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THE ROLE OF CAPITAL CONTROLS AND PRUDENTIAL POLICIES

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ABSTRACT

We examine whether macroprudential policies and capital controls can contribute to enhancing financial stability in the face of large capital inflows. We construct new indices of foreign currency (FX)-related prudential measures, domestic prudential measures, and financial-sector capital controls for 51 emerging market economies over the period 1995–2008. Our results indicate that both capital controls and FX-related prudential measures are associated with a lower proportion of FX lending in total domestic bank credit and a lower proportion of portfolio debt in total external liabilities. Other prudential policies appear to help restrain the intensity of aggregate credit booms. Experience from the global financial crisis suggests that prudential and capital control policies in place during the boom seem to have enhanced economic resilience during the bust.

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I. INTRODUCTION

The strong recovery in capital inflows to emerging market economies (EMEs) since the sudden stop in late 2008-early 2009 is giving rise to (at least) two sets of concerns. The first relates to macroeconomic challenges, especially the intense pressure on a number of emerging-market currencies, which, if not sustained, may create costly dislocations when exchange rates come down, given the erosion in competitiveness and possible exposure to foreign-currency denominated debt on domestic balance sheets. The second relates to financial-stability risks, especially the possibility that some of the flows may not be channeled towards productive uses, and may thus end up fueling credit and asset price booms that may not be sustainable, amplifying financial fragilities down the road.

Such concerns have led to renewed interest in the effectiveness and design of macroprudential policies and the possible use of capital controls—that is, measures that treat transactions between residents and nonresidents less favorably than those amongst residents—in helping to manage financial-stability risks associated with inflows. Systematic investigations of the impact of macroprudential policies and capital controls on the financial-stability risks associated with inflows have nevertheless been lacking.² This paper thus aims to fill a gap in the existing literature by examining the nexus between various macroprudential policies, controls on capital inflows, and economic and financial stability. As regards capital controls, we focus exclusively on inflow controls.

For the purpose of our analysis, we group the available policy tools into four broad categories: (i) domestic prudential regulations, (ii) foreign currency (FX)-related prudential measures, (iii) financial-sector specific capital controls, and (iv) economy-wide capital controls. We then assess the impact of these various measures on the structure of external liabilities; the growth of domestic banking system credit; and the currency composition of domestic bank lending. To the extent that portfolio debt is the riskiest type of external liability, and credit booms—especially in foreign currency—can exacerbate financial fragilities, measures that reduce these concerns should be associated with greater resilience of the economy to financial crises. To test this hypothesis, we exploit the “natural experiment” afforded by the recent (2008–09) global financial crisis, which triggered downturns of varying intensities across emerging market economies, and see whether

² Several studies examine the impact of overall institutional quality on the composition of the external liability structure (for example, Razin, Sadka, and Yuen, 1998, 2000; Wei, 2001), and the association between financial regulatory quality and credit booms (for example, Dell’Ariccia and Marquez, 2006; Barajas, Dell’Ariccia, and Levchenko, 2007; Mendoza and Terrones, 2008; Bakker and Gulde, 2010). A few recent studies, particularly in the context of Central and Eastern European economies, also investigate the impact of policies related to foreign currency borrowing on foreign currency lending (for example, Rosenberg and Tirpak, 2009).

countries that had prudential measures and capital controls in place before the crisis also fared better during the crisis (controlling for other characteristics).

While several indices of economy-wide capital controls have been put forward in the recent literature, composite measures of financial sector-specific capital controls, and prudential regulations for a wide range of emerging market economies, have hitherto been unavailable. Using information from the International Monetary Fund's (IMF) Annual Report on Exchange Arrangements and Exchange Restrictions (AREAER), we construct new indices for the regulation of FX transactions in the domestic financial sector, and for financial-sector specific capital controls. We also construct an index of domestic prudential regulations based on a survey of IMF desk economists. These three indices, together with Schindler's (2009) index of economy-wide controls on inflows, are used in our empirical analysis.

Our results suggest that FX-related prudential measures as well as capital controls, are associated with a lower proportion of FX loans in domestic bank lending. Second, other prudential regulations (i.e., measures that do not discriminate either on the basis of currency denomination or the residency of the parties to the transaction) are associated with smaller aggregate credit booms. Third, capital controls and FX-related prudential measures are associated with a shift away from portfolio debt flows towards portfolio equity and FDI flows within the country's overall external liability structure. The estimated effects presented below, moreover, are not only statistically significant, but also economically relevant. For instance, moving from the 25th to the 75th percentile of capital controls restrictiveness or FX-related prudential measures lowers the share of portfolio debt in external liabilities by about 4-7 percentage points and the share of FX credit in the domestic banking sector by 20-25 percentage points. Consistent with these results, we also find reasonably strong (economically and statistically-significant) associations between pre-crisis policies and the extent of economic resilience during the period of sudden stop—suggesting that capital controls and prudential measures can indeed reduce financial fragilities.

Our results dovetail nicely with the existing literature, which has mostly focused on possible macroeconomic effects of capital controls—on the aggregate volume of flows, the exchange rate, and monetary policy autonomy. By and large, evidence on this is mixed. The survey and meta-analysis of Magud, Reinhart, and Rogoff (2007) points to capital controls having only limited effectiveness in altering the overall volume of capital inflows (and hence the level of the exchange rate). Consistent with our findings, evidence that capital controls may affect the composition of capital flows is stronger, with at least some studies finding that capital controls have managed to lengthen the maturity of inflows.³

³ On altering the composition (lengthening maturities) of inflows, see De Gregorio, Edwards, and Valdés (2000) on Chile, and Cardenas and Barrera (1997) on Colombia. On monetary policy autonomy, De Gregorio, Edwards, and Valdés (2000) find that capital controls allowed Chile's central bank to target a higher domestic interest rate over a period of 6 to 12 months; Ma and McCauley (2008), and Hutchison et al. (2009) find that

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Previous studies on capital controls have, however, not examined other aspects of financial stability—for example, the share of foreign currency lending and the riskiness of the external liability structure—that we consider here. Further, the mixed evidence of the effectiveness of capital controls on the aggregate volume of flows (and hence on the exchange rate) has been taken to imply a severe limitation on their use in practice. It is worth pointing out, however, that from a financial-stability perspective, altering the composition of inflows without affecting the aggregate level would be the ideal outcome. One of the contributions of our paper is therefore to highlight this distinction, and show that while capital controls may be of limited (or only temporary) use in affecting the aggregate volume of flows, inflow controls (together with FX-related and other prudential measures) can form an important part of the policy toolkit to reduce the financial-stability risks associated with inflow surges.

The remainder of the paper is organized as follows. Section 2 presents an overview of the instruments in the prudential toolkit to manage the macroeconomic and financial stability risks posed by excessive capital inflows. Section 3 describes the construction of indices of financial sector capital controls, FX-related prudential measures, and domestic prudential policies. Section IV presents some empirical evidence on the association between the policy indices with financial fragilities and crisis resilience. Section 5 concludes.

II. THE PRUDENTIAL TOOLKIT

A. Defining the Toolkit

Beyond purely macroeconomic policies, policy makers have at their disposal a number of tools to help mitigate financial-stability risks associated with capital inflows. It is convenient to group these according to whether they discriminate in terms of the residency of the parties to the capital transaction (capital controls), the denomination of the currency of the transaction (FX-related prudential measures), or neither (other prudential measures). By definition, prudential measures apply only to the regulated domestic financial system (notably banks, but sometimes also other financial institutions), whereas capital controls can apply to all residents (though they can also be applied selectively to specific sectors).

Capital controls are measures that restrict capital transactions (or transfers and payments necessary to effect them) by virtue of the residency of the parties to the transaction.⁴ Controls

interest differentials are significant and persistent in China and India, which maintain more extensive capital controls. However, Ghosh, Ostry and Tsangarides (2010) find significantly lower monetary autonomy in countries with fixed exchange rates compared with more flexible regimes, even in countries with relatively closed capital accounts.

⁴ There is no unique generally accepted legal definition of capital controls. In the broadest sense, they are measures meant to affect the cross-border movement of capital. In its *Code of Liberalization of Capital*

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may be economy-wide, sector-specific (usually the financial sector), or industry specific (for example, “strategic” industries in the case of controls on FDI). Measures may apply to all flows, or may differentiate by type or duration of the flow (debt, equity, direct investment; short-term vs. medium- and long-term). Since much of our analysis focuses on the financial-sector, we distinguish between financial-sector and economy-wide capital controls below.

FX-related prudential measures discriminate by virtue of the currency denomination of the capital transaction, not the residency of the parties to the transaction. These measures are applied to domestic financial institutions, primarily to banks. Limits on banks’ open FX position (as a proportion of their capital) are common, as are limits on banks’ investments in FX assets.⁵ Other measures may serve to limit FX lending by domestic banks, especially to borrowers that lack a natural hedge, including for example, differential reserve requirements on liabilities in local currency and FX. These types of measures will affect the composition of liabilities, and will also affect the volume to the extent that forcing foreigners to bear the currency risk affects their willingness to lend.

Other prudential measures are all other prudential regulations that discriminate neither on the basis of the currency of the transaction or the residency of the parties to the transaction. Typical measures include maximum loan-to-value (LTV) ratios, limits on domestic credit growth, asset classification and provisioning rules, sectoral limits on loan concentration, dynamic loan-loss provisions, and counter-cyclical capital requirements.

While this categorization is analytically convenient, one should bear in mind that policies in one group can also affect risks that are more directly related to another group of policies. For example, capital controls may have the effect of reducing FX-denominated capital transactions (and, likewise, FX-related measures may have the effect of reducing resident/non-resident transactions), even if that is not their primary intent.

