



Tools for managing financial-stability risks from capital inflows[☆]

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ABSTRACT

We examine whether macroprudential policies and capital controls can enhance financial stability in the face of the risks typically associated with large capital inflows. We construct new indices of foreign currency (FX)-related prudential measures, domestic prudential measures, and financial-sector specific 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 with 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 enhanced economic resilience during the bust.

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1. Introduction

The strong recovery in capital inflows to emerging market economies (EMEs) since the sudden stop in late 2008–early 2009 gave 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. The second relates to financial-stability risks, especially the possibility that some of the flows may not be channeled toward productive uses, and may result in fragile external liability structures, excessive foreign currency exposure

on domestic balance sheets, or fuel credit booms and asset price bubbles.¹

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 among residents—in helping to manage financial-stability risks associated with inflows. But, to date, a systematic look at the impact of macroprudential policies and capital controls on the financial-stability

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¹ Mendoza and Terrones (2008) find that capital inflows are significantly associated with credit booms, while Basso et al. (2007) and Rosenberg and Tirpak (2009) show that the availability of foreign funding significantly raises the share of FX lending in total lending. The correlation between private capital flows and domestic credit booms/FX lending is statistically strong in our dataset as well—a 10 percentage point increase in net private capital flows to GDP is associated with about 5–7 percentage points larger credit booms, and a 1–3 percentage points higher share of FX lending (conditional on country-specific and time effects). On the riskiness of debt liabilities, Furceri et al. (2011) find that large debt-driven capital inflows significantly raise the probability of banking and balance of payments crises (whereas those driven by equity portfolio and FDI have a negligible effect on crisis probability). Similarly, Bordo et al. (2009) find that a higher share of foreign currency debt in total debt is associated with an increased likelihood of debt crises after large foreign capital inflows (which significantly increase external debt burdens).

risks associated with inflows has 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 relationship between 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 vulnerabilities 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 countries that had prudential measures and capital controls in place before the crisis also fared better during the crisis (controlling for other characteristics). We also test this idea using a panel dataset of EME financial crises over the period 1995–2008.

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 toward 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 7 percentage points (against a sample average of about 46%) and the share of FX credit in the domestic banking sector by 20–28 percentage points (against a sample average of 38%). Consistent with these results, we also find reasonably strong 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 findings 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 et al. (2006) 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

Previous studies on capital controls have not, however, 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, therefore, is 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 policy toolkit to manage the financial-stability risks posed by capital inflows and describes the construction of indices of financial sector capital controls, FX-related prudential measures, and domestic prudential policies. Section 3 presents our empirical results on the association between the various policy measures and reduced financial fragilities and greater crisis resilience. Section 4 concludes.

2. The prudential toolkit

2.1. 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 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

³ On altering the composition (lengthening maturities) of inflows, see De Gregorio et al. (2000) on Chile, and Cardenas and Barrera (1997) on Colombia. On monetary policy autonomy, De Gregorio et al. (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. (2011) find that interest differentials are significant and persistent in China and India, which maintain more extensive capital controls. However, Ghosh et al. (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 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.

² Several studies examine the impact of overall institutional quality on the composition of the external liability structure (for example, Razin et al., 1998, 2000; Wei, 2001), and the association between financial regulatory quality and credit booms (for example, Dell'Ariccia and Marquez, 2006; Barajas, 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).

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 seek 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 may also affect the volume of cross border flows 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 nor 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 domestic bank lending (and, likewise, FX-related measures may have the effect of reducing resident/non-resident transactions), even if that is not their primary intent.

2.2. 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 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. For other prudential measures, we conduct a survey of IMF country teams and compile information for 42 EMEs for the years 2005 and 2007.⁶ For economy-wide capital controls, we rely on the index provided by Schindler (2009), which, importantly for our purposes, and unlike the other indices, differentiates between controls on inflows and those on outflows.⁷

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).

⁶ The constructed indices are available online at: <http://www.imf.org/external/npr/docs/2012/data/020112.xlsx>. See Table A1, in the online appendix, 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 Schindler (2009) constructs subindices for restrictions on inflows and outflows based on six asset categories (equities, bonds/other debt securities, money market instruments, collective instruments, and financial credits). The respective subindices are averaged to construct inflow and outflow restrictiveness indices (which are then averaged to create an overall index of capital account restrictiveness). For a comparison of results using the Schindler and the other indices, see Section 3.2.

2.2.1. 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).⁸

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

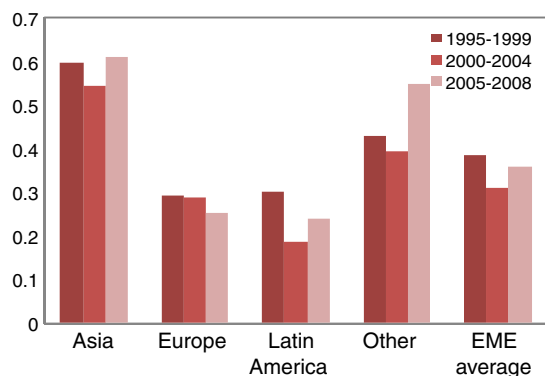
2.2.2. Foreign currency-related prudential measures

Our index of FX-related prudential regulations is based on whether measures exist to (i) limit local lending 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.⁹ 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.¹⁰ Fig. 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.

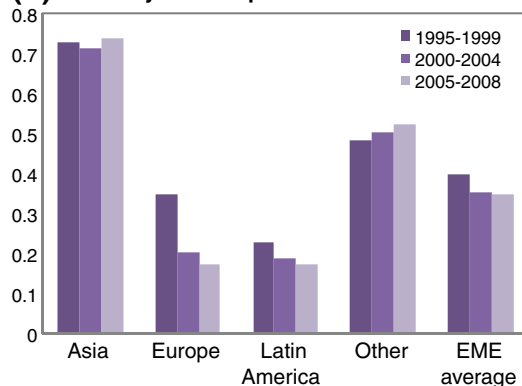
⁸ Ideally, the index and its subcomponents would capture the intensity, rather than just the existence, of the various restrictions, but in practice this is almost impossible to do for administrative measures without making arbitrary choices. The index is therefore coded based on binary variables for the presence of restrictions (as is the case of other indices in the literature constructed from the AREAER).

⁹ 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.

