Regulating Capital Flows at Both Ends: Does it Work?‡

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Abstract

This paper is the first to examine whether cross-border capital flows can be regulated by imposing capital account restrictions (CARs) in both source and recipient countries, as was originally advocated by John Maynard Keynes and Harry Dexter White some seventy years ago. To this end, we use bilateral data on cross-border bank flows from 31 source to 76 major recipient countries over 1995–2012, and combine this information with a novel dataset on various outflow and inflow related capital controls and prudential measures in source and recipient countries. Our findings suggest that CARs at either end can significantly influence the volume of cross-border bank flows, with restrictions at both ends associated with a larger reduction in flows. These findings suggest a useful scope for welfare-enhancing policy cooperation between source and recipient countries to better manage potentially volatile financial flows, as is also envisaged under the Basel III "reciprocity" principle.

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I. INTRODUCTION

"Control will be more difficult to work by unilateral action on the part of those countries which cannot afford to dispense with it …if movements of capital cannot be controlled at both ends."
- J. M. Keynes[1]

"Almost every country, at one time or another, exercises control over the inflow or outflow of investments, but without the co-operation of other countries such control is difficult, expensive and subject to considerable evasion." - H. D. White[1]

Capital flows to emerging markets (EMs) have been extraordinarily volatile since the global financial crisis (GFC), prompting debates on whether—and how—they may be better managed. While most of the literature has focused on the policy options of countries at the receiving end (e.g., Ostry et al., 2010, 2011; IMF, 2011), some recent studies and policy papers call for a more cooperative approach to regulating capital flows by acting at both the source and recipient country ends (e.g., Ostry et al., 2012a; IMF, 2012; Brunnermeier et al., 2012). But can capital account restrictions help tame potentially volatile cross-border flows? And is there scope for a cooperative approach in managing capital flows at both ends? These are the questions we take up in this paper.

The idea of regulating short-term speculative flows "at both ends" to reduce excessive volatility is not new. In fact, this is one issue on which the principal architects of the Bretton Woods system—John Maynard Keynes and Harry Dexter White—were in complete agreement when debating the post-war international monetary system (Helleiner, 1994). But domestic political constraints and vested interests meant that, historically, instances of international cooperation in the management of capital flows have been rare, leaving countries to contend with large inflows on their own.[2]

More recently, however, the issue has gained prominence in the context of cross-border bank flows, where Basel III mandates "reciprocity" in the application of counter-cyclical capital buffers. Under such reciprocity, home country regulators are required to impose the same capital buffers on their international banks' credit exposures in the host country (up to a level of 2.5 percent), as are being imposed by host country regulators on domestic banks.[3] In essence, therefore, Basel III mandates source country regulators to cooperate in the prudential management of cross-border bank flows. While this measure goes into effect

[1] Source: Horsefield (1969).

[2] In the early 1970s, for instance, when massive capital outflows from the United States threatened the stability of the Bretton Woods system, both Japan and Western Europe proposed that they would cooperatively impose inflow controls while the US would intensify its outflow controls—but the proposal did not win US backing (Helleiner, 1994). Even when capital controls have been introduced congruently by countries—e.g., the US' interest equalization tax to stem outflows in 1963-74, and Germany's capital controls program over 1968-73 to reduce inflows primarily originating from the US, the actions have not been explicitly coordinated.

[3] See, e.g., Basel Committee on Banking Supervision, 2015, *Frequently Asked Questions on the Basel III Countercyclical Capital Buffer* (Basel: Bank for International Settlements). Move toward such initiatives can partly be attributed to the pre-GFC experience of several countries where a lack of cooperation between financial regulators caused financial excesses, eventually leading to a crisis. For example, some Baltic countries faced inflow-fueled credit booms in the runup to the GFC due to large-scale lending by Swedish banks, but despite requests by host country regulators, the Swedish regulators declined to tighten measures to curb the international lending of the banks they supervised (Grønn and Fredholm, 2013).

between 2016 and 2019, the European Union (EU) is applying the same principle to other macroprudential measures, notably for lending to the housing sector (European Systemic Risk Board, 2014)—against the backdrop of more general calls for shared responsibility between source and recipient countries for the management of cross-border flows (IMF, 2012; G20, 2011; Reinhardt and Sowerbutts, 2015). There is thus a pressing need to better understand the scope for, and feasibility of, such international cooperation in the application of prudential measures and capital controls.