B. Measuring Capital Controls and Prudential Regulations

Like most discrete policy variables, capital controls and prudential measures are difficult to quantify. Commonly used de jure measures (which are based on the IMF’s AREAER) include Chinn and Ito (2008), and Quinn and Toyoda (2008), who provide an index of overall capital account restrictiveness (combining both inflow and outflow controls), and Schindler (2009), who differentiates between (economy-wide) inflow and outflow controls. Some studies have resorted to de facto measures or outcome variables to proxy for the de jure

Movements, the Organization for Economic Cooperation and Development (2009) considers measures to be capital controls subject to liberalization obligations if they discriminate between residents and nonresidents.

⁵ In some currency-board or fixed-exchange-rate countries, exposures in the peg currency are excluded in the calculation of the open position. In our empirical analysis, asymmetric open position limits, which introduce different limits on short and long positions, are categorized as FX-related measures—even though these could be considered a form of capital control inasmuch as they act to discourage inflows (e.g., a lower short position limit could limit capital inflows).

regulation, but clearly that cannot be done here as we are interested in the effect of policy measures on outcomes.

We therefore develop three new indices of de jure measures of (i) capital controls specific to the financial sector; (ii) FX-related prudential measures, and (iii) other prudential measures. For financial sector specific controls and FX-related measures, we obtain information from the IMF's AREAER for 51 EMEs over the period 1995–2008.⁶ For other prudential measures, we conduct a survey of IMF country teams and compile information for 42 EMEs for the years 2005 and 2007. For economy-wide capital controls, we rely on the index provided by Schindler (2009).

Financial sector capital controls

Our measure of financial sector-specific capital controls (*Fincont*) is based on whether the AREAER documents provisions that apply only to the financial sector, and that discriminate based on the residency of the parties to the transaction. Specifically, whether measures exist that (i) impose limits on financial sector borrowing from abroad; (ii) restrict the maintenance of accounts abroad; or (iii) impose differential treatment of accounts held by nonresidents (e.g., different reserve/liquid asset requirements, interest rate, or credit controls). Each type of restriction, if it exists, is assigned a value of one (and zero otherwise), and this information is used to create two composite measures—a simple average of restrictions on (i) the financial sector's borrowing from abroad, and (ii) differential treatment of accounts held by nonresidents (labeled *Fincont1*), and an average of all the three components: (i) differential treatment of accounts held by nonresidents; (ii) limits on borrowing from abroad; and (iii) restrictions on maintenance of accounts abroad (denoted as *Fincont2*).⁷

Figure 1(a) plots the composite *Fincont2* index over 1995–2008 across different regions, and gives an indication of how financial sector-specific controls have evolved over time. On average, both Europe and Latin America appear to be the least restrictive in terms of capital controls on the financial sector, while Asia is the most restrictive. This pattern mimics that of economy-wide capital controls on inflows, as measured by Schindler's (2009) index (labeled here as *Kcont*). Figure 1(b) shows that Asia is more intensive in economy-wide capital account restrictions on inflows than either Europe or Latin America. Interestingly, while the average intensity of economy-wide capital controls has been falling somewhat in EMEs over the years as countries have moved towards capital account liberalization, the prevalence of

⁶ See Table A1 for the list of countries in the sample, which is based on the sample of EMEs covered in the IMF's Early Warning Exercise (IMF, 2010).

⁷ Ideally, the index and its subcomponents would capture the intensity, rather than just the existence, of the various restrictions, but in practice this is almost impossible to do for administrative measures without making arbitrary choices. The index is therefore coded based on binary variables for the presence of restrictions (as is the case of other indices in the literature constructed from the AREAER).

financial sector-specific capital controls increased in the second half of 2000s, presumably in response to perceived risks associated with inflow surges.

Foreign currency-related prudential measures

Our index of FX-related prudential regulations is based on whether measures exist to (i) limit lending locally in foreign currency; (ii) limit purchase of locally issued securities denominated in foreign currency; (iii) impose differential treatment of deposit accounts in foreign exchange; and (iv) limit open foreign exchange positions.⁸ As before, a score of one is assigned when such restrictions exist (and zero otherwise). Based on this information, we create two indices: *FXreg1*, which is a simple average of restrictions on lending locally in foreign exchange, and differential treatment of deposit accounts in foreign exchange; and *FXreg2*, which is an average of all four components.⁹ Figure 1(c) shows that while FX-related regulations are more common in Asia, their adoption has increased over the years in both Asia and Latin America. By contrast, FX regulations are the least prevalent in emerging Europe, and seem to have been relaxed gradually over the years.

Domestic prudential regulations

Our measures of domestic prudential regulations cover three aspects of macro prudential policy: maximum loan-to-value (LTV) ratios; existence of reserve requirements; and limits on credit concentration to specific sectors. While the existence of maximum LTV ratios and sector-specific credit concentration limits are coded by binary variables, the reserve requirement measure is coded as 0 if the reserve requirement ratio is below 10 percent; 0.5 if it is in the range of 10-20 percent; and 1 if it is greater than 20 percent. As above, we create two measures to capture domestic prudential regulations—*Domreg1*, which is an average of the reserve requirement variable, and limit on credit concentration to specific sectors; and *Domreg2*, which also includes the LTV limit. Figure 1(d) shows that, between 2005 and 2007, the prevalence of domestic prudential regulations increased across all regions. Nevertheless, Asian EMEs appear to rely the most on domestic macro prudential measures, while European EMEs the least.

Measures in the Run-up to the Global Financial Crisis

How prevalent were these measures in the years leading up to the 2008 global financial crisis? Figure 2 provides a detailed snapshot of the individual measures comprising the various indices that were in place in our sample of emerging market economies in 2007.

⁸ If the limits on open FX positions differentiate between residents and nonresidents, they would constitute a capital control on the financial sector. However, disaggregated data on residents versus nonresidents open foreign exchange position limits is relatively limited, and where such information is available, there are only a handful of cases where limits existed on nonresidents' but not on the residents' assets and liabilities.

⁹ Typically, countries with a currency board exclude the anchor currency from the computation of limits on FX positions; we code such cases as not having limits on open FX positions.

Around one half of the countries had controls on bond inflows, with slightly fewer having controls on portfolio equity and even fewer on FDI flows.¹⁰ Somewhat surprisingly, capital controls specific to the financial sector were not more common than economy-wide controls. FX-related policies tend to be the most common type of measure, with over half of the countries imposing restrictions on lending locally in FX, and stricter requirements for deposit accounts in FX. Virtually all countries had limits on banks' open FX positions.

In general, the constructed measures tend to be positively correlated with each other as well as with the measure of economy-wide capital account controls on inflows (Figure 3).¹¹ The correlation is higher between capital controls (both economy-wide and financial sector) and FX-related prudential regulations than among these measures and other prudential policies. A detailed pre-crisis cross-sectional snapshot for the EMEs reveals that most countries had more than one set of measures in place, with about one-third having measures pertaining to all the categories considered here—capital controls, FX-related prudential regulations, and other prudential measures (Figure 4).¹² All countries barring Bulgaria (which has a currency board) and Ecuador (which is dollarized) had some form of FX-related prudential regulations in place, and several countries (for example, Chile, Costa Rica, Korea, and Israel) had imposed capital controls on the financial sector but not on the rest of the economy.

III. ESTIMATION RESULTS

Using these measures, we assess the extent to which capital controls and prudential regulations are associated with a number of financial fragilities—for example, the composition of external liabilities, the extent of FX lending by domestic banks, and the intensity of credit booms. We also ask how policies in place during the boom may affect the intensity of the bust (especially in relation to the decline in economic activity relative to the pre-crisis trend). Our estimations pertain to cross-sectional data, which is based on the "natural experiment" afforded by the most recent financial crisis, as well as a panel data set covering the period 1995–2008.¹³

¹⁰ It is very common for countries to have FDI restrictions on strategic industries, even in the U.S., but these are not coded as restrictions in Schindler's (2009) data.

¹¹ Another popular index for capital account restrictions is the one constructed by Chinn and Ito (2008). However, unlike Schindler (2009), their index does not distinguish between restrictions on inflows from restrictions on outflows. Nevertheless, the correlation between the Chinn-Ito index and our measures of financial sector specific capital controls and forex regulations is about 0.5.

¹² Only one country (Ecuador)—out of the 34 EMEs for which we had information on all policy measures—had no type of regulation in place in 2007.

¹³ We estimate all specifications using pooled ordinary least squares (OLS). This is because inclusion of country fixed effects in the panel regressions makes it difficult to identify the effect of our policy measures, which tend to be slow moving variables. In the pooled regressions, however, we control for region specific effects to capture time-invariant factors specific to countries in different regions, and annual dummies to control for shocks common across countries, and cluster the standard errors at the country level. The sample size in the panel estimations drops drastically when indices for other prudential measures (Domreg1 and Domreg2) are

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A. Baseline Specification

Composition of external liabilities

To assess the association between capital controls or prudential measures and the share of debt in the country's total external liabilities, we estimate benchmark specifications including the *Kcont*, *Fincont*, *Fxreg*, and *Domreg* indices, while controlling for the country's overall institutional quality, and a composite measure of vulnerability to capital account crises.¹⁴ Columns (1) through (13) in Table 1 present the cross-sectional results for the pre-crisis liability structure of EMEs.¹⁵ Countries rated more vulnerable or with weaker institutions appear to rely more heavily on debt financing, presumably because foreign investors are more reluctant to lend to such countries using risk-sharing instruments (e.g., equity).¹⁶

Among the variables of interest—economy-wide capital controls have a statistically strong effect on tilting the composition of external liabilities away from debt liabilities. The estimated coefficient for FX-related prudential measures is also statistically significant when included individually in the regression, albeit at the 10 percent level. To put estimates in perspective, moving from the sample's 25th to the 75th percentile of either the capital controls or FX-prudential index lowers the share of debt liabilities in total liabilities by about 4-7 percent. While sizable, the effect is in line with previous studies that also tend to find quantitatively important effects of capital controls on the composition of inflows.¹⁷

While capital controls, particularly those on bond inflows, can have a direct effect on the share of debt liabilities, FX-related prudential measures that limit a bank's ability to pass on the currency risk to domestic borrowers can also affect debt liabilities indirectly, by limiting the bank's ability to fund itself abroad to the extent that foreign lenders demand a significant premium for holding currency risk. When included jointly in the regression, however, the statistical significance of the association between economy-wide capital controls and a lower

included since, for these measures, the available data is for two years (2005 and 2007) only. Table A2 describes the variables and data sources.