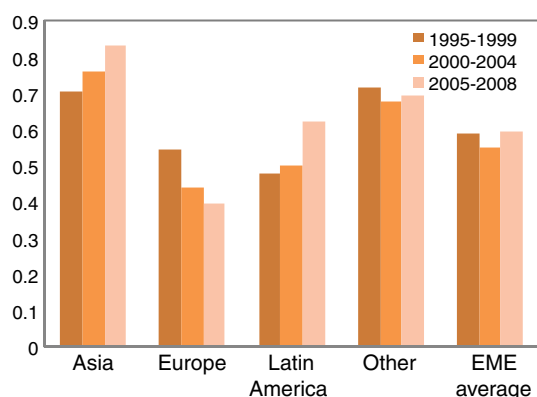
¹⁰ Typically, countries with a currency board exclude the anchor currency from the computation of limits on FX positions; we code such cases as not having limits on open FX positions.

(a) Financial Sector Capital Controls Index*

* Average of binary variables indicating restrictions on borrowing from abroad, maintenance of accounts abroad, and differential treatment of nonresident deposit accounts.

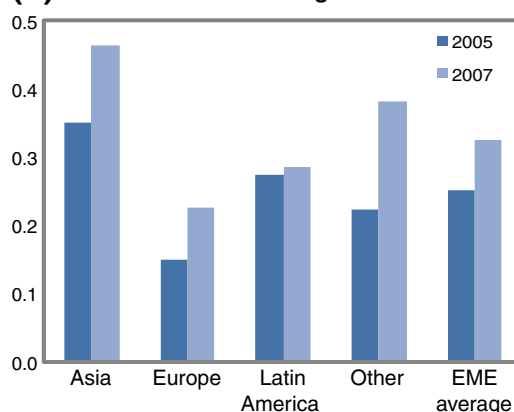
(b) Economy Wide Capital Controls on Inflow Index*

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

(c) Foreign Currency Regulations Index*

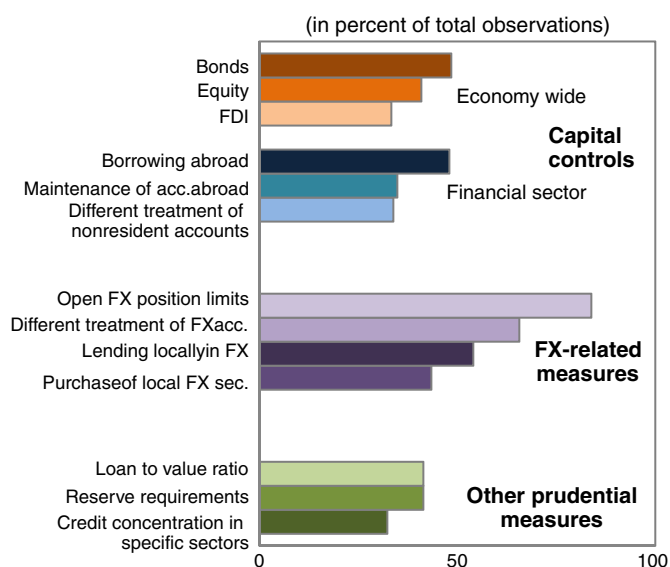
* Average of restrictions on lending locally in foreign currency, purchase of locally issued securities denominated in foreign currency, differential treatment of deposit accounts in foreign exchange, and open foreign exchange position limits.

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

(d) Domestic Prudential Regulations Index*

*Average of reserve requirements, LTV limit, and limit on credit concentration to specific sectors.

Fig. 1. Capital controls and prudential measures in EMEs, 1995–2008.



Source: IMF's AREAER, Schindler (2009), and IMF country desk survey.

*Numbers reflect the share of countries with a measure in 2007.

Fig. 2. Frequency distribution of pre-crisis policy measures*.

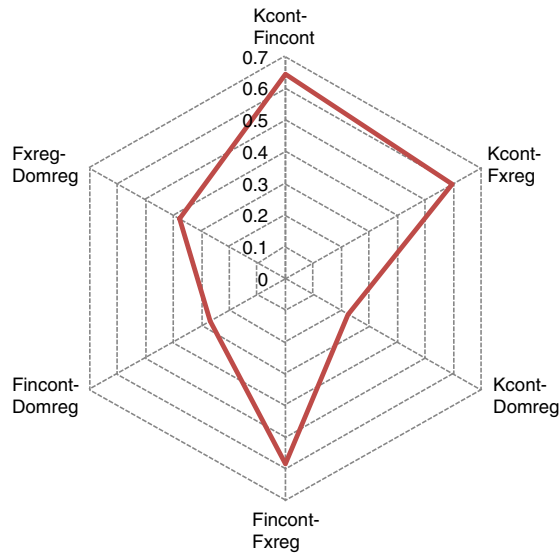
2.2.3. Domestic prudential regulations

Our measures of domestic prudential regulations cover three aspects of macroprudential 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%; 0.5 if it is in the range of 10–20%; and 1 if it is greater than 20%. 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. Fig. 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 macroprudential measures, while European EMEs the least.

2.2.4. 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? Fig. 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.

Around one half of the countries had controls on bond inflows, with slightly fewer having controls on portfolio equity and even fewer on FDI



Source: Authors' estimates.

* Kcont=Schindler's (2009) capital controls on inflow index. Fincont=mean of binary variables reflecting restrictions on financial sector's borrowing abroad, maintenance of accounts abroad, and differential treatment of accounts held by nonresidents. Fxreg=mean of binary variables reflecting restrictions on financial sector's lending locally in foreign exchange, purchase of locally issued securities denominated in foreign exchange, differential treatment of deposit accounts in foreign exchange, and limits on open forex positions. Domreg=average of binary variables reflecting LTV ratio, limit on credit concentration in specific sectors, and reserve requirements.

Fig. 3. Correlation between policy measures*.

flows.¹¹ 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 (Fig. 3). 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 (Fig. 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.

3. 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 (as measured by the decline

in output growth relative to its 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

3.1. Baseline specification

3.1.1. 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% level. These estimates imply that 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 7 percentage points (against a sample average debt share of about 45%, while the sample average for total liabilities is 110% of GDP).¹⁷ This reduction in debt liabilities is commensurate with that implied by a social planner's optimal tax on foreign currency debt in a calibration exercise based on Korinek (2010). Using the estimates of Ostry et al. (2010), moreover, the reduction in debt liabilities would have been associated with a 0.7 percentage points smaller output decline during the 2008–09 global financial crisis. As such, the reduction in the proportion of debt liabilities associated with the use of prudential measures or capital controls has substantial financial-stability benefits. It is also worth noting that our findings are in line with previous studies, which also tend to find quantitatively important effects of capital controls on the composition of inflows (for example, De Gregorio et al., 2000; and Clements and Kamil, 2009).

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 included since, for these measures, the available data is for two years (2005 and 2007) only. See Table A2, available online, for 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 (2012).