A pertinent question at the outset is why would countries want to cooperate in the management of cross-border capital flows? While the incentives for the recipient country seeking to limit temporarily large or especially risky inflows to prevent adverse macroeconomic and financial-stability consequences are clear, cooperation may benefit the source country as well—for example, by shifting the intertemporal terms of trade in its favor, as well as by lowering the likelihood of a financial crisis in the recipient country that could inflict losses on the source country's financial institutions, and thus its taxpayers.

Formally, the efficiency case for cooperation between the source and recipient country rests on the assumption that the costs of regulation are convex in the (implicit or explicit) tax rate. This is a standard assumption in the public finance literature, where distortionary costs are commonly modeled as being proportional to the square of the tax rate (Barro, 1979; Auerbach,1985; Ghosh 1995)—and seems plausible in the context of capital account regulations. For instance, the higher the tax rate, the greater the incentive for circumvention, which may prompt the authorities to widen the application of the measure, and in turn impede the movement of more desirable forms of capital along with the originally-targeted risky flows. Given such convexity, the global cost is minimized by regulating flows at *both* ends, rather than by putting the full onus on either the recipient or the source country alone (Ostry et al., 2012a). Moreover, both the source and recipient countries gain individually as well, relative to the no-tax counterfactual.[4]

The feasibility of such cooperation, however, depends on whether—as an empirical matter—the measures adopted by source and recipient countries actually affect the targeted flows. If not, the issue of cooperation becomes moot. Existing evidence in this regard is decidedly mixed. At the recipient end, most studies find little or no effect of controls on the aggregate volume of flows but some find a statistically significant impact on the composition of flows, and consequently, on financial stability (e.g., Ostry et al., 2012b; Forbes et al., 2013). As regards source countries, the issue is largely unexplored with the few studies that do exist focusing on a related but different issue of the use of outflow controls in crisis situations.[5]

In this paper, we go beyond existing studies to assess the feasibility of source-recipient cooperation by investigating whether the *simultaneous* use of outflow and inflow-related capital controls or prudential measures that may act like capital controls (hereafter referred to

[4] In the appendix to this paper, we sketch a simple theoretical model in which source- and recipient-country cooperation in the management of cross-border capital flows is welfare-enhancing for both countries.

[5] A notable exception is Binici et al. (2010) who examine the effectiveness of outflow controls more generally, and find that they are associated with lower outflows in advanced countries.

collectively as capital account restrictions, CARs) are associated with lower cross-border capital flows. Even though Keynes and White proposed such cooperation more than 70 years ago, the literature has not yet explored this issue—perhaps because to date there have been few instances of coordinated policy action on CARs, and also because comprehensive data on inflow and outflow restrictions (both capital controls and prudential measures) have been lacking.[6] To get around these difficulties, in this paper we use *bilateral* data on cross-border bank flows (which includes bank deposits, loans, portfolio, and foreign direct investment flows) from 31 major source to 76 major recipient countries over 1995–2012 and combine this information with different types of CARs—constructed using detailed information from the IMF's Annual Report on Exchange Arrangements and Exchange Restrictions (AREAER) and the OECD Code of Liberalization of Capital Movements.