¹⁴ Our measure is based on 18 indicators spanning the external, fiscal, financial and real sectors of the economy (we exclude variables related to external debt liabilities). The measure is a weighted average of dummies for whether or not each of the 18 indicators is above a threshold associated with crises: see IMF (2010, 2011).

¹⁵ The number of observations across estimated specifications is not uniform as data availability, particularly on policy measures, varies considerably across countries.

¹⁶ Several studies, for example, Wei (2001), suggest that weak institutions may increase the importance of debt in total liabilities, but reduce the relative importance of FDI, as foreign banks are more likely to be bailed out than foreign direct investors in the event of a crisis. FDI could also be lower in institutionally weak countries if foreign investors are concerned about the likely exposure to requests for bribes and red tapism. By contrast, others (for example, Razin, Sadka, and Yuen, 1998 and 2000) argue that institutionally vulnerable countries would have a higher share of FDI in total external liabilities since FDI is relatively difficult to expropriate.

¹⁷ See, for example, De Gregorio, Edwards, and Valdés (2000) on the maturity of flows in Chile, and Clements and Kamil (2009) on FDI vs non-FDI flows in Colombia.

share of debt liabilities survives (Table 1, columns 8-13). This makes intuitive sense inasmuch as FX-related prudential measures can, at most, affect flows that are intermediated through the banking system, whereas *Kcont* potentially apply to all flows.

The cross-sectional results are supported by the panel specification (Table 1, columns 14-26), where in addition to the overall institutional quality and external vulnerability, we also control for the level of financial development and (log of) real per capita income of the economies. The estimated coefficient of *Kcont* is statistically significant in almost all specifications, and the magnitude of the estimated effect is similar to that reported above. Examining the individual components of *Kcont*, both in cross-section and panel data, the association between *Kcont* and debt liabilities stems from the effect of capital controls on bond inflows, which strongly reduce the share of debt liabilities in total liabilities.¹⁸

Foreign Currency Lending and Domestic Credit booms

To examine whether capital controls and prudential measures are associated with lower FX-denominated lending by the domestic banking system (another potential source of financial fragility), we estimate the effect of these measures on the share of foreign currency loans in total bank credit, while controlling for the effects of the exchange rate regime, the level of financial development (proxied by the share of private credit to GDP), and the overall institutional quality. The exchange rate regime is included to capture the possibility that countries with fixed exchange rate regimes may have higher foreign currency lending, while countries with more developed financial markets are likely to have less FX lending.¹⁹

The cross-sectional evidence from the recent crisis, presented in Table 2 (columns 1-13) indicates that countries with economy-wide capital controls and FX-related prudential regulations had lower pre-crisis domestic borrowing in FX. Both measures retain their (strong) statistical significance when included jointly in the regression (column 10).²⁰

The estimates suggest that moving from the 25th to the 75th percentile of *Kcont* or *Fxreg2* is associated with a 20-25 percentage point reduction in the share of foreign currency-denominated lending in total bank lending in 2007. While the magnitude of the effects appear to be large, they are plausible since FX-related prudential measures can have a direct impact on foreign currency lending by domestic banks (sufficiently restrictive measures can in

¹⁸ The results for individual components of the indices are not reported here but are available upon request.

¹⁹ In panel estimations, we also control for the (log of) real per capita income. The results confirm that fixed exchange rate regimes are associated with a significantly higher share of FX lending, while a higher level of financial market development and per capita income (in panel estimations) is associated with a lower share of FX lending.

²⁰ The obtained results remain qualitatively similar if FX credit-to-GDP ratio is used as the dependent variable.

principle drive such lending to zero).²¹ In particular, we find a strong association between restrictions on lending locally in foreign exchange, and limits on open FX positions and lower FX lending.

The results obtained from the panel dataset (Table 2, columns 14-26) confirm these findings, but in addition show a statistically strong association between financial sector-specific capital controls and lower FX borrowing. Specifically, columns (16) and (22) show that an increase in the composite financial sector-specific controls index, *Fincont2*, from the 25th percentile to the 75th percentile is associated with about a 9-13 percentage points reduction in the proportion of FX-denominated lending. This result is also plausible because when banks borrow abroad, they typically do so in foreign currency. Therefore, capital controls that impede external borrowing, combined with limits on banks' open FX positions, will also tend to reduce foreign currency lending by banks.

In addition to FX lending, we also examine whether regulatory measures have any effect on overall domestic lending. Table 3 reports the results of the effect on capital controls and (FX-related and other) prudential measures on the magnitude of credit booms (defined as the change in private credit-to-GDP ratio), while controlling for other factors such as the level of financial development, overall regulatory/institutional quality, the availability of creditor information sharing institutions (à la Djankov, McLiesh, and Shleifer, 2007), the exchange rate regime, and lagged private credit to GDP ratio as an initial condition.²²

Evidence from both the recent crisis (Table 3, columns 1-13) and panel specifications (columns 14-26) indicate that other prudential measures are significantly associated with smaller credit booms. Moving from the 25th to the 75th percentile of domestic prudential regulations slows credit growth during the boom years of 2003-07 by about 1-1.5 percentage points per year. Among the individual components, reserve requirements and limits on credit concentration in specific sectors appear to be effective in restraining lending by the domestic financial system. We do not, however, find any significant association between FX-related regulations (or capital controls) and the size of credit booms, perhaps because FX lending typically does not constitute a large share of total lending.

Crisis resilience

If, as Tables 1-3 suggest, capital controls and prudential measures are associated with lower financial fragilities, then this should show up in greater resilience of the economy in the

²¹ Of course, that could come at a cost in terms of volume of credit, and in some cases cause lending to migrate to unregulated corners of the financial sector.

²² In addition, in panel estimations we also include the lagged real GDP growth rate and (log of) real GDP per capita. The estimation results show that countries with higher institutional quality, fixed exchange rate regimes, and higher real growth experienced larger domestic credit booms, whereas a higher initial private credit to GDP ratio and the existence of public or private credit registries/bureaus is associated with smaller booms.

event of a crisis. We estimate the effect of these measures on the change in average real GDP growth in 2008–09 relative to the country’s average growth over 2003–07. Columns (1) through (13) in Table 4 indicate that economy-wide capital controls are indeed associated with improved growth resilience, while controlling for overall institutional quality, change in terms of trade, and real GDP growth of trading partners.²³ Thus, countries that had capital controls in place in the years leading up to the global financial crisis fared better during the crisis. Moving from the 25th to the 75th percentile of capital control restrictiveness or FX-related prudential measures reduces the growth decline in the aftermath of the crisis by 2.5–3.5 percentage points (the average growth decline in our sample is 5.2 percentage points). Regressions for individual components (not reported here) show that this result is largely driven by controls on bond inflows.

While FX-related prudential regulations appear to have some effect on growth resilience during crises when included on their own, the effect of capital controls tends to dominate when both are included together in the regression (column 11). Other prudential measures, particularly, limits on sectoral lending and reserve requirements, seem to complement the effect of capital account restrictions, with both measures retaining significance when included together. Evidence from past crises episodes (in columns 14–24) supports the association of capital controls with growth resilience—specifically, we find that among the EMEs that experienced crises in earlier years, those with higher economy-wide capital account restrictions in their pre-crisis years experienced smaller growth declines when the crises occurred.²⁴ These results support those of some earlier studies, for example, Gupta et al. (2007), who find that the fall in output during crisis episodes is significantly lower if capital controls were in place in the years running up to the crisis.²⁵

B. Sensitivity Analysis

The results presented in Tables 1–4 suggest that both capital controls and prudential measures are strongly associated—in the cross-sectional and panel data—with reduced financial vulnerabilities. We now examine the robustness of our results to model specification, alternative indices of policy measures, estimation methods, and country sample.

²³ The change in terms of trade, and real GDP growth of trading partners are constructed as the difference between the average of 2008–09 and 2003–07. Using the average growth in 2008–09 instead of the difference from average growth over 2003–07 has no effect on the results. Further, the finding of a negative association between restrictions on capital inflows and output decline in the crisis is robust to the inclusion of several other control variables as reported below.

²⁴ Past crises are those identified by the IMF (2010) database over 1995–2008. Growth decline for these crises cases is computed as the difference between real GDP growth rate in the crisis year and the average past 5 year growth rate. Domreg1 and Domreg2 are not included in these regressions (Table 4, columns 14–24) because of insufficient observations.

²⁵ The sample of Gupta et al. (2007) comprises about 200 crisis episodes in 90 countries over 1970–2007.

Model specification

While the regressions reported in Tables 1-4 include several relevant control variables, to ensure that the strong association between our policy measures and financial fragilities/crisis resilience is not driven by omitted variables, we also estimate alternative specifications with additional control variables, particularly, to capture country characteristics such as the level of financial development (as proxied by stock market capitalization), soundness of the financial system (proxied by bank return on equity), and the type of political regime in place (proxied by the polity index).

Tables 5 and 6 report the results with these additional variables added to both the cross-section and panel specifications for debt liabilities, FX lending, domestic credit booms, and crisis resilience, respectively. We find that the results reported in Tables 1-4 generally survive the addition of other control variables—specifically, economy-wide capital controls remain associated with a lower proportion of debt liabilities, lower FX lending, and improved crisis resilience; FX-related prudential measures have a strong dampening effect on FX-lending; and other domestic prudential measures lead to smaller aggregate credit booms.²⁶

In addition to model specification, we check the sensitivity of our results to the construction of policy indices. Specifically, we replace our financial sector-specific capital controls and prudential indices (which are simple averages of the individual components, as discussed in Section III) with the first principal components of the individual sub-indices. The results (not reported here) using these alternative measures are very similar to those obtained in Tables 1-4, both in terms of statistical significance and the estimated magnitude of the association between policy measures and financial/economic vulnerabilities.