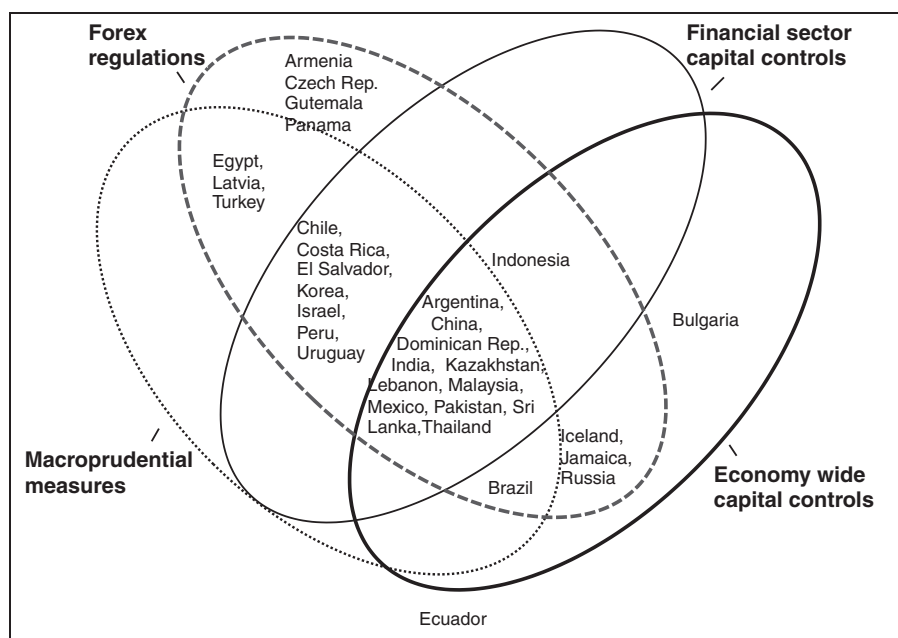
¹⁵ The number of observations across estimated specifications is not uniform as data availability, particularly on policy measures, varies considerably across countries.

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 corruption and red tape. By contrast, others (for example, Razin et al., 1998, 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 Countries in the bottom quartile of the economy-wide capital controls index include the Baltics as well as Croatia, Peru, and Uruguay; while those in the top quartile include China, India, Indonesia, and Thailand. For FX-regulations, some of the countries in the bottom quartile of the index are the Eastern European countries (notably, Bulgaria, Estonia, Hungary, and Latvia), Ecuador and El Salvador; while those in the top quartile include Chile, China, Indonesia, Mexico, and Turkey.

¹¹ It is very common for countries to have restrictions on FDI in strategic industries, even in the U.S., but these are not coded as restrictions in Schindler's (2009) data.

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.



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, in macroprudential measures, only cases where the reserve requirement exceeds 10% are considered as having reserve requirements.

Fig. 4. Pre-crisis country coverage of policy measures, 2007*.

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

Table 1
Policy measures and debt liabilities: pre-crisis cross-section.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
Kcont	−11.52** (5.05)							−11.31* (6.66)	−9.40 (8.73)	−10.81* (6.09)	−12.95* (6.71)	−10.63* (5.29)	−9.69* (5.23)
Fincont1		−7.13 (5.72)						−1.09 (7.51)					
Fincont2			−10.58 (6.41)						−3.73 (10.54)				
Fxreg1				−7.97* (4.49)						−2.46 (5.73)			
Fxreg2					−8.61 (6.49)						0.85 (9.06)		
Domreg1						−2.68 (7.86)						−2.61 (7.56)	
Domreg2							−5.02 (8.24)						−3.82 (8.01)
Vulnerability index	35.76*** (10.56)	42.81*** (12.03)	41.05*** (11.75)	39.08*** (10.61)	38.72*** (10.73)	45.12*** (10.20)	47.14*** (11.03)	37.79*** (12.80)	38.08*** (12.44)	37.39*** (11.12)	38.16*** (10.95)	40.83*** (9.92)	42.47*** (10.47)
Institutional quality index	−43.64** (19.24)	−31.61 (20.00)	−29.60 (20.99)	−34.74 (20.63)	−35.28* (20.06)	−26.96 (21.88)	−21.22 (24.47)	−38.65* (20.41)	−37.06 (22.58)	−40.58* (20.22)	−40.05* (19.83)	−36.72* (20.38)	−33.04 (23.76)
Observations	38	35	35	37	37	32	30	35	35	37	37	32	30
R-squared	0.39	0.35	0.38	0.39	0.38	0.38	0.43	0.39	0.40	0.42	0.42	0.43	0.48

Notes: Dependent variable is share of debt liabilities in total liabilities in 2007 (in percent; Mean = 46.2; Std dev = 15.5). Kcont, Fincontrol, and Fxreg are averaged over 2000–05. Domreg pertain to the measures in place in 2005. Constant included in all regressions. Vulnerability index is lagged one period. Robust standard errors in parentheses; *, **, and *** indicate significance at 10, 5, and 1% 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 debt liabilities: panel data, 1995–2008.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
Kcont	−10.05*** (3.33)							−9.27** (3.93)	−7.55* (4.42)	−9.42** (3.61)	−7.85* (3.91)	−1.25 (4.17)	−0.78 (4.00)
Fincont1		−3.11 (3.33)						2.34 (4.49)					
Fincont2			−6.95** (3.35)						−1.88 (4.93)				
Fxreg1				−2.13 (3.38)						−2.06 (3.55)			
Fxreg2					−5.39 (3.93)						−5.24 (4.18)		
Domreg1						−3.75 (5.42)						−3.56 (5.64)	
Domreg2							2.15 (5.04)						0.04 (5.72)
Vulnerability index	15.61** (7.26)	19.94*** (6.63)	18.51*** (6.67)	13.39* (6.67)	13.66* (6.89)	25.46*** (8.50)	27.26*** (8.33)	23.56*** (7.45)	23.25*** (7.25)	16.68** (7.08)	16.49** (7.19)	24.21** (9.87)	25.53** (9.69)
Institutional quality index	−52.23*** (19.08)	−47.61*** (15.34)	−45.57*** (15.76)	−53.53*** (16.64)	−46.79** (18.18)	−20.75 (16.98)	−32.34* (17.69)	−41.12** (17.51)	−39.79** (18.18)	−44.56** (19.10)	−39.76* (19.99)	−23.96 (20.24)	−39.90* (22.34)
M2/GDP	−0.18** (0.07)	−0.136** (0.06)	−0.13** (0.05)	−0.13** (0.06)	−0.14** (0.06)	−0.14*** (0.04)	−0.14*** (0.04)	−0.19*** (0.06)	−0.19*** (0.06)	−0.21*** (0.06)	−0.22*** (0.06)	−0.16** (0.06)	−0.11* (0.06)
Real GDP per capita (log)	−0.32 (2.83)	−1.97 (2.50)	−2.47 (2.51)	−0.49 (2.57)	−0.83 (2.63)	−0.60 (2.03)	0.84 (2.12)	−1.15 (2.69)	−1.26 (2.71)	−0.05 (2.61)	0.29 (2.58)	−0.31 (2.09)	1.51 (2.20)
Observations	412	430	429	468	448	76	72	355	354	391	379	66	62
R-squared	0.50	0.48	0.49	0.46	0.45	0.32	0.36	0.53	0.53	0.51	0.51	0.29	0.33