The use of bilateral data on bank flows for our purposes has several advantages. First, and most simply, since inflow and outflow measures are not universal in most countries, the only way to identify the possible impact of their simultaneous use is to employ bilateral data. In practice, moreover, if imposed for the specific purpose of safeguarding financial stability in recipient countries, then the measures would likely be imposed bilaterally (as is the case of Basel III reciprocity) because even as one recipient country is contending with a surfeit of inflows, another may be facing a dearth. Second, cross-border bank flows, which have grown exponentially in recent years, form a sizable proportion of total cross-border lending and tend to be highly procyclical—with the potential to create serious macroeconomic and financial instabilities (Brunnermeier et al., 2012); as such they are the form of capital flow that governments are most likely to want to manage.[7] Third, the use of bilateral data helps mitigate potential endogeneity concerns in econometric estimations (since, to date, such measures have nearly always been adopted in response to the *aggregate*—and not bilateral—volume of flows). Finally, the bilateral cross-border bank flows data comprises information on flows to both advanced and emerging market recipient countries, enabling us to analyze the potential impact of CARs across different regions.[8]

We begin our empirical analysis by examining the association between cross-border bank flows and CARs in source and recipient countries individually. Our results show that restrictions are associated with a significantly lower volume of flows: on the source side, moving from the lower to the upper quartile on measures of overall, bond, equity, direct investment or financial credit outflow controls is associated with about 50-100 percent lower bank outflows, while prudential measures such as restrictions on lending to nonresidents also

[6] An early example of cooperation on capital controls is that between Western Europe and Britain, when they signed bilateral agreements with provisions for cooperative control of speculative flows to tackle massive capital flight from Western Europe in 1945-47. In practice, however, the effectiveness of this cooperation was undermined by the US' refusal to impose inflow controls on West European capital (Helleiner, 1994).

[7] To the extent that cross-border bank flows comprise bank intermediated credit flows that rely on short-term wholesale funding, as is typically the case when global liquidity is abundant and risk aversion is low, they pose a higher risk than those funded by stable deposits (Brunnermeier et al., 2012). Milesi-Ferretti and Tille (2011) find that across different types of flows, the retrenchment in banking flows was the largest during the GFC.

[8] Bilateral data on other types of flows, e.g., portfolio flows is mostly available for advanced countries (Portes and Rey, 2005). More recently, the IMF has initiated coordinated investment surveys that document the total *stock* of direct and portfolio investment assets/liabilities of reporting countries against major partner countries, but their cross-country and time coverage remains very limited.

imply a similar reduction in flows. On the recipient side, moving from the lower to the upper quartile on overall and bond inflow controls, and on the existence of foreign currency (FX) related prudential measures (such as restrictions on lending in FX, and open FX position limits) is associated with some 50-80 percent lower inflows. Among other factors, we find a strong effect of global risk aversion and monetary policy (proxied by the interest rate) in source countries on bank flows—highlighting the procyclical nature of such flows—as well as of the domestic interest rate and exchange rate regime of the recipient countries.

Controlling simultaneously for both source and recipient country restrictions, the estimated effects remain largely unchanged. Individual measures are, however, associated with a greater reduction in flows when the other side is financially more open—though not necessarily *fully* open. Inasmuch as capital controls are effective, this result makes intuitive sense: when the source country is already restricting outflows, the incremental effect of inflow restrictions will be smaller than if the source side is completely free. Likewise, the incremental effect of source country restrictions on outflows will be smaller when the recipient is already restricting inflows. The estimated effects of source and recipient country restrictions are thus partially (but not fully) additive, making it possible to operate CARs at both ends, achieving either a larger reduction in flows, or the same reduction with less intensive (and therefore perhaps less distortive) measures at either end.

Our results survive a battery of robustness tests, including use of alternate samples (e.g., restricting the source countries to advanced countries or restricting the recipient countries to EM countries only, excluding offshore financial centers, and restricting the sample to pre-GFC years); defining the dependent variable in different ways (such as in stock, rather than in flow, terms); and addressing potential endogeneity concerns through the instrumental variable approach—where we use two novel instruments for the existence of CARs (which satisfy the exclusion restriction): the lack of monetary/central bank freedom, and the presence of a democratic left-wing government.