Endogeneity

One concern when estimating the effect of capital controls on the aggregate stock or flow of external liabilities relates to reverse causality—that is, countries may strengthen capital account restrictions in response to a surge in capital inflows, which could give rise to a spurious positive association between controls and inflows. While such endogeneity concerns may be less pertinent when considering the impact of controls on the composition, rather than on the overall level or flow of liabilities, endogeneity bias—if it exists—would tend to reduce the estimated effects of capital controls and other prudential measures.²⁷ The

²⁶ In the crisis resilience regressions, we also control for other policy variables such as the pre-crisis foreign exchange reserves to GDP ratio, exchange rate regime, and the monetary policy and fiscal policy stance over the crisis (proxied by the change in interest rates and cyclically adjusted fiscal balance to GDP ratio in the crisis year vis-à-vis the past five years, respectively), but do not find this to have any significant effect on the estimated coefficient of the economy-wide capital controls variable (results available upon request).

²⁷ The lack of association between capital controls and capital inflows in some studies is often attributed to econometric identification (see Ostry et al., 2010).

relatively strong findings above are therefore, despite, rather than because of, any potential endogeneity bias (which would tend to bias the results toward finding no effect).²⁸

Nevertheless, we use lagged values of the capital controls index in all estimations to mitigate the endogeneity concerns, and, in addition, apply an instrumental variable two-stage least squares (IV-2SLS) approach to explicitly address reverse causality. For this, we require at least one valid instrument that is correlated with the capital controls index but is not expected to affect the dependent variable directly. We consider two such potential instruments—a (binary) variable reflecting the existence of a bilateral investment treaty (BIT) between country i and the United States in year t , and a (binary) variable indicating whether the country is a member of the European Union (EU). These variables are expected to be important determinants of capital controls because both BITs with the United States and EU membership constrain the use of capital account restrictions, but there is no *a priori* reason to believe that they would be directly related to, say, the composition of external liabilities.²⁹

The validity of our instrument is supported by the results from the first stage of the IV-2SLS estimation: the estimated coefficients of BITs and EU membership are negative and mostly statistically significant indicating that countries which have ratified a BIT with the United States, or are members of the EU have lower prevalence of capital controls on inflows. The F-test of the hypothesis that the estimates in the first stage regression are jointly equal to zero is rejected, and the R-squared of all first stage specifications (reported in Table 7) is in the range of 0.30-0.64, offering some evidence on the appropriateness of our instruments. The Sargan test of over-identifying restrictions also cannot be rejected in most cases, and supports the validity of the instruments. The results of the second stage of the estimation support the strong association between capital controls and crisis resilience in both the recent and past crises episodes. The relationship between capital controls and debt liabilities becomes weaker in the cross-sectional specification, but remains strong in the panel regressions (Table 7, panel b). The magnitude of the effect is however somewhat *larger*, consistent with the intuition above that not controlling for potential endogeneity would bias the coefficient downwards.

²⁸ Another type of bias might arise if countries that have capital controls tend to pursue less market-friendly policies, and it is the latter that dissuades investors from investing in the country; however, our vulnerability measure should capture much of this.

²⁹ In growth resilience regressions, there could be a concern that BITs and EU membership may be directly associated with the dependent variable. The correlation between growth performance and BITs/EU membership is only moderate in both cross-sectional and panel data. The Sargan test of over-identifying restrictions (reported in the last row of Table 7) also supports the validity of the chosen instruments for the growth resilience regressions. Moreover, existence of a BIT is not especially associated with greater assistance during the recent global financial crisis—of the 20 EME countries in our sample with a BIT, none received a Federal Reserve swap line (Korea has an FTA which has not been approved by the U.S. Congress yet, and Mexico has an exception for balance-of-payments difficulties under NAFTA that is less restrictive on capital controls than the terms of the BITs).

Country sample

Finally, we check the robustness of our results to the country sample, dropping some of the smallest countries; and dropping countries that are classified as advanced economies in the IMF's World Economic Outlook classification. In a recent study of 24 EMEs, Cline (2010) finds no relationship between capital account openness and the output decline during the crisis, and questions whether such a relationship exists (or whether it is driven by the experience of the Baltic countries in the EME sample, which he considers unrepresentative).³⁰ While we believe that including the Baltic countries in the sample is important, as their experience in the recent financial crisis offers important insights, we re-estimate the cross-sectional and panel specifications without the three Baltic countries (Estonia, Latvia, and Lithuania) in the sample.

As shown in Table 5, excluding the Baltic countries from the sample weakens the statistical significance of the association between economy-wide capital controls on inflows and the growth decline in the recent crisis (although has no effect on the sign of the estimated coefficient for *Kcont*). Nevertheless, we find that the association between growth decline in past crises and capital controls on inflows remains robust (Table 6). Exclusion of countries that may be identified as advanced economies otherwise (specifically, Czech Republic, Iceland, Israel, Korea, and Slovakia), does not change the estimated sign and magnitude of the coefficients either; and capital controls remain strongly associated with the share of debt liabilities, FX lending and crisis resilience in both cross-section and panel specifications.

IV. CONCLUSION

This paper analyzes the effects of prudential policies and capital controls on the financial-stability risks associated with capital inflow surges and the extent to which policies in place during booms may help to mitigate the damage that can occur during busts. We construct new indices for prudential measures and for financial sector-specific capital controls for 51 emerging market economies over the period 1995–2008.

Our findings suggest that capital controls and various prudential policies can help reduce the riskiness of external liability structures and the extent of risky foreign-currency lending in the economy. Prudential policies that do not discriminate on the basis either of currency or residency can also help to mitigate the intensity of domestic credit booms. By helping to reduce the buildup of financial fragilities during the boom phase, prudential policies and capital controls can help to enhance economic resilience during the bust when foreign capital

³⁰ Cline (2010), however, uses a composite index of capital account restrictiveness, which does not distinguish between controls on inflows and controls on outflows, whereas our analysis, based on the Schindler index, distinguishes explicitly between inflow and outflow controls (so, for example, India and Turkey are similar in terms of their capital account restrictiveness as defined by the Quinn index; but differ considerably based on the Schindler inflows index).

dries up and flows out. Our empirical results suggest the benefits from appropriate pre-crisis policies are both statistically significant and economically relevant.

Our paper has not discussed potential costs associated with use of prudential policies and capital controls. Micro-level studies have shown that capital controls can make access to financing relatively more difficult to small and medium enterprises (Forbes, 2007) and domestically-owned firms (Harrison, Love and McMillan, 2004). However, if the choice is between capital controls and prudential policies, the issue is not completely clear-cut. While capital controls may indeed make financing for small and medium enterprises (SMEs) more difficult, these firms typically rely more on domestic bank financing than on foreign flows, whereas larger and internationally-known firms are more likely to be able to access foreign financing. Therefore, prudential measures on the domestic banking system are also likely to disproportionately affect the availability of finance to SMEs. Further, excessive limits on banks could lead to disintermediation and proliferation of non-regulated financial institutions (Wakeman-Linn, 2007).

By definition, prudential measures can only have traction on flows that are intermediated through the regulated financial institutions. Direct borrowing from abroad, through branches of foreign banks, or intermediated through unregulated institutions such as finance companies, may not be subject to domestic prudential regulation. Moreover, applying prudential measures to domestic banks may cause flows to migrate to unregulated corners of the financial system as a result of regulatory arbitrage.³¹ This can also create an un-level playing field for domestic banks relative to foreign competitors and non-banks. While it may be possible to widen the perimeter of regulation, this normally takes time, and at least in the interim, capital controls may have a useful role.

Beyond a fuller treatment of the relative costs and benefits of the various measures, future research might usefully consider a number of issues related to their design, including how they can be geared to temporary versus more persistent capital flows, whether they should be broad or narrowly targeted, and whether they should be price or quantity-based.

³¹ For example, when Croatia imposed “speed limits” on credit growth in 2003, banks moved part of their loan portfolio to affiliated leasing companies. That speed limit was later replaced by higher marginal reserve requirements on foreign liabilities, with regulations being continuously refined to close loopholes exploited by the banks. Their experience suggests that targeted controls may lead to migration to unregulated corners of the financial sector, and a shift towards direct borrowing from abroad. See Ostry et al. (2011).