Notes: Dependent variable is share of debt liabilities in total liabilities (in percent; Mean = 60.9; Std dev = 17.6). Kcont, Fincontrol, Fxreg and Domreg are lagged one year. Domreg is available for 2005 and 2007 only. Constant, region-specific and time effects are included in all regressions. Vulnerability index is lagged one period. Clustered standard errors (on country level) reported in parentheses; *, **, and *** indicate significance at 10, 5, and 1% levels respectively. See Table 1 for the definitions of Kcont, Fincont1, Fincont2, Fxreg1, Fxreg2, Domreg1 and Domreg2.

Table 3

Policy measures and foreign-currency lending: pre-crisis cross-section.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
Kcont	−39.62*** (13.30)							−41.57** (15.409)	−40.13** (17.664)	−28.36* (15.025)	−22.60 (16.624)	−46.11*** (12.118)	−46.28*** (12.801)
Fincont1		−7.05 (20.15)						3.04 (17.791)					
Fincont2			−26.16 (19.72)						−2.43 (21.948)				
Fxreg1				−41.71*** (9.34)						−27.51** (11.428)			
Fxreg2					−55.21*** (11.312)						−37.82** (14.804)		
Domreg1						−3.66 (22.755)						−8.57 (24.858)	
Domreg2							−7.91 (20.651)						5.16 (25.569)
Institutional quality index	−58.22 (60.06)	−1.96 (65.10)	4.89 (62.27)	−28.99 (57.90)	−41.75 (52.233)	−35.47 (74.962)	−32.60 (72.19)	−49.43 (65.99)	−47.45 (69.48)	−49.20 (55.03)	−53.92 (51.12)	−48.58 (67.59)	−59.51 (71.04)
Exchange rate regime	32.99*** (9.75)	35.09*** (11.81)	35.46*** (12.03)	22.14** (9.44)	19.05* (9.522)	27.96** (12.478)	27.83** (13.18)	37.00*** (10.54)	36.82*** (10.61)	27.37** (10.78)	25.43** (10.87)	28.95** (11.63)	30.32** (12.68)
Observations	30	27	27	30	30	25	25	27	27	29	29	24	24
R-squared	0.47	0.33	0.37	0.50	0.53	0.24	0.24	0.49	0.49	0.57	0.58	0.52	0.52

Notes: Dependent variable is FX credit to total credit in 2007 (in percent; Mean = 37.6%; Std dev = 29.6). Kcont, Fincontrol, and Fxreg are averaged over 2003–05. Domreg pertain to the measures in place in 2005. Exchange rate regime (binary variable equal to 1 for a de facto fixed exchange rate regime, and 0 otherwise) is lagged one period. Constant included in all specifications. Robust standard errors in parentheses; *, **, and *** indicate significance at 10, 5, and 1% levels respectively. See Table 1 for the definitions of Kcont, Fincont1, Fincont2, Fxreg1, Fxreg2, Domreg1 and Domreg2.

risk. When included jointly in the regression, however, the statistical significance of the association between economy-wide capital controls and a lower 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 2), where in addition to the overall institutional quality and external vulnerability, we also control for the level of financial development (M2/GDP) 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

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

Table 4
Policy measures and foreign-currency lending: panel data, 1995–2008.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
Kcont	−28.50*** (7.95)							−24.44*** (8.29)	−18.72* (9.33)	−17.81** (8.53)	−11.48 (8.57)	−16.35* (9.49)	−16.90* (8.860)
Fincont1		−9.01 (8.02)						−5.85 (8.96)					
Fincont2			−20.55** (7.93)						−17.85* (10.22)				
Fxreg1				−23.64*** (7.01)						−21.06*** (6.81)			
Fxreg2					−36.55*** (7.85)						−36.10*** (6.41)		
Domreg1						3.42 (9.10)						5.61 (11.50)	
Domreg2							12.48 (10.86)						21.62 (12.919)
Institutional quality index	−50.68 (38.27)	−45.40 (34.84)	−40.38 (34.92)	−50.17 (35.51)	−47.69 (36.06)	−29.12 (44.95)	−28.68 (44.92)	−60.08 (37.73)	−55.22 (34.30)	−63.42* (35.40)	−61.67* (34.75)	−66.10 (55.40)	−72.67 (52.513)
Exchange rate regime	28.81*** (8.49)	33.30*** (8.28)	32.69*** (8.09)	21.75*** (7.08)	20.75*** (7.04)	29.27*** (6.64)	29.41*** (6.86)	36.17*** (8.46)	36.04*** (8.06)	24.50*** (7.65)	22.89*** (7.30)	28.30*** (7.73)	28.95*** (7.699)
M2/GDP	−0.24** (0.12)	−0.42*** (0.10)	−0.41*** (0.10)	−0.35*** (0.08)	−0.36*** (0.10)	−0.40*** (0.06)	−0.42*** (0.06)	−0.30** (0.12)	−0.28** (0.13)	−0.27** (0.12)	−0.27** (0.13)	−0.31*** (0.07)	−0.35*** (0.083)
Real GDP per capita (log)	−2.50 (5.40)	5.25 (4.91)	4.36 (5.17)	1.86 (5.10)	1.04 (5.39)	1.96 (3.86)	1.79 (3.78)	2.21 (5.44)	2.06 (5.49)	−0.57 (5.74)	−0.45 (5.85)	−0.04 (4.91)	−0.54 (4.415)
Observations	326	339	338	372	367	61	60	283	282	316	315	53	52
R-squared	0.53	0.45	0.48	0.50	0.54	0.44	0.44	0.55	0.57	0.58	0.61	0.49	0.51

Notes: Dependent variable is FX credit to total credit (in percent; 37.4; Std dev = 27.8). 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 specifications. M2/GDP and exchange rate regime are lagged one period. Clustered robust standard errors (on country level) in parentheses; *, **, and *** indicate significance at 10, 5, and 1% levels respectively. See Table 1 for the definitions of Kcont, Fincont1, Fincont2, Fxreg1, Fxreg2, Domreg1 and Domreg2.