Our findings have important policy implications. Given the close connection between cross-border bank flows and risks to global financial stability, our analysis suggests that adoption of relevant CARs in boom times could help to dampen the procyclicality of these flows, thereby lowering the risk of systemic financial crises. The traction of both source and recipient country CARs in regulating flows implies that coordination could be useful to achieve a given reduction in cross-border flows by adopting relatively lower levels of restrictions at both ends, which—as mentioned earlier—is globally more efficient if costs of regulation are convex. Such cooperation may be especially beneficial when the scope to act at one end is limited—for instance, because of weak institutional capacity to enact measures, or because international legal obligations constrain the availability of certain restrictions.

We make several contributions to the literature. First, unlike previous studies, which focus on the impact of either capital inflow or outflow restrictions, we use bilateral data on capital flows to empirically establish the feasibility of *jointly* imposing restrictions on outflows by the source country, and on inflows by the recipient country. In doing so, we not only establish the effect of outflow controls on the country implementing the control, but also that

on the recipient countries. The use of bilateral data, moreover, helps to mitigate potential endogeneity concerns pertinent to earlier studies, and allows us to establish economically and statistically significant effects of capital account restrictions on both outflows and inflows. Second, while the existing literature has extensively analyzed the effect of capital account restrictions on aggregate flows, and on different types of portfolio flows, their impact on bank flows—an increasingly important and volatile component of total cross-border flows—has remained largely unexplored. Third, for our analysis, we construct a comprehensive dataset of capital controls (disaggregated by asset type) and prudential measures that may act as capital controls for source and recipient countries over 1995–2012.[9]

The remainder of the paper is organized as follows. Section 2 describes the data used in the empirical analysis, and presents some stylized facts. Section 3 examines whether CARs imposed by source and recipient countries affect the volume of capital flows between them. Section 4 analyzes the implications of implementing CARs simultaneously in both source and recipient countries, and presents an extensive sensitivity analysis to establish the robustness of our results. Section 5 provides some concluding remarks.

II. Cross-Border Bank Flows and Capital Account Restrictions

As noted in the introduction, if the distortive (or other) costs of regulation are convex in the tax rate, then at least theoretically, there exists scope for Pareto-improving policy cooperation between source and recipient countries in managing cross-border capital flows. In the Appendix, we sketch a simple theoretical model to illustrate the gains from cooperation given the existence of a borrowing externality in the recipient country, which justifies the focus of policy makers on strengthening source-recipient country cooperation.

A prerequisite for such cooperation, of course, is that source- and recipient-country measures are both actually able to influence the targeted flows. To examine whether this is the case, we consider annual bilateral data on cross-border bank flows from 31 source countries to 76 recipient countries over 1995–2012, obtained from the Bank for International Settlements (BIS) Locational Banking Statistics by Residence.[10] Our source and recipient countries include both advanced and emerging market countries, though data availability varies across countries (see Appendix, Table A1).

Flows are estimated by the BIS as the exchange rate-adjusted changes in the gross international financial claims of resident banks in the reporting country on the bank and nonbank sectors of recipient countries (i.e., as changes in total stock, amounts outstanding, of reporting country banks' foreign assets, accounting for repayments and exchange rate

[9] A few existing studies examine the determinants of cross-border bank flows (or stocks) and include proxies for financial openness in their analysis (e.g., Blank and Buch, 2010; Ghosh et al., 2012). They however rely on aggregate measures of openness, and do not systematically explore the impact of different types of CARs in both source and recipient countries.

[10] We use the BIS Locational Statistics by Residence (instead of the consolidated statistics) as these report bank claims based on the *residence* of the reporting (source country) banks and of the counterparties. Moreover, the capital account measures considered here (both controls and prudential measures) also apply to resident versus non-resident transactions.