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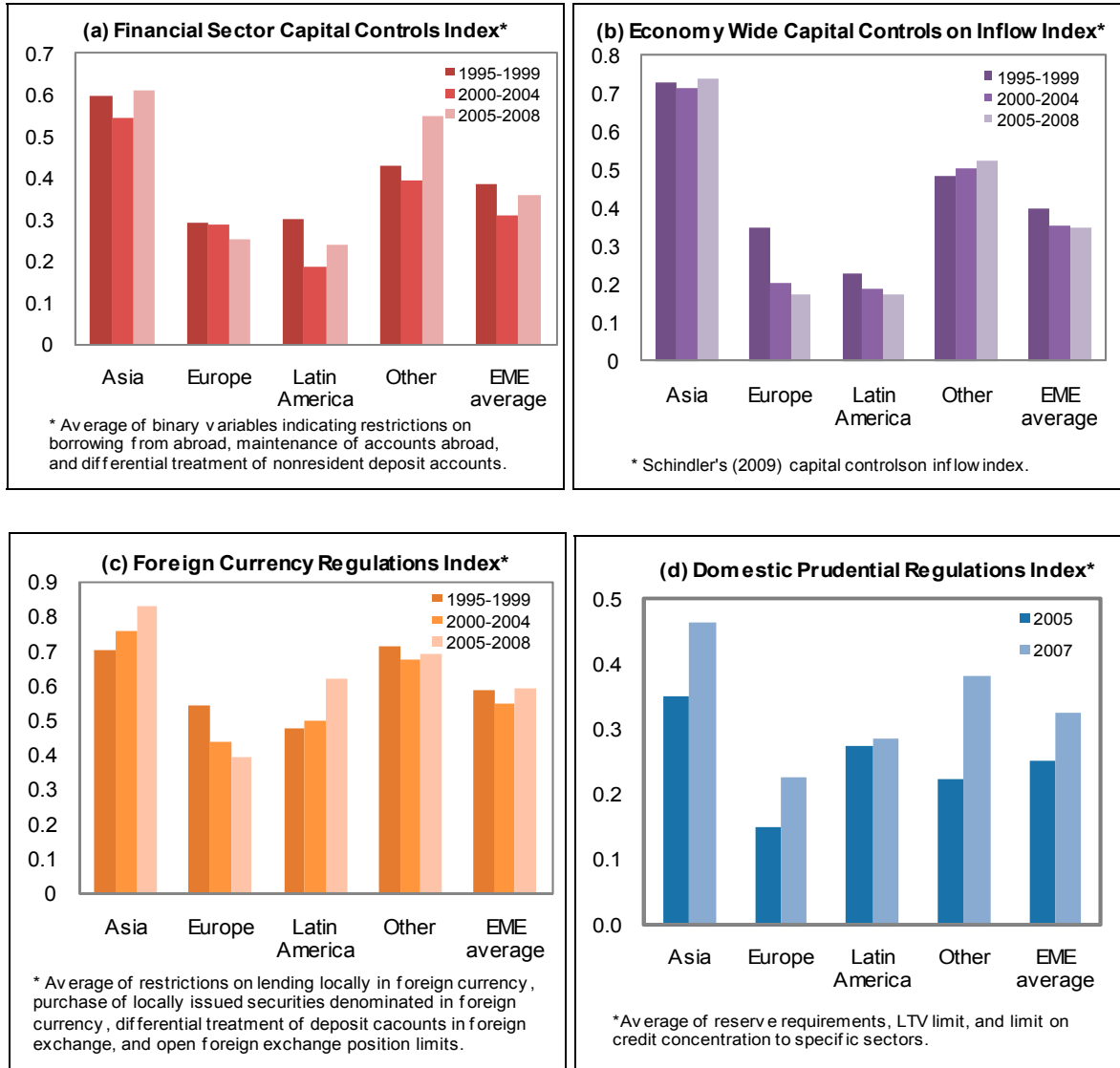
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Figure 1. Capital Controls and Prudential Measures in EMEs, 1995-2008



Source: Authors' estimates based on IMF's AREAER and Schindler (2009).

Figure 2. Frequency Distribution of Pre-Crisis Policy Measures*
(in percent of total observations)

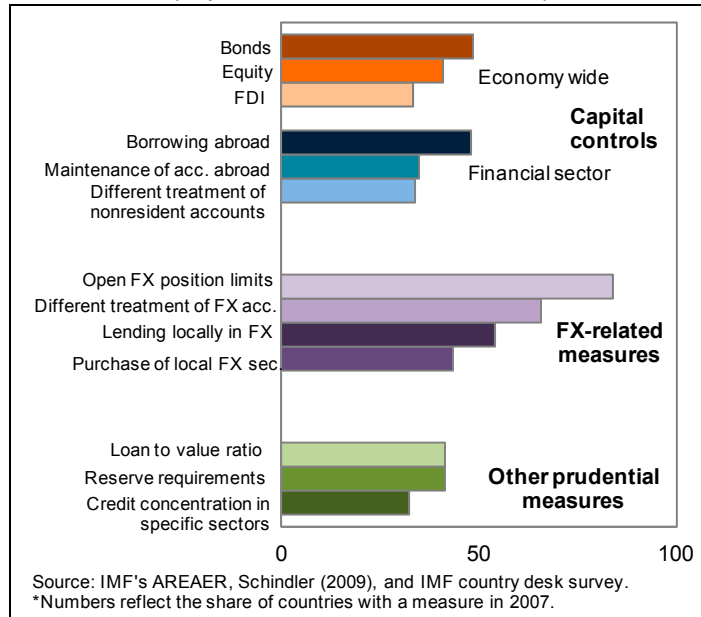


Figure 3. Correlation between Policy Measures*

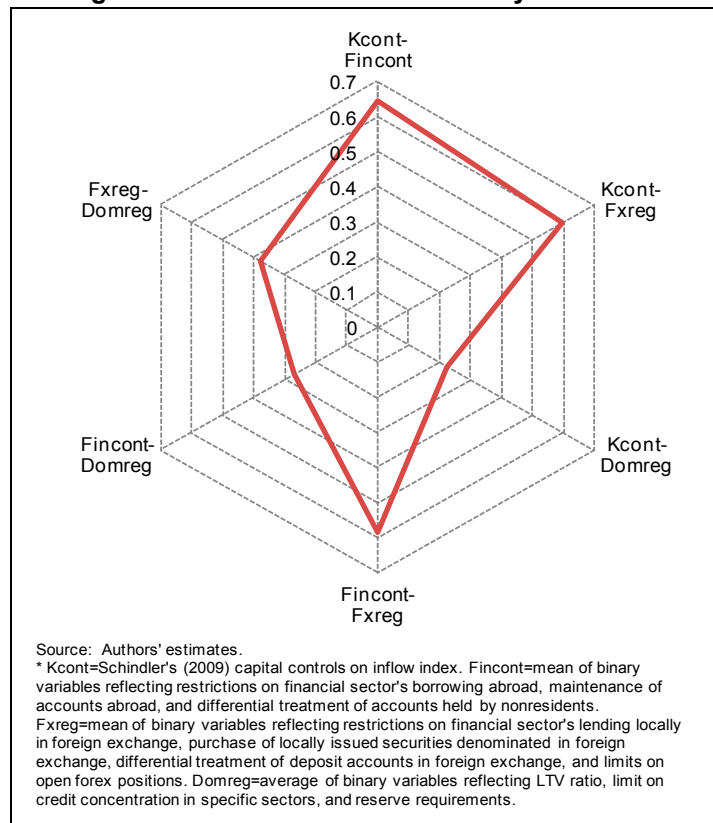
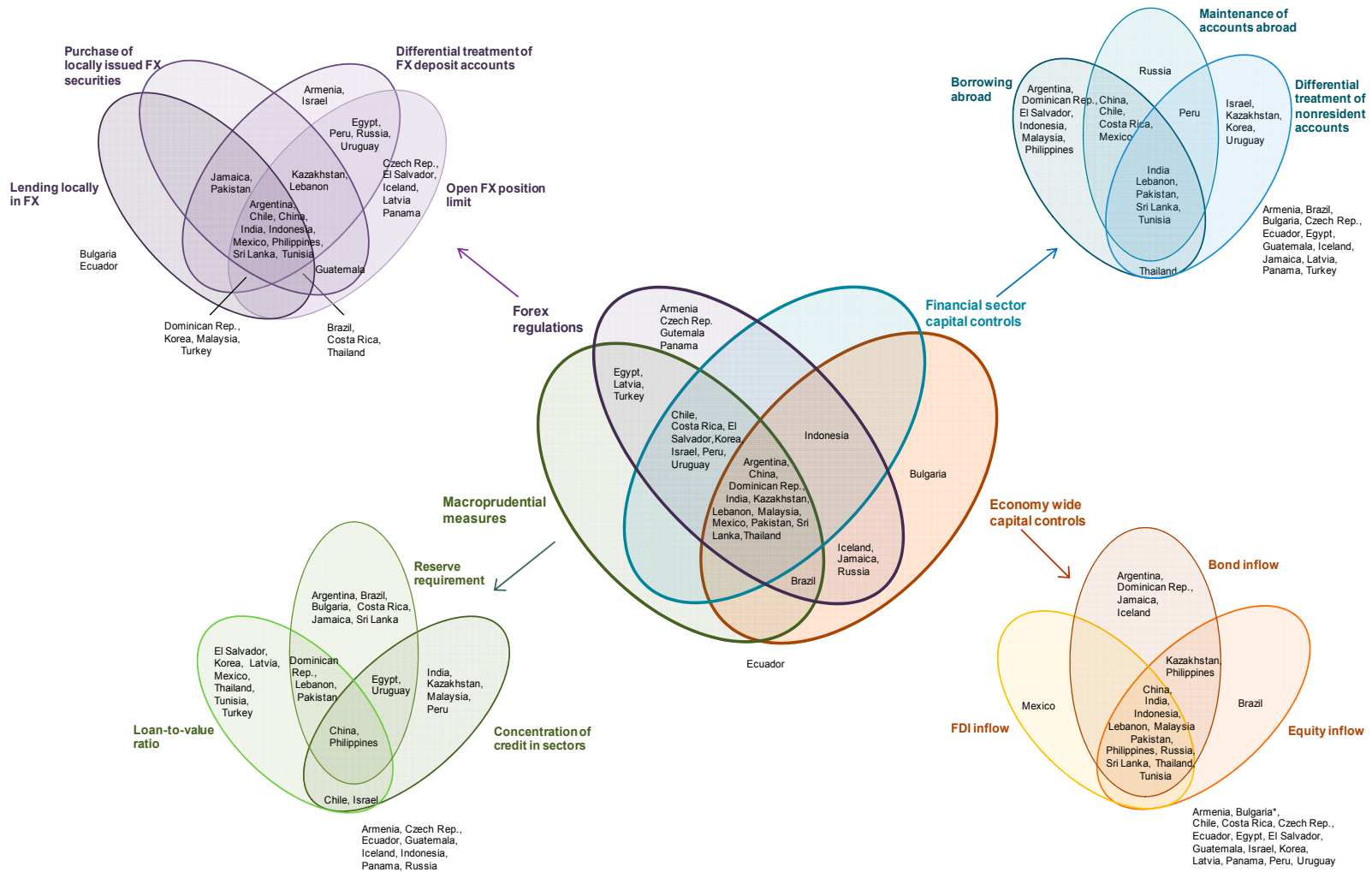


Figure 4. Pre-Crisis Country Coverage of Policy Measures, 2007*



Source: IMF staff estimates based on AREAER, Schindler (2009), and country desk survey. The universe comprises 34 countries for which data on all measures is available. Countries outside the ovals are those for which the relevant policy measures were not in place. In 2007, Bulgaria did not have controls on bond, equity and FDI inflows, but had restrictions on financial credit inflow. For analytical purposes, only cases where the reserve requirement exceeds 10 percent are considered as having reserve requirements; countries in the sample where reserve requirements existed in 2007 but were less than 10 percent are Armenia, Chile, Ecuador, El Salvador, India, Indonesia, Kazakhstan, Korea, Latvia, Malaysia, Panama, Peru, Russia, and Turkey.