3.1.2. 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—included to capture the possibility that countries with fixed exchange rate regimes may have higher foreign currency lending—and the overall institutional quality.¹⁹

The cross-sectional evidence from the recent crisis, presented in Table 3 indicates that countries with economy-wide capital controls and FX-related prudential regulations had lower pre-crisis domestic lending 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 20–28 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 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 4) confirm these findings, but in addition show a statistically strong association between financial sector-specific capital controls and lower FX borrowing.

Specifically, column (22) shows that an increase in the composite financial sector-specific controls index, Fincont2, from the 25th percentile to the 75th percentile is associated with about an 11 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. Tables 5 and 6 report 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 overall regulatory/institutional quality, the availability of creditor information sharing institutions (à la Djankov et al., 2008), lagged private credit to GDP ratio as an initial condition, and (in the panel specifications) the exchange rate regime, real GDP growth, and (log of) real GDP per capita.²²

Evidence from both the recent crisis (Table 5) and panel specifications (Table 6) 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 sufficiently large share of total lending (or there is substitution toward domestic currency lending).

¹⁹ In panel estimations (Table 4), we also control for the level of financial development and (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 the panel estimates) 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.

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 The estimation results show that countries with stronger institutional quality, less flexible exchange rate regimes, and higher real growth experience 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.

Table 5

Policy measures and domestic credit booms: pre-crisis cross-section.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
Kcont	−6.54 (6.74)							−8.10 (9.54)	−12.67 (9.33)	2.79 (9.21)	2.08 (9.53)	−7.83 (6.33)	−5.74 (7.01)
Fincont1		−1.16 (7.25)						3.12 (10.05)					
Fincont2			1.31 (7.45)						9.33 (10.37)				
Fxreg1				−7.87 (7.41)						−13.15 (8.32)			
Fxreg2					−11.09 (7.78)						−14.10 (10.23)		
Domreg1						−19.21** (8.79)						−15.81* (8.30)	
Domreg2							−15.22* (7.87)						−15.88* (8.03)
Institutional quality index	49.67** (20.53)	59.94** (23.65)	61.38** (23.03)	48.98** (19.21)	55.45** (21.77)	35.25 (22.00)	43.36* (24.64)	51.16** (21.64)	45.46** (21.13)	49.46** (22.31)	59.98** (24.39)	25.76 (20.02)	35.86 (23.37)
Credit bureaus	−9.48 (7.23)	−7.18 (6.67)	−7.22 (6.87)	−5.78 (6.41)	−5.79 (8.86)	−9.76 (7.63)	−8.44 (7.36)	−10.87 (7.65)	−12.06* (6.85)	−5.95 (7.69)	−6.20 (10.53)	−13.88* (7.86)	−12.22 (7.84)
Private credit to GDP (initial)	−0.20*** (0.06)	−0.19** (0.07)	−0.20*** (0.07)	−0.21*** (0.05)	−0.21*** (0.05)	−0.18*** (0.06)	−0.17*** (0.06)	−0.17*** (0.06)	−0.18*** (0.06)	−0.22*** (0.07)	−0.22*** (0.07)	−0.14*** (0.05)	−0.14*** (0.05)
Observations	36	33	33	36	34	32	30	33	33	35	33	31	29
R-squared	0.31	0.26	0.26	0.27	0.28	0.31	0.27	0.28	0.29	0.37	0.36	0.37	0.38

Notes: Dependent variable is the change in private credit to GDP over 2003–07 (in percentage points; Mean = 13.2; Std dev = 25.4). Kcont, Fincontrol, and Fxreg are averaged over 2003–05. Domreg1 and Domreg2 pertain to the measures in place in 2005. Constant included in all specifications. Exchange rate regime (a binary variable equal to 1 for a de facto fixed exchange rate regime, and 0 otherwise), real GDP growth and (log) real GDP per capita are lagged one period. Private credit to GDP in 2003 is included as an initial condition. Robust standard errors in parentheses; *, **, and *** indicate significance at 10, 5, and 1% levels respectively. See Table 1 for the definitions of Kcont, Fincont1, Fincont2, Fxreg1, Fxreg2, Domreg1 and Domreg2.

3.1.3. Crisis resilience

If, as Tables 1–6 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 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 7 indicate that economy-wide capital controls are indeed

Table 6

Policy measures and domestic credit booms: panel data, 1995–2008.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
Kcont	0.78 (3.17)							3.16 (4.23)	1.12 (4.47)	2.05 (3.03)	5.53 (3.37)	−5.63 (4.83)	−4.90 (4.63)
Fincont1		−1.25 (2.71)						−2.90 (3.86)					
Fincont2			2.18 (3.18)						1.65 (4.48)				
Fxreg1				1.25 (3.10)						−1.14 (3.28)			
Fxreg2					−1.83 (4.16)						−6.87 (4.91)		
Domreg1						−9.38** (4.24)						−9.66* (4.88)	
Domreg2							−5.86 (4.78)						−6.82 (5.10)
Institutional quality index	27.76** (12.07)	21.03** (10.37)	19.41* (10.03)	28.45** (11.54)	27.21* (14.50)	55.89*** (13.83)	63.10*** (18.47)	21.25 (12.69)	20.62 (12.73)	28.68** (13.54)	28.28* (14.65)	51.31*** (16.32)	61.21*** (21.46)
Credit bureaus	0.80 (1.98)	−1.48 (2.36)	−1.86 (2.15)	−0.16 (2.03)	0.23 (2.22)	−6.52** (3.23)	−6.55* (3.35)	−0.14 (2.81)	−1.11 (2.59)	0.94 (2.25)	2.94 (2.09)	−6.35** (3.14)	−5.71* (3.23)
Private credit to GDP (initial)	−0.22*** (0.05)	−0.16*** (0.06)	−0.16*** (0.05)	−0.19*** (0.05)	−0.21*** (0.06)	−0.11** (0.04)	−0.11** (0.05)	−0.19*** (0.06)	−0.19*** (0.06)	−0.21*** (0.05)	−0.24*** (0.07)	−0.08* (0.04)	−0.08* (0.05)
Real GDP growth	0.59** (0.24)	0.62** (0.24)	0.61** (0.24)	0.52** (0.25)	0.58** (0.25)	1.33** (0.64)	1.20* (0.68)	0.59** (0.26)	0.60** (0.26)	0.52* (0.27)	0.59** (0.27)	1.41* (0.73)	1.24* (0.73)
Exchange rate regime	5.23** (2.28)	6.17*** (2.26)	6.56*** (2.29)	5.55** (2.33)	5.26** (2.41)	7.53*** (2.64)	8.88*** (3.23)	6.35** (2.61)	6.68** (2.64)	5.25* (2.60)	4.89* (2.72)	6.01* (3.14)	7.12* (3.67)
Real GDP per capita (log)	3.08 (2.08)	2.48 (1.91)	2.95 (1.89)	1.63 (2.00)	1.92 (2.31)	−2.41 (1.88)	−2.88 (2.68)	3.62* (2.04)	3.91* (1.96)	2.80 (2.13)	3.44 (2.32)	−3.09 (1.99)	−3.70 (2.65)
Observations	388	366	363	411	383	64	60	317	314	360	341	57	53
R-squared	0.33	0.37	0.37	0.34	0.36	0.46	0.46	0.37	0.37	0.34	0.37	0.42	0.42