(continued…)

effects). The data—originally complied by reporting country central banks, and then provided to the BIS—cover over 90 percent of the international assets of the domestic banking institutions, and comprise cross-border bank loans, bank credit lines (used portions), trade-related credit, as well as debt securities, equity holdings and participations of banks (i.e., portfolio debt and equity, and foreign direct investment).[11]

To obtain information on prudential measures and capital controls, we draw on the IMF's AREAER database, supplemented with information from the OECD Code of Liberalization of Capital Movements.[12] By definition, prudential measures are provisions specific to the regulated domestic financial sector (notably banks, but sometimes also other financial institutions). These could discriminate by the *currency* denomination of the capital transaction (e.g., restrictions on local FX lending), or could be general (nondiscriminatory) measures to preserve financial system stability (such as cyclical capital requirements, maximum loan-to-value ratios, etc.). Capital controls, by contrast, may be economy-wide and apply to all residents, or could be sector-specific—but restrict capital transactions by virtue of the *residency* of the parties to the transaction. In this respect, measures specific to the financial sector that discriminate based on residency (such as restrictions on lending to, or borrowing from, nonresidents) could be considered as financial sector-specific capital controls. It is also important to recognize that certain prudential measures—especially those that discriminate based on currency denomination of the capital transaction—can also influence flows, effectively acting as capital controls (Ostry et al., 2012b; IMF, 2012).

For our empirical analysis, we consider several capital outflow and inflow related CARs from the source and recipient sides, respectively. These include economy-wide capital controls disaggregated by asset class, as well as measures specific to the financial sector. Specifically, for source countries, we consider capital controls on bonds, equity, direct investment, and financial credit *outflows* (along with a measure of the overall restrictiveness on capital outflows), and the following prudential measures: (i) restrictions on lending to nonresidents; (ii) restrictions on maintenance of accounts abroad; and (iii) open FX position limits. For recipient countries, we include capital controls on bond, equity, direct investment and financial credit *inflows* (along with a measure of the overall restrictiveness on capital inflows), and the following prudential measures: (i) restrictions on lending locally in FX; (ii) restrictions on purchase of locally issued securities denominated in FX; and (iii) open FX position limits.[13]

These various measures are expected to reduce the volume of cross-border bank flows, with the exception of open FX position limits in source countries, where the effect is potentially ambiguous. If banks in source countries have few FX deposits, then such limits are likely to

[11] The reporting institutions are mostly deposit-taking banks and similar financial institutions. In some countries, specialized non-deposit-taking, trade-related financial entities also report (BIS, 2009). Since the creditor data is reported on residence (and not nationality) basis, the measurement of flows is consistent with the Balance of Payments Statistics.

[12] The detailed data on different types of measures that we use in our analysis is available in the AREAER from 1995 onward, which precludes including the pre-1995 years in the sample.

[13] Our choice of prudential measures is driven by data availability. In some countries with pegged exchange rates, exposure in the anchor currency is excluded from the calculation of the open position. We code such cases as not having limits on open FX positions. The Appendix provides a description of variables and data sources (Tables A2 and A3).

deter cross-border lending as the bank would be limited in the foreign currency (and hence foreign) assets it could acquire. Conversely, if banks in source countries have large FX deposits, then open position limits would force them to acquire FX assets, which may well take the form of cross-border bank claims. In recipient countries, however, open FX position limits are likely to reduce cross-border bank borrowing as the bank would have to acquire FX-denominated assets, which could entail greater credit risk if domestic borrowers lack a natural hedge.

We capture prudential measures through binary variables with a value of one indicating the presence of a restriction (and zero otherwise). To construct the capital control measures, we follow the approach of Schindler (2009), which—importantly for our purposes, and unlike other capital account openness indices—allows us to differentiate between controls on inflows and on outflows, while also differentiating between restrictions by asset type. These measures are constructed by taking averages of binary variables reflecting the existence of controls at the level of individual (resident/nonresident) transactions, and range between 0 and 1. For example, controls on bond and equity inflows are an average of binary variables reflecting the presence of restrictions on the sale of securities abroad by residents, and on the purchase of locally issued securities by nonresidents. By contrast, controls on bond and equity outflows are an average of binary variables indicating restrictions on the purchase of securities abroad by residents, and on the sale of locally issued securities by nonresidents. These measures can thus assume three values: 0 (no restriction), 0.5 (restriction on one type of transaction), or 1 (restrictions on both types of transactions). For controls on direct investment and financial credit flows, where the AREAER provides less disaggregated information, the inflow/outflow controls can take on only two values, 0 or 1.[14]