Table 1: Policy Measures and Debt Liabilities

	Recent crisis ^a													Panel data (1995-2008) ^b												
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26
Kcont	-11.517** (5.045)																									
Fincont1		-7.129 (5.719)																								
Fincont2			-10.578 (6.406)																							
Fxreg1				-7.970* (4.492)																						
Fxreg2					-8.614 (6.488)																					
Domreg1						-2.680 (7.863)																				
Domreg2							-5.022 (8.240)																			
Observations	38	35	35	37	37	32	30	35	35	37	37	32	30	432	443	440	483	454	64	60	368	365	406	388	55	51
R-squared	0.388	0.352	0.375	0.387	0.376	0.383	0.434	0.393	0.396	0.422	0.420	0.434	0.477	0.469	0.473	0.483	0.447	0.426	0.245	0.259	0.490	0.477	0.462	0.455	0.247	0.279

a/ Dependent variable is share of debt liabilities in total liabilities in 2007 (in percent). Kcont, Fincontrol, and Fxreg are averaged over 2000-05. Domreg pertain to the measures in place in 2005. Constant, and a (lagged) composite index of external vulnerability (excluding debt liabilities), and an indicator of overall institutional quality (ICRG index) in 2007 included as controls in all regressions. Robust standard errors in parentheses; *, **, and *** indicate significance at 10, 5, and 1 percent levels respectively.

b/ Dependent variable is share of debt liabilities in total liabilities (in percent). Kcont, Fincontrol, Fxreg and Domreg are lagged one year. Domreg is available for 2005 and 2007 only. Constant, and region specific and time effects included in all regressions. Lagged composite index of external vulnerability, (log of) real GDP per capita, institutional quality (ICRG) index and a proxy for financial market development (private credit to GDP) included as controls in all regressions. Clustered standard errors (on country level) reported in parentheses; *, **, and *** indicate significance at 10, 5, and 1 percent levels respectively.

Kcont is Schindler's (2009) capital controls on inflow index.

Fincont1 is the average of binary variables reflecting restrictions on financial sector's borrowing abroad, and differential treatment of nonresident accounts.

Fincont2 is the average of binary variables reflecting restrictions on financial sector's borrowing abroad, maintenance of accounts abroad, and differential treatment of accounts held by nonresidents.

Fxreg1 is the average of binary variables reflecting restrictions on financial sector's lending locally in foreign exchange, and differential treatment of deposit accounts in foreign exchange.

Fxreg2 is the average of binary variables reflecting restrictions on financial sector's lending locally in foreign exchange, purchase of locally issued securities denominated in forex; differential treatment of deposit accounts in foreign exchange; and open FX position limits.

Domreg1 is the average of reserve requirements and restrictions on concentration in sectors.

Domreg2 is the average of reserve requirements, restrictions on concentration in specific sectors, and LTV ratios.

Table 2: Policy Measures and Foreign-Currency Lending

	Recent crisis ^a													Panel data (1995-2008) ^b																																		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26																						
Kcont	-38.888** (14.399)													-38.155** (15.638)	-37.782* (18.697)	-25.944** (12.034)	-15.863 (11.895)	-44.688** (17.704)	-44.306** (17.980)	-33.880*** (7.558)									-33.349*** (8.000)	-28.184*** (7.944)	-24.289*** (7.582)	-20.017*** (7.191)	-34.877*** (8.869)	-34.084*** (9.001)														
Fincont1		-11.323 (18.468)																																														
Fincont2			-22.901 (17.307)																																													
Fxreg1				-37.459*** (10.136)																																												
Fxreg2					-52.233*** (12.374)																																											
Domreg1						6.410 (17.680)																																										
Domreg2							5.522 (16.755)																																									
Observations	30	27	27	30	30	25	25	27	27	29	29	24	24	320	332	331	364	359	56	55	277	276	309	308	48	47																						
R-squared	0.599	0.484	0.504	0.597	0.660	0.410	0.408	0.615	0.612	0.649	0.694	0.643	0.644	0.501	0.302	0.345	0.437	0.459	0.154	0.147	0.472	0.490	0.549	0.566	0.355	0.344																						

^a / Dependent variable is FX credit to total credit in 2007. Kcont, Fincontrol, and Fxreg are averaged over 2003-05. Domreg pertain to the measures in place in 2005. Constant, lagged private credit to GDP, a dummy variable for the de facto exchange rate regime (=1 if fixed exchange rate; 0 otherwise), and institutional quality (ICRG) index included as control variables in all regressions. Robust standard errors in parentheses; *, **, and *** indicate significance at 10, 5, and 1 percent levels respectively.
^b / Dependent variable is FX credit to total credit. Kcont, Fincontrol, Fxreg, and Domreg are lagged by one year. Domreg is available for 2005 and 2007 only. Constant, and region specific and time effects included. Lagged private credit to GDP, lagged dummy variable for a de facto fixed exchange rate regime, (log) of real GDP per capita, and institutional quality (ICRG) index included as control variables in all regressions. Clustered robust standard errors (on country level) in parentheses; *, **, and *** indicate significance at 10, 5, and 1 percent levels respectively.

Notes: Kcont is Schindler's (2009) capital controls on inflow index.
 Fincont1 is the average of binary variables reflecting restrictions on financial sector's borrowing abroad, and differential treatment of nonresident accounts.
 Fincont2 is the average of binary variables reflecting restrictions on financial sector's borrowing abroad, maintenance of accounts abroad, and differential treatment of accounts held by nonresidents.
 Fxreg1 is the average of binary variables reflecting restrictions on financial sector's lending locally in forex, and differential treatment of deposit accounts in foreign exchange.
 Fxreg2 is the average of binary variables reflecting restrictions on financial sector's lending locally in forex, purchase of locally issued securities denominated in forex; differential treatment of deposit accounts in foreign exchange; and limits on open forex positions.
 Domreg1 is the average of reserve requirements and restrictions on concentration in sectors.
 Domreg2 is the average of reserve requirements, restrictions on concentration in specific sectors, and LTV ratios.

Table 3: Policy Measures and Domestic Credit Booms

	Recent crisis ^a														Panel data (1995-2008) ^b												
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	
Kcont	-6.472 (7.049)						-8.294 (10.929)	-12.913 (10.562)	-3.541 (8.769)	-4.371 (8.081)	-8.036 (6.832)	-6.685 (7.612)	0.388 (3.537)							3.733 (4.814)	2.196 (5.161)	2.217 (3.703)	3.627 (4.117)	-7.061 (5.091)	-6.654 (5.030)		
Fincont1	-0.256 (6.187)						4.122 (10.147)								-2.706 (2.650)						-4.708 (4.093)						
Fincont2		2.091 (5.882)						10.267 (9.677)							0.728 (3.061)							-0.668 (4.597)					
Fxreg1			-1.417 (6.657)						-3.981 (6.493)							0.269 (3.466)							-1.909 (4.087)				
Fxreg2				-3.795 (7.925)						-3.917 (7.821)							-1.163 (4.667)							-4.246 (6.626)			
Domreg1							-14.613** (6.545)					-13.049* (7.046)													-10.622** (4.384)		-10.899** (5.043)
Domreg2								-13.195* (6.416)					-13.957* (7.471)													-7.938 (4.753)	-9.858* (5.659)
Observations	36	33	33	36	34	32	30	33	33	35	33	31	29	357	336	333	379	352	62	58	290	287	331	313	55	51	
R-squared	0.478	0.469	0.470	0.463	0.467	0.521	0.529	0.485	0.503	0.481	0.482	0.534	0.564	0.364	0.378	0.374	0.351	0.358	0.439	0.439	0.406	0.398	0.372	0.375	0.403	0.411	

a/ Dependent variable is the change in private credit to GDP over 2003-07. Kcont, Fincontrol, and Fxreg are averaged over 2003-05. Domreg1 and Domreg2 pertain to the measures in place in 2005. All regressions include a constant, institutional quality (ICRG) index, a dummy variable for de facto exchange rate regime (=1 if fixed exchange rate regime; 0 otherwise), and a dummy variable for public or private credit registries/bureaus in 2007. Robust standard errors in parentheses; *, **, and *** indicate significance at 10, 5, and 1 percent levels respectively.

b/ Dependent variable is the cumulative three year change in private credit to GDP. Kcont, Fincontrol, and Fxreg are averaged over three lags. Domreg is available for 2005 and 2007 only, and is lagged by one year. Constant, region specific and time effects, an institutional quality (ICRG) index, dummy variable for fixed exchange rate regime (=1 if fixed exchange rate regime; 0 otherwise), dummy variable for public or private credit registries/bureaus, lagged (log of) real GDP per capita, lagged real growth rate of GDP, and three-year lagged private credit to GDP as initial condition included in regressions. Clustered robust standard errors (on country level) in parentheses; *, **, and *** indicate significance at 10, 5, and 1 percent levels respectively.

Notes: Kcont is Schindler's (2009) capital controls on inflow index.
 Fincont1 is the average of binary variables reflecting restrictions on financial sector's borrowing abroad, and differential treatment of nonresident accounts.
 Fincont2 is the average of binary variables reflecting restrictions on financial sector's borrowing abroad, maintenance of accounts abroad, and differential treatment of accounts held by nonresidents.
 Fxreg1 is the average of binary variables reflecting restrictions on financial sector's lending locally in forex, and differential treatment of deposit accounts in foreign exchange.
 Fxreg2 is the average of binary variables reflecting restrictions on financial sector's lending locally in forex, purchase of locally issued securities denominated in forex; differential treatment of deposit accounts in foreign exchange; and limits on open forex positions.
 Domreg1 is the average of reserve requirements and restrictions on concentration in sectors.
 Domreg2 is the average of reserve requirements, restrictions on concentration in specific sectors, and LTV ratios.