Notes: Dependent variable is the cumulative three year change in private credit to GDP (in percentage points; Mean = 4.6; Std dev = 16.5). Kcont, Fincontrol, and Fxreg are averaged over three lags. Domreg is available for 2005 and 2007 only, and is lagged by one year. Exchange rate regime (a binary variable equal to 1 for a de facto fixed exchange rate regime, and 0 otherwise), real GDP growth and (log) real GDP per capita are lagged one period. Three year lagged private credit to GDP is included as an initial condition. Constant, region specific and time effects included in all specifications. Clustered robust standard errors (on country level) in parentheses; *, **, and *** indicate significance at 10, 5, and 1% levels respectively. See Table 1 for the definitions of Kcont, Fincont1, Fincont2, Fxreg1, Fxreg2, Domreg1 and Domreg2.

Table 7
Policy measures and crisis resilience: global financial crisis.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
Kcont	5.15** (2.30)							5.98** (2.31)	7.12*** (2.52)	2.34 (2.65)	5.43* (3.14)	4.20* (2.38)	3.66 (2.65)
Fincont1		0.13 (3.27)						−2.91 (3.12)					
Fincont2			1.20 (3.07)						−4.11 (3.38)				
Fxreg1				5.28** (2.16)						3.97 (2.47)			
Fxreg2					4.23 (2.78)						−0.33 (3.10)		
Domreg1						4.65* (2.72)						4.73* (2.70)	
Domreg2							3.12 (2.53)						2.75 (2.49)
Terms of trade change	0.13 (0.10)	0.16 (0.12)	0.15 (0.11)	0.13 (0.088)	0.14 (0.10)	0.14 (0.10)	0.08 (0.10)	0.18 (0.12)	0.17 (0.11)	0.12 (0.09)	0.13 (0.10)	0.12 (0.09)	0.07 (0.11)
Growth in trading partners	1.10 (0.74)	2.18* (1.09)	2.13* (1.11)	0.65 (0.78)	0.62 (0.83)	0.17 (0.33)	0.10 (0.38)	2.15** (0.85)	2.22** (0.86)	0.82 (0.77)	1.13 (0.83)	0.63* (0.36)	0.52 (0.37)
Institutional quality index	−4.91 (8.67)	−6.88 (10.33)	−6.69 (10.04)	−8.30 (8.12)	−7.97 (9.53)	−2.98 (8.49)	−7.70 (9.87)	−4.85 (9.16)	−2.75 (8.78)	−6.53 (8.41)	−5.03 (8.88)	1.61 (7.56)	−2.88 (8.98)
Observations	40	36	36	39	39	33	31	36	36	39	39	33	31
R-squared	0.24	0.19	0.19	0.27	0.18	0.15	0.09	0.29	0.29	0.29	0.24	0.24	0.16

Notes: Dependent variable is the difference between real GDP growth rates averaged over 2008–09, and 2003–07 (in percentage points; Mean = −5.2; Std dev = 5.1). Kcont, Fincont, and Fxreg are averaged over 2000–02. Domreg1 and Domreg2 pertain to the measures in place in 2005. All regressions include a constant and control variables (growth in trading partners, terms of trade change, and institutional quality (ICRG) index). Robust standard errors in parentheses; *, **, and *** indicate significance at 10, 5, and 1% levels respectively. See Table 1 for the definitions of Kcont, Fincont1, Fincont2, Fxreg1, Fxreg2, Domreg1 and Domreg2.

Table 8
Policy measures and crisis resilience: past crises.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Kcont	5.80*** (1.73)					6.58*** (1.82)	7.17*** (1.80)	5.92*** (1.71)	6.08*** (1.89)
Fincont1		−0.40 (2.57)				−1.69 (2.40)			
Fincont2			1.09 (3.20)				−2.65 (3.53)		
Fxreg1				0.82 (2.36)				−0.48 (2.60)	
Fxreg2					3.98 (3.09)				0.22 (3.84)
Terms of trade change	−0.18*** (0.03)	−0.17*** (0.05)	−0.19*** (0.06)	−0.18*** (0.06)	−0.17*** (0.06)	−0.19*** (0.05)	−0.18*** (0.05)	−0.19*** (0.05)	−0.17*** (0.05)
Growth in trading partners	−0.22 (0.64)	0.21 (0.75)	0.17 (0.71)	0.13 (0.66)	−0.05 (0.67)	−0.12 (0.74)	−0.19 (0.72)	−0.16 (0.69)	−0.37 (0.69)
Institutional quality	−8.18 (7.44)	−10.75 (8.69)	−9.68 (8.94)	−9.13 (7.48)	−6.37 (10.53)	−11.01 (8.12)	−11.98 (8.77)	−10.04 (7.52)	−12.75 (10.23)
Observations	30	31	31	32	31	27	27	28	27
R-squared	0.35	0.15	0.15	0.15	0.19	0.38	0.38	0.34	0.35

Notes: Dependent variable is the difference between real GDP growth rate in crisis year and the average growth rate over past 5 years (in percentage points; Mean = −3.2; Std dev = 5.0). All regressions include a constant. Kcont, Fincont, and Fxreg are lagged one year. Robust standard errors in parentheses; *, **, and *** indicate significance at 10, 5, and 1% levels respectively. See Table 1 for the definitions of Kcont, Fincont1, Fincont2, Fxreg1, Fxreg2, Domreg1 and Domreg2.

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 3–4 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 Table 8) 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

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.

the crises occurred.²⁴ Thus our hypothesis is not that prudential measures and controls on capital flows are necessarily good for growth in “normal” times, but rather that such measures—by reducing financial vulnerabilities—can help countries avoid some of the worst outcomes in the event of a crisis. Our findings 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

3.2. New vs. old capital account openness measures

The estimation results presented above show that capital controls on inflows are associated with a less vulnerable external liability structure (in terms of a smaller share of debt liabilities in total liabilities), lower FX lending, and greater crisis resilience. How would these results fare if we use the more commonly used capital account openness measures that combine restrictions on inflows and outflows? Tables A3 and A4, which are available online, present the results for our baseline specification for the recent crisis cross-section and panel data, respectively, using two well known financial openness indices: Chinn and Ito (2008), and Quinn and Toyoda (2008), where higher values indicate more liberalized economies.

