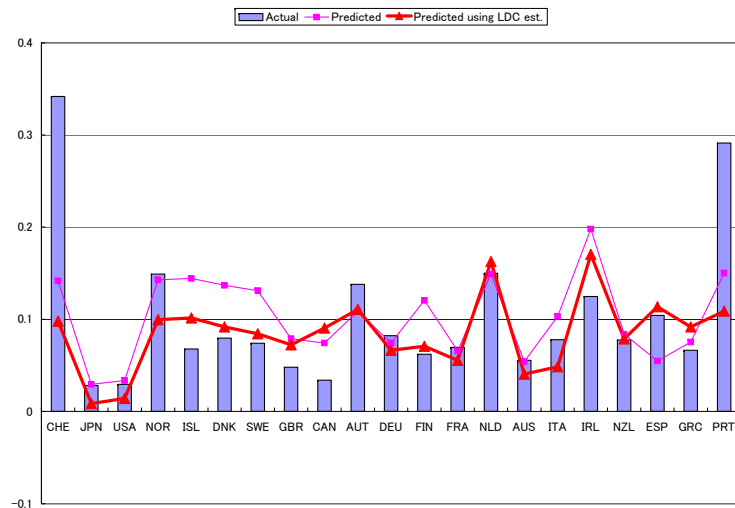
A: Predictions with macro variables



C: Predictions with macro vars, dummies, and fin. vars.



B: Predictions with macro variables and dummies



D: Predictions with all variables

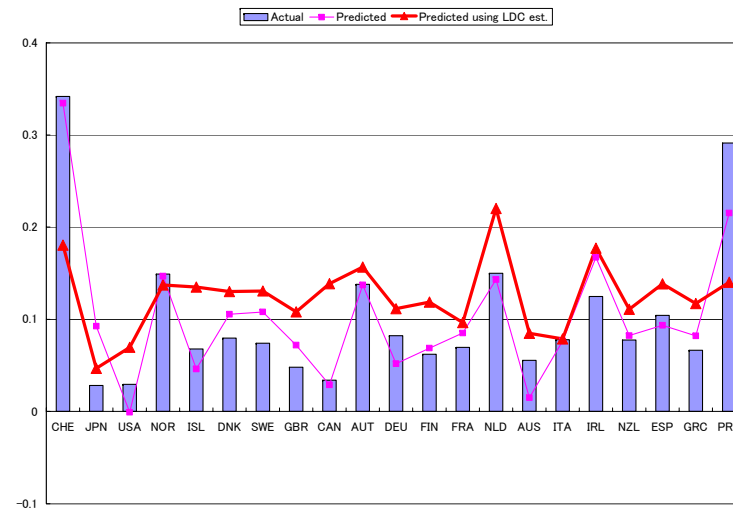
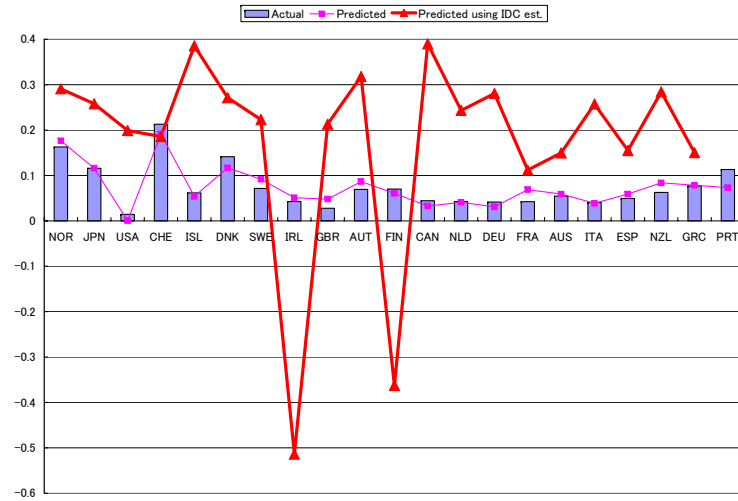
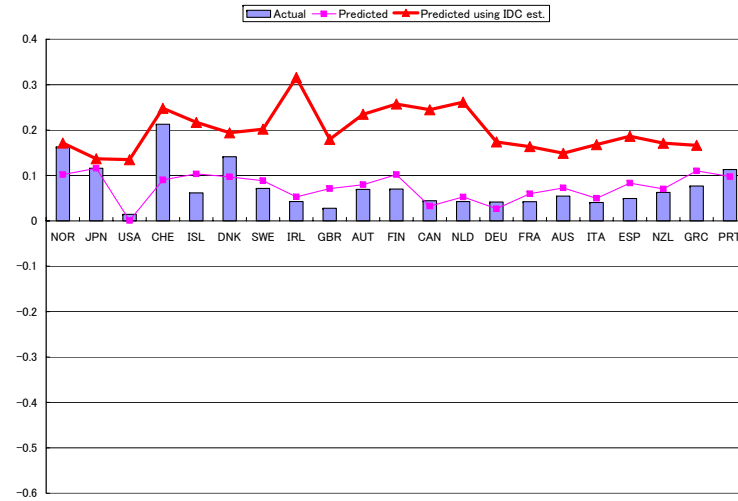


Figure 9: What if Developed Economies Acted as if They were Developing Economies? 1999 – 2004

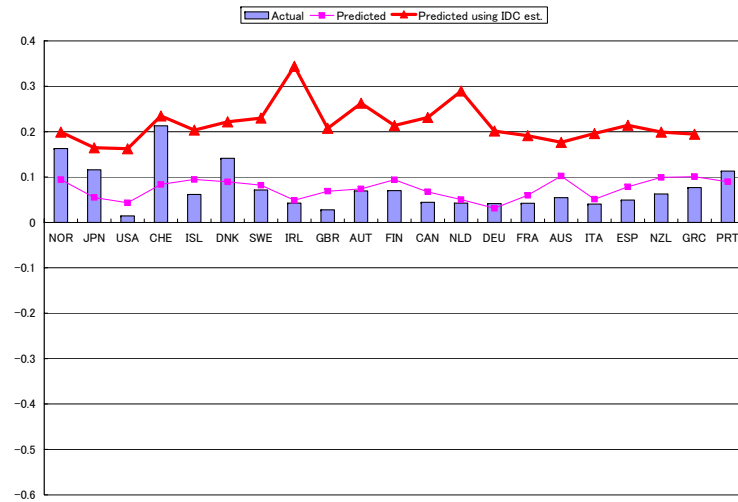
A: Predictions with macro variables



C: Predictions with macro vars, dummies, and fin. vars.



B: Predictions with macro variables and dummies



D: Predictions with all variables