Table 4. Policy Measures and Crisis Resilience

	Recent crisis ^a										Past Crises (1995-2008) ^b												
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	
Kcont	5.153** (2.300)							5.980** (2.311)	7.120*** (2.523)	2.335 (2.648)	5.426* (3.139)	4.198* (2.380)	3.657 (2.654)	5.235*** (1.666)					5.909*** (1.880)	6.611*** (1.851)	5.444*** (1.615)	5.298*** (1.731)	
Fincont1		0.133 (3.271)						-2.914 (3.119)							-0.939 (2.506)								
Fincont2			1.198 (3.073)						-4.106 (3.379)							0.290 (3.077)							
Fxreg1				5.277** (2.160)						3.969 (2.471)							1.275 (2.387)						
Fxreg2					4.231 (2.780)						-0.333 (3.103)							4.372 (3.136)					
Domreg1						4.650* (2.715)						4.725* (2.701)											
Domreg2							3.115 (2.534)						2.749 (2.487)										
Observations	40	36	36	39	39	33	31	36	36	39	39	33	31	30	31	31	32	31	27	27	28	27	
R-squared	0.236	0.190	0.194	0.272	0.180	0.151	0.086	0.287	0.293	0.285	0.237	0.242	0.156	0.257	0.145	0.140	0.147	0.195	0.325	0.329	0.296	0.312	

Notes: All regressions include a constant and control variables (growth in trading partners, terms of trade change, and an institutional quality (ICRG) index). Robust standard errors in parentheses; *, **, and *** indicate significance at 10, 5, and 1 percent levels respectively. Kcont is Schindler's (2009) capital controls on inflow index. Fincont1 is the average of binary variables reflecting restrictions on financial sector's borrowing abroad, and differential treatment of nonresident accounts. Fincont2 is the average of binary variables reflecting restrictions on financial sector's borrowing abroad, maintenance of accounts abroad, and differential treatment of accounts held by nonresidents. Fxreg1 is the average of binary variables reflecting restrictions on financial sector's lending locally in foreign exchange, and differential treatment of deposit accounts in foreign exchange. Fxreg2 is the average of binary variables reflecting restrictions on financial sector's lending locally in foreign exchange, purchase of locally issued securities denominated in forex; differential treatment of deposit accounts in foreign exchange; and limits on open forex positions. Domreg1 is the average of reserve requirements and restrictions on concentration in sectors. Domreg2 is the average of reserve requirements, restrictions on concentration in specific sectors, and LTV ratios.

a/ Dependent variable is the difference between real GDP growth rates averaged over 2008-09, and 2003-07. Kcont, Fincont, and Fxreg are averaged over 2000-02. Domreg1 and Domreg2 pertain to the measures in place in 2005.

b/ Dependent variable is the difference between real GDP growth rate in crisis year and the average growth rate over past 5 years. Kcont, Fincont, and Fxreg are lagged one year.

Table 5: Sensitivity Analysis: Recent Crisis Cross-Section

	Baseline ¹	Stock market capitalization ²	Financial soundness ³	Polity ⁴	(Log of) Real GDP per capita ⁵	Excluding Baltics ⁶	Excluding advanced ⁷	FX reserves/GDP ⁸
Debt Liabilities								
Kcont	-11.517**	-5.022	-11.576**	-8.556	-12.105*	-8.808	-11.937**	
Fincont1	-7.129	-2.820	-7.322	-4.579	-6.596	-5.425	-7.891	
Fincont2	-10.578	-4.155	-10.624	-9.283	-10.406	-8.007	-10.678	
Fxreg1	-7.970*	-0.564	-8.321	-5.875	-7.598	-5.487	-7.647	
Fxreg2	-8.614	-2.303	-8.875	-5.029	-8.036	-6.085	-8.532	
Domreg1	-2.680	4.167	-2.416	-1.549	-2.547	-0.974	-1.586	
Domreg2	-5.022	6.464	-5.569	-3.914	-4.625	-6.738	-3.777	
FX Credit								
Kcont	-38.888**	-32.133*	-40.188**	-29.789*	-40.143**	-36.946**	-42.769**	
Fincont1	-11.323	-12.112	-8.877	-17.151	-11.483	-6.860	-10.402	
Fincont2	-22.901	-17.516	-21.157	-27.311*	-22.952	-16.384	-23.649	
Fxreg1	-37.459***	-39.362***	-37.826***	-32.574***	-36.751***	-34.028***	-40.160***	
Fxreg2	-52.233***	-48.788***	-55.168***	-46.399***	-51.529***	-48.591***	-56.719***	
Domreg1	6.410	13.145	6.188	8.280	6.890	12.235	7.231	
Domreg2	5.522	5.476	7.816	7.813	6.671	4.665	7.306	
Change in Private Credit to GDP								
Kcont	-6.472	-7.181	-4.643	-13.781**	-8.608	-4.023	-4.955	
Fincont1	-0.256	3.242	1.321	-4.369	-0.886	1.135	0.401	
Fincont2	2.091	2.611	2.640	0.288	1.908	4.462	3.409	
Fxreg1	-1.417	-0.758	-0.868	-8.671	-4.019	-0.219	-0.484	
Fxreg2	-3.795	-4.420	-2.708	-12.672	-6.345	-1.337	-2.207	
Domreg1	-14.613**	-19.119***	-15.954**	-17.679**	-14.245**	-13.275*	-14.091*	
Domreg2	-13.195*	-11.601	-9.758	-16.377*	-17.704**	-15.074**	-11.752*	
Crisis Resilience								
Kcont	5.153**	4.182*	5.039**	4.590*	5.497*	2.004	5.593**	5.022*
Fincont1	0.133	-0.679	0.023	0.581	-0.210	-0.932	0.331	-0.322
Fincont2	1.198	-0.193	1.250	1.235	0.785	-0.831	1.660	0.352
Fxreg1	5.277**	4.720*	4.885**	5.080**	5.166**	2.675*	5.561**	4.934**
Fxreg2	4.231	3.019	3.670	3.797	3.895	2.149	4.689	3.375
Domreg1	4.650*	5.484**	4.717*	4.743	4.725*	3.151	4.881	4.677*
Domreg2	3.115	1.348	2.434	3.116	2.788	3.793	3.649	3.042

Notes: Debt liabilities is the share of debt liabilities in total liabilities in 2007 (in percent). FX credit is the share of FX loans in total loans in 2007 (in percent). Change in private credit to GDP is calculated over 2003-07. Crisis resilience is the difference between real GDP growth rates averaged over 2008-09, and 2003-07. Robust standard errors. *, **, and *** indicate significance at 10, 5, and 1 percent levels respectively. Values in cells indicate the estimated coefficients for relevant policy measures indicated in row headers. Thus, for example, -11.517 in the first cell (column 1) is the estimated effect of capital controls on the share of debt liabilities in the benchmark specification, and -5.022 is the estimated effect of capital controls on the share of debt liabilities when the stock market capitalization variable is included in the benchmark specification.

¹Baseline specification refers to columns (1)-(7) in Tables 1-4.
²Stock market capitalization variable added to the baseline specification.
³Banks' return on equity added to the benchmark specification.
⁴The ICRG index replaced with the polity index (reflecting the type of political regime) in the baseline specification.
⁵(Log of) real GDP per capita added to the baseline specification.
⁶Excluding the Baltic countries (Estonia, Latvia, and Lithuania) from the sample and re-estimating baseline specification.
⁷Excluding the countries identified as advanced economies (Czech Rep., Iceland, Israel, Korea, and Slovakia) from the sample and re-estimating baseline specification.
⁸(Log of) forex reserves to GDP ratio added to the baseline specification.

Table 6: Sensitivity Analysis: Panel Data

	Baseline ¹	Stock market capitalization ²	Financial soundness ³	Polity ⁴	Excluding Baltics ⁵	Excluding advanced ⁶	FX reserves/GDP ⁷
Debt Liabilities							
Kcont	-10.879***	-6.864**	-11.117***	-10.448***	-10.990**	-10.967***	
Fincont1	-1.432	0.007	-1.605	-2.395	-1.077	-1.481	
Fincont2	-7.468**	-4.462	-7.527**	-9.052**	-7.061*	-7.570***	
Fxreg1	-2.76	1.103	-2.709	-0.535	-3.108	-2.738	
Fxreg2	-6.545	-2.526	-7.109	-4.392	-6.604	-6.596	
Domreg1	-5.187	0.882	-6.191	-5.016	-1.993	-5.311	
Domreg2	1.011	6.055	0.503	1.889	2.780	1.261	
FX Credit							
Kcont	-33.880***	-29.150***	-33.812***	-36.195***	-31.426***	-33.963***	
Fincont1	-6.338	-6.094	-6.069	-6.190	-7.894	-6.410	
Fincont2	-19.972**	-15.897	-19.312**	-19.105**	-20.121**	-20.138**	
Fxreg1	-26.288***	-25.372***	-25.598***	-26.920***	-24.723**	-27.359***	
Fxreg2	-37.246***	-33.128***	-36.491***	-37.784***	-34.439***	-38.286***	
Domreg1	-3.133	3.813	-4.065	4.575	4.372	-6.926	
Domreg2	5.144	1.658	4.596	12.362	6.081	1.298	
Change in Private Credit to GDP							
Kcont	-6.472	-7.181	-4.643	-13.781**	-4.023	1.599	
Fincont1	-0.256	3.242	1.321	-4.369	1.135	-3.527	
Fincont2	2.091	2.611	2.640	0.288	4.462	0.399	
Fxreg1	-1.417	-0.758	-0.868	-8.671	-0.219	0.248	
Fxreg2	-3.795	-4.420	-2.708	-12.672	-1.337	0.351	
Domreg1	-14.613**	-19.119***	-15.954**	-17.679**	-13.275*	-9.607**	
Domreg2	-13.195*	-11.601	-9.758	-16.377*	-15.074**	-8.242*	
Crisis Resilience							
Kcont	5.235***	4.641**	5.231***	6.123***	3.718**	5.877***	5.247***
Fincont1	-0.939	-1.193	-0.733	-0.310	-1.241	-1.071	-1.006
Fincont2	0.290	-1.709	0.543	1.663	-0.582	0.143	0.360
Fxreg1	1.275	1.323	1.459	2.006	-2.505	0.652	1.530
Fxreg2	4.372	3.816	4.928	5.157	-0.226	4.314	5.028