The evidence obtained from these indices is somewhat mixed. For panel data (Table A4, panel [A]), we do not find that capital account openness—as measured by Chinn–Ito and Quinn–Toyoda indices—has a statistically significant impact on the share of debt in total liabilities. For the recent crisis cross-section, however, the results are largely similar to those reported in Table 1 (columns 1–7), and show that greater pre-crisis capital account openness was associated with a greater reliance on debt financing (Table A3, panel [A]).

The results for FX lending are more uniform—for both panel and cross-section data, the estimated coefficients of the indices are strongly positive, indicating that more financially open economies have higher foreign currency denominated lending (Tables A3 and A4, panel [B]). Moving from the 25th to the 75th percentile of both indices implies an increase in FX lending of about 22 percentage points (in panel data). On domestic credit booms, capital account openness generally has a negligible impact (panel [C])—though for the recent crisis cross section, we obtain a (somewhat counterintuitive) result with the Chinn–Ito index that more financially liberalized economies had significantly smaller pre-financial crisis credit booms.

Turning to the crisis resilience regressions (panel [D])—with the Chinn–Ito index, greater capital account openness is associated with larger output declines in both the past and recent crises, but the estimated effect is statistically insignificant. The Quinn–Toyoda index also indicates a positive but insignificant impact of capital account openness in the recent financial crisis, but shows that greater openness was associated with significantly larger output declines in past crises.

Overall, the results using the older indices of capital account openness are not inconsistent with those using our indices (Tables 1–8), but the findings are generally more mixed and less clear cut. This highlights the importance of using our finer measures and of distinguishing between controls on capital inflows and controls on capital outflows—as the Schindler measure does, but previously available indices do not.

3.3. Sensitivity analysis

The results presented in Tables 1–8 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.

3.3.1. Model specification

While the regressions reported in Tables 1–8 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 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). In addition, in the crisis resilience regressions, we also include the pre-crisis foreign exchange reserves to GDP ratio as an additional control variable.²⁶

Tables 9 and 10 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 1–8 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.

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 2) 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 1–8, both in terms of statistical significance and the estimated magnitude of the association between policy measures and financial/economic vulnerabilities.

3.3.2. 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 relatively strong findings above are therefore

²⁴ Past crises are those identified by the IMF (2012) 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.

²⁶ In addition to the overall institutional quality and polity indices, we also test the sensitivity of our results to including rule-of-law variable. Further, in the crisis resilience regressions, we also control for other policy variables such as the pre-crisis 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 relative to the previous five years, respectively). These modifications to the specification do not, however, have any appreciable 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).

Table 9

Sensitivity analysis: cross-section.

Source: Authors's estimations.

	Baseline ^a	Stock market capitalization ^b	Financial soundness ^c	Polity ^d	(Log) Real GDP per capita ^e	Excluding Baltics ^f	Excluding advanced ^g	FX reserves/GDP ^h	Pre-crisis GDP ⁱ
<i>Debt liabilities</i>									
Kcont	−11.52**	−5.022	−11.576**	−8.556	−12.105*	−8.808	−11.937**		
Fincont1	−7.13	−2.820	−7.322	−4.579	−6.596	−5.425	−7.891		
Fincont2	−10.58	−4.155	−10.624	−9.283	−10.406	−8.007	−10.678		
Fxreg1	−7.97*	−0.564	−8.321	−5.875	−7.598	−5.487	−7.647		
Fxreg2	−8.61	−2.303	−8.875	−5.029	−8.036	−6.085	−8.532		
Domreg1	−2.68	4.167	−2.416	−1.549	−2.547	−0.974	−1.586		
Domreg2	−5.02	6.464	−5.569	−3.914	−4.625	−6.738	−3.777		
<i>FX credit</i>									
Kcont	−39.62***	−26.99	−40.33***	−34.95*	−39.97***	−36.88**	−40.54***		
Fincont1	−7.05	−7.22	−4.04	−9.04	−6.13	−7.66	−4.76		
Fincont2	−26.16	−16.58	−24.47	−25.71	−25.87	−22.52	−25.45		
Fxreg1	−41.71***	−40.02***	−41.97***	−36.69***	−41.60***	−38.86***	−45.30***		
Fxreg2	−55.21***	−48.27***	−57.33***	−48.06***	−55.49***	−51.94***	−62.48***		
Domreg1	−3.66	10.72	−3.89	−0.80	−3.68	2.30	−7.23		
Domreg2	−7.91	9.55	−4.45	0.22	−8.20	−11.46	−14.30		
<i>Change in private credit to GDP</i>									
Kcont	−6.54	−7.70	−3.99	−13.54*	−7.87	−3.24	−5.36		
Fincont1	−1.16	2.00	0.88	−4.85	−1.30	0.76	−0.96		
Fincont2	1.31	2.39	2.09	−0.53	1.72	4.65	2.17		
Fxreg1	−7.87	−7.34	−6.13	−13.79*	−11.08	−4.34	−8.20		
Fxreg2	−11.09	−10.37	−8.37	−20.17*	−14.17*	−5.37	−11.39		
Domreg1	−19.21**	−24.90**	−20.09**	−20.42**	−18.60**	−16.07*	−19.21*		
Domreg2	−15.22*	−10.60	−9.72	−17.69*	−21.11**	−17.36**	−15.07*		
<i>Crisis resilience</i>									
Kcont	5.15**	4.18*	5.04**	5.02*	5.50*	2.00	5.59**	4.59*	4.60**
Fincont1	0.13	−0.68	0.02	−0.32	−0.21	−0.93	0.33	0.58	−0.59
Fincont2	1.20	−0.19	1.25	0.35	0.79	−0.83	1.66	1.24	0.26
Fxreg1	5.28**	4.72*	4.89**	4.93**	5.17**	2.68*	5.56**	5.08**	4.90**
Fxreg2	4.23	3.02	3.67	3.38	3.90	2.15	4.69	3.80	3.00
Domreg1	4.65*	5.48**	4.72*	4.68*	4.73*	3.15	4.88	4.74	4.31
Domreg2	3.12	1.35	2.43	3.04	2.79	3.79	3.65	3.12	2.58

Notes: Debt liabilities are 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% levels respectively. Values in cells indicate the estimated coefficients for relevant policy measures indicated in row headers. Thus, for example, −11.52 in the first cell (column 1) is the estimated effect of capital controls on the share of debt liabilities in the benchmark specification, and −5.02 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.

^a Baseline specification refers to columns (1)–(7) in Tables 1–4.

^b Stock market capitalization variable added to the baseline specification.

^c Banks' return on equity added to the baseline specification.

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

^e (Log of) real GDP per capita added to the baseline specification.

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

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

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

ⁱ Nominal GDP (average 2005–07) added to the baseline specification.

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

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 had not been approved by the U.S. Congress at that time, 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).

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

Table 10Sensitivity analysis: panel data, 1995–2008.
Source: Authors's estimations.

	Baseline ^a	Stock market capitalization ^b	Financial soundness ^c	Polity ^d	Excluding Baltics ^e	Excluding advanced ^f	FX reserves/GDP ^g	Pre-crisis GDP ^h
<i>Debt liabilities</i>								
Kcont	−10.05***	−6.35*	−10.17***	−9.88**	−9.63***	−10.20***		
Fincont1	−3.11	1.09	−3.64	−3.63	−1.83	−3.44		
Fincont2	−6.95**	−3.26	−7.61**	−8.13**	−6.16*	−7.21**		
Fxreg1	−2.13	1.98	−2.46	−0.21	−2.61	−3.26		
Fxreg2	−5.39	−1.98	−6.52	−3.80	−4.56	−6.10		
Domreg1	−3.75	1.85	−4.55	−2.82	−2.80	−0.31		
Domreg2	2.15	7.50	1.93	3.38	0.70	3.79		
<i>FX credit</i>								
Kcont	−28.50***	−26.18***	−28.48***	−27.79***	−28.09***			
Fincont1	−9.01	−4.00	−8.85	−7.67	−10.76	−10.10		
Fincont2	−20.55**	−15.45	−20.16**	−19.50**	−21.86***	−21.38**		
Fxreg1	−23.64***	−26.37***	−22.58***	−24.31***	−23.73***	−24.93***		
Fxreg2	−36.55***	−35.78***	−35.63***	−36.37***	−35.35***	−39.21***		
Domreg1	3.42	5.15	3.44	3.09	6.37	3.35		
Domreg2	12.48	0.77	12.47	13.29	10.41	14.35		
<i>Change in private credit to GDP</i>								
Kcont	0.78	0.99	0.79	−1.14	1.62	0.68		
Fincont1	−1.25	−1.06	−1.27	−0.72	−1.17	−3.48		
Fincont2	2.18	2.33	2.17	3.14	2.54	0.05		
Fxreg1	1.25	1.32	1.21	−0.73	1.41	0.39		
Fxreg2	−1.83	−1.17	−1.74	−3.97	−0.36	−0.15		
Domreg1	−9.38**	−12.86***	−10.40**	−11.67**	−7.12*	−9.05**		
Domreg2	−5.86	−5.65	−6.04	−6.01	−7.11	−7.26		
<i>Crisis resilience</i>								
Kcont	5.80***	5.08***	5.78***	6.70***	4.56***	6.32***	5.82***	8.26***
Fincont1	−0.40	−0.57	−0.45	0.18	−0.78	−0.54	−0.31	−0.06
Fincont2	1.09	−0.88	1.11	2.42	0.25	0.90	1.23	1.28
Fxreg1	0.82	0.82	0.82	1.51	−2.39	0.06	1.10	0.52
Fxreg2	3.98	3.50	4.00	4.62	−0.14	3.60	4.71	3.58

Notes: Debt liabilities are 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, Fincont1, 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% levels respectively. Values in cells indicate the estimated coefficients for relevant policy measures indicated in row headers. Thus, for example, −10.05 is the estimated effect of capital controls on the share of debt liabilities in the benchmark specification, and −6.35 is the estimated effect of capital controls on the share of debt liabilities when the stock market.

^a Baseline specification refers to columns (1)–(7) in Tables 4–8.

^b Stock market capitalization variable added to the baseline specification.

^c Banks' return on equity added to the baseline specification.

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

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

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

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

^h Nominal GDP (average 2005–07) added to the baseline specification.

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 that 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 A5, which is available online) is in the range of 0.30–0.60, 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 is stronger in the panel regressions (Table A5, 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.

3.3.3. 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 as they are small economies).³⁰ While we believe that including the Baltic countries in the sample is important, as they suffered some of the largest output declines during the 2008–09, and as such their experience is informative, we re-estimate the cross-sectional and panel

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–Toyoda index; but differ considerably based on the Schindler inflows index).

specifications without the three Baltic countries (Estonia, Latvia, and Lithuania) in the sample.

As shown in Table 9, excluding the Baltic countries from the sample leaves the sign of the effect of economy-wide capital controls, K_{cont} , the same, but reduces the magnitude of the coefficient, which now becomes statistically insignificant.³¹ This is scarcely surprising, however, as the Baltic countries suffered the largest output declines in the 2008–09 crisis—excluding them means throwing out highly informative observations. In particular, as noted above, our hypothesis is not that controls on capital inflows are beneficial for growth in normal times, but rather that by reducing the build-up of financial fragilities, such measures can help avoid the worst outcomes in the event of crisis. Once countries that suffered the worst crises are excluded from the sample, therefore, it is natural that this effect cannot be identified in the data.

Rather than simply exclude the Baltic countries on grounds that they are small economies, therefore, it is preferable to retain them in the sample but control explicitly for the size of the economy (lest that be the cause of their larger output decline). This is done in Tables 9 and 10 (last column), where the pre-crisis U.S. dollar-value of GDP is added as a regressor; doing so leave the coefficient on economy-wide capital controls largely unchanged, positive, and statistically significant. Moreover, in the panel regressions of past crises (where the Baltics are not so important because other countries in the sample also suffered severe crises), excluding the Baltics makes little difference to the results, with K_{cont} again positive and statistically significant—regardless of whether one controls for foreign currency reserves or the economic size of the country (Table 10).

Finally, we also try excluding countries that may be identified as advanced economies otherwise (specifically, Czech Republic, Iceland, Israel, and Korea). This does not change the estimated sign and magnitude of the coefficients; and capital controls remain strongly associated with a lower share of debt liabilities, less FX lending, and greater crisis resilience in both cross-section and panel specifications.

4. 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 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 et al., 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). Although beyond the scope of this paper (which looks at the financial-stability risks associated with capital flows, rather than the magnitude of the flows themselves), a further consideration in the use of capital controls (or prudential measures that may act like them) concerns their multi-lateral impact—including possible diversion of flows toward other EMEs that may be less able to absorb them without incurring their own financial-stability risks (Forbes et al., 2011).

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.³² 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.

Appendix A. Supplementary data

Supplementary data to this article can be found online at doi:10.1016/j.jinteco.2012.02.002.

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³¹ It is noteworthy, however, that using Schindler's sub-index of capital controls specific to debt liabilities (rather than the overall capital control index) yields a statistically significant association between the growth decline in the 2008–09 global financial crisis and the controls that were in place prior to the crisis even excluding the three Baltic countries from the sample.

³² 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 toward direct borrowing from abroad; see Ostry et al. (2011).

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