Notes: Debt liabilities is the share of debt liabilities in total liabilities (in percent). FX credit is the share of FX loans in total loans (in percent). Change in private credit to GDP is calculated over three years. Crisis resilience is the difference between real GDP growth rate in crisis year and the average growth rate over past 5 years. Kcont, Fincontrol, Fxreg and Domreg are lagged one year. Domreg is available for 2005 and 2007 only. Clustered robust standard errors (on country level). *, **, and *** indicate significance at 10, 5, and 1 percent levels respectively. Values in cells indicate the estimated coefficients for relevant policy measures indicated in row headers. Thus, for example, -10.879 is the estimated effect of capital controls on the share of debt liabilities in the benchmark specification, and -6.864 is the estimated effect of capital controls on the share of debt liabilities when the stock market capitalization variable is included in the benchmark specification.

¹Baseline specification refers to columns (14)-(20) in Tables 14.

²Stock market capitalization variable added to the baseline specification.

³Banks' return on equity added to the benchmark specification.

⁴ICRG index replaced with the polity index (reflecting the type of political regime) in the baseline specification.

⁵Excluding the Baltic countries (Estonia, Latvia, and Lithuania) from the sample and re-estimating baseline specification.

⁶Excluding the countries identified as advanced economies (Czech Rep., Iceland, Israel, Korea, and Slovakia) from the sample and re-estimating baseline specification.

⁷(Log of) forex reserves to GDP ratio added to the baseline specification.

Table 7. Sensitivity Analysis: Instrumental Variables Approach

	[a] Recent crisis													
	Debt liabilities ^a							Growth resilience ^b						
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Kcont	-48.181*	-48.170	-45.911	-122.259	-137.448	-66.397	-55.067	22.733***	22.485***	25.494**	33.225**	51.204**	23.400	26.481
	(29.123)	(37.811)	(43.808)	(145.046)	(167.784)	(60.658)	(63.183)	(7.487)	(8.683)	(11.542)	(15.106)	(22.553)	(15.662)	(17.419)
Fincont1		15.071							-6.440					
		(18.946)							(4.400)					
Fincont2			16.661							-13.063*				
			(28.139)							(7.493)				
Fxreg1				47.773							-9.309			
				(72.203)							(8.110)			
Fxreg2					75.963							-34.569*		
					(112.888)							(18.095)		
Domreg1						-1.592							3.713	
						(14.565)							(5.404)	
Domreg2							1.745							0.127
							(17.263)							(6.710)
Observations	37	34	34	36	34	31	29	39	35	35	38	38	32	30
R2 (1st stage)	0.30	0.43	0.51	0.44	0.44	0.46	0.50	0.44	0.45	0.53	0.54	0.64	0.40	0.41
Sargan test (p-value)	0.12	0.14	0.11	0.70	0.85	0.48	0.45	0.94	0.96	0.97	0.94	0.89	0.76	0.87
	[b] Panel data (1995-2008)													
	Debt liabilities ^c							Growth resilience ^d						
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Kcont	-17.504**	-21.308*	-17.798	-54.289*	-29.314*	-15.874	-11.645	13.542**	19.055**	26.830	17.318**	19.432*		
	(7.360)	(12.616)	(16.607)	(28.025)	(17.205)	(27.560)	(23.824)	(6.467)	(9.658)	(16.394)	(8.161)	(10.990)		
Fincont1		7.025							-1.160					
		(4.952)							(3.100)					
Fincont2			1.867							-9.723				
			(8.714)							(7.781)				
Fxreg1				14.036							-2.314			
				(10.465)							(2.837)			
Fxreg2					8.048							-7.761		
					(10.142)							(6.498)		
Domreg1						-3.310								
						(6.180)								
Domreg2							-3.961							
							(6.835)							
Observations	492	395	392	433	414	63	59	29	25	25	26	25		
R2 (1st stage)	0.434	0.487	0.553	0.527	0.315	0.254	0.300	0.465	0.519	0.517	0.487	0.526		
Sargan test (p-	0.00	0.00	0.00	0.01	0.01	0.00	0.03	0.83	0.89	0.98	0.68	0.45		

Notes: All specifications estimated using the instrumental variable-two stage least squares approach. Robust standard errors in parentheses; *, **, and *** indicate significance at 10, 5, and 1 percent levels respectively.

a/ Dependent variable is share of debt liabilities in total liabilities in 2007 (in percent). Kcont is instrumented with binary variables equal to one if the country has a BIT with the US in 2007 (and zero otherwise); and if the country is in the EU in 2007 (and zero otherwise). Fincont and Fxreg are averaged over 2003-05 as in the baseline specification, and Domreg pertains to the year 2005. Constant, lagged composite index of external vulnerability, (log of) real GDP per capita, and institutional quality index included in all regressions.

b/ Dependent variable is the difference between real GDP growth rates averaged over 2008-09, and 2003-07. Kcont is instrumented with binary variables equal to one if the country has a BIT with the US in 2007 (and zero otherwise); and if the country is in the EU in 2007 (and zero otherwise). Fincont, and Fxreg are averaged over 2000-02 as in the baseline specifications. All regressions include a constant and control variables (growth in trading partners, terms of trade change, lagged (log of) real GDP per capita, and institutional quality index).

c/ Dependent variable is share of debt liabilities in total liabilities (in percent). Kcont is instrumented with binary variables equal to one if the country has a BIT with the US in year t (and zero otherwise); and if the country is in the EU in year t (and zero otherwise). Fincont, Fxreg and Domreg are lagged one year. Domreg is available for 2005 and 2007 only. Constant, and regional and time effects included in all regressions. Lagged composite index of external vulnerability, (log of) real GDP per capita, and overall institutional quality index included as controls in all regressions.

d/ Dependent variable is the difference between real GDP growth rate in crisis year and the average growth rate over past 5 years. Kcont is instrumented with binary variables equal to one if the country has a BIT with the US in year t (and zero otherwise); and if the country is in the EU in year t (and zero otherwise). Fincont, and Fxreg are lagged one year. All regressions include a constant and control variables (growth in trading partners, terms of trade change, lagged (log of) real GDP per capita, and institutional quality index).

e/ Sargan test of overidentifying restrictions.

APPENDIX A: DATA SOURCES

Table A1. List of Countries in the Sample

Algeria	Egypt	Kazakhstan	Romania
Argentina	El Salvador	Korea	Russian Federation
Armenia	Estonia	Latvia	Serbia, Republic of
Bosnia & Herzegovina	Georgia	Lebanon	South Africa
Brazil	Guatemala	Lithuania	Sri Lanka
Bulgaria	Hungary	Malaysia	Thailand
Chile	Iceland	Mexico	Tunisia
China,P.R.: Mainland	India	Morocco	Turkey
Colombia	Indonesia	Pakistan	Ukraine
Costa Rica	Israel	Panama	Uruguay
Croatia	Jamaica	Peru	Venezuela, Rep. Bol.
Dominican Republic	Jordan	Philippines	Vietnam
Ecuador	Jordan	Poland	

Table A2. Variable Description and Sources

Variable	Description	Obs.	Mean	Std. Dev	Source
Capital controls on the financial sector	Index (between 0 (no restrictions) to 1 (restrictions))	542	0.4	0.3	Authors' calculations based on IMF's AREAER
Foreign currency regulations	Index (between 0 (no restrictions) to 1 (restrictions))	546	0.6	0.3	Authors' calculations based on IMF's AREAER
Domestic prudential measures	Index (between 0 (no restrictions) to 1 (restrictions))	75	0.3	0.2	Authors' calculations based on IMF's AREAER
Capital controls on inflows index	Index (between 0 (no restrictions) to 1 (restrictions))	506	0.4	0.4	Schindler (2009)
Debt liabilities to total external liabilities	In percent	672	61.7	17.8	Milesi-Ferretti and Lane (2007)
FX loans to total loans	In percent	474	35.0	26.9	IMF's External Vulnerability database
Private credit to GDP	In percent	626	42.7	33.5	IMF's IFS database
Real GDP growth	In percent	714	4.4	4.2	IMF's WEO database
Real GDP per capita	In constant 2000 USD	686	7.8	0.9	World Development Indicators
Foreign reserves to GDP	In percent	715	16.4	12.2	IMF's WEO database
Exchange rate regime	Binary variable equal to one if fixed exchange rate regime, and zero otherwise	724	0.2	0.4	Ghosh, Ostry and Tsangarides (2010)
Stock market capitalization	Value of listed shares to GDP	600	0.4	0.5	Beck and Demirguc-Kent (2009)
Bank return on equity	In percent	676	0.1	0.5	Beck and Demirguc-Kent (2009)
Growth in trading partners	In percent	709	2.3	1.7	IMF's WEO database
Institutional quality (ICRG) index	Index (between 0 (high) to 1 (low))	693	0.7	0.1	International Risk Country Guide (http://www.prsgroup.com/ICRG_Methodology.aspx)
External vulnerability index	Index (between 0 (low external vulnerability) to 1 (high external))	686	0.4	0.2	Authors' calculations
Bilateral Investment Treaty (BIT)	Binary variable equal to one if a BIT exists with the US, and zero otherwise	686	0.4	0.5	Trade Compliance Center (http://tcc.export.gov/Trade_Agreements/All_Trade_Agreements/exp_002699.asp)