The overall restrictiveness on capital outflows and inflows is captured by taking the average of measures over different types of asset classes (e.g., bond, equity, direct investment, financial credit flows, as well as over money market instruments and collective investment flows), and hence can assume a range of values between 0 and 1. Ideally, both prudential and capital control measures would capture the intensity, rather than just the existence, of various restrictions. In practice, however, this is almost impossible to do, especially for administrative measures, without making arbitrary choices. For this reason, like existing studies, we rely on indicators of de jure restrictiveness that capture the presence of measures. Nevertheless, since some measures—such as simple notification requirements—may reflect mere formalities that are unlikely to have a substantial impact on cross-border flows, or there may be restrictions that apply to specific countries (that are not part of the sample), we treat these measures as no restrictions. Moreover, we create alternative outflow/inflow control measures where provisions unlikely to be directly related to cross-border banking flows (such as restrictions on investment in a limited number of sectors for national security purposes), or

[14] For direct investment, the AREAER provides information on inward and outward restrictions, as well as on the liquidation of direct investment. Following Schindler (2009), we consider controls on direct investment inflows as the maximum of restrictions on inward direct investment and the liquidation of direct investment, which recognizes that liquidation restrictions indirectly impose costs on direct investment inflows.

milder regulations such as registration requirements, are not treated as restrictions, and use them to check the robustness of our results below.

It is worth noting that existing inflow and outflow restrictions imposed by countries are typically applied against *all* other countries—and not bilaterally between pairs of countries. Nevertheless, the use of bilateral data is important because it allows us to identify the impact of *simultaneous* source- and recipient-country measures on cross-border flows (which in turn depends on whether the source country has a restriction, the recipient country has a restriction, or both have restrictions in place). Moreover, in practice, cooperation would likely entail managing bilateral flows (as is the case under Basel III reciprocity); our analysis can thus allow us to gauge the impact of such initiatives.[15]

A. Stylized Facts

By any estimate, cross-border bank flows have ballooned over the past couple of decades. Total bank asset flows from reporting advanced source countries to advanced recipient countries increased from about USD 435 billion in 1995 to almost USD 4 trillion in 2007, before dropping sharply during the GFC in 2008–09 (Figure 1[a]). Recovery has been gradual and volatile, with flows totaling about USD 280 billion in 2010, but falling again in 2011–12. Flows from advanced countries to EMs, though smaller in absolute terms, present a similar picture—but with a somewhat sharper post-crisis recovery. The post-crisis bounce back in flows is, however, not uniform across regions—Latin America and Asia have been the major recipients, with total flows received in 2010 close to the pre-crisis peak, while recovery in emerging Europe has lagged. Flows from (reporting) EMs to advanced and to other EMs also increased sharply before the GFC, and have picked up since the sharp fall in 2009, but the recovery is largely driven by EM-to-EM flows (Figure 1[b]). Expressed in percent of (either source or recipient country) GDP, the pre-crisis rise in flows remains striking, and the recovery appears modest but volatile (Figure 1[c], [d]).

In terms of the importance of bank inflows in the total inflows received by countries, Figure 2 shows that their share gradually increased in the runup to the GFC. On the eve of the crisis in 2007, they constituted about 50 and 40 percent of gross inflows to advanced countries and EMs, respectively.[16] Among EMs, perhaps the starkest increase was for the Baltics, where their share increased from 11 percent in 2000 to about 70 percent just before the crisis. It is also pertinent to note the highly procyclical nature of these flows, as documented in earlier studies (e.g., Milesi-Ferretti and Tille, 2011; Brunnermeier et al., 2012), with surges in bank inflows often followed by sharp declines (such as in Asia and Latin America in the late 1990s, and more generally across all countries in the GFC).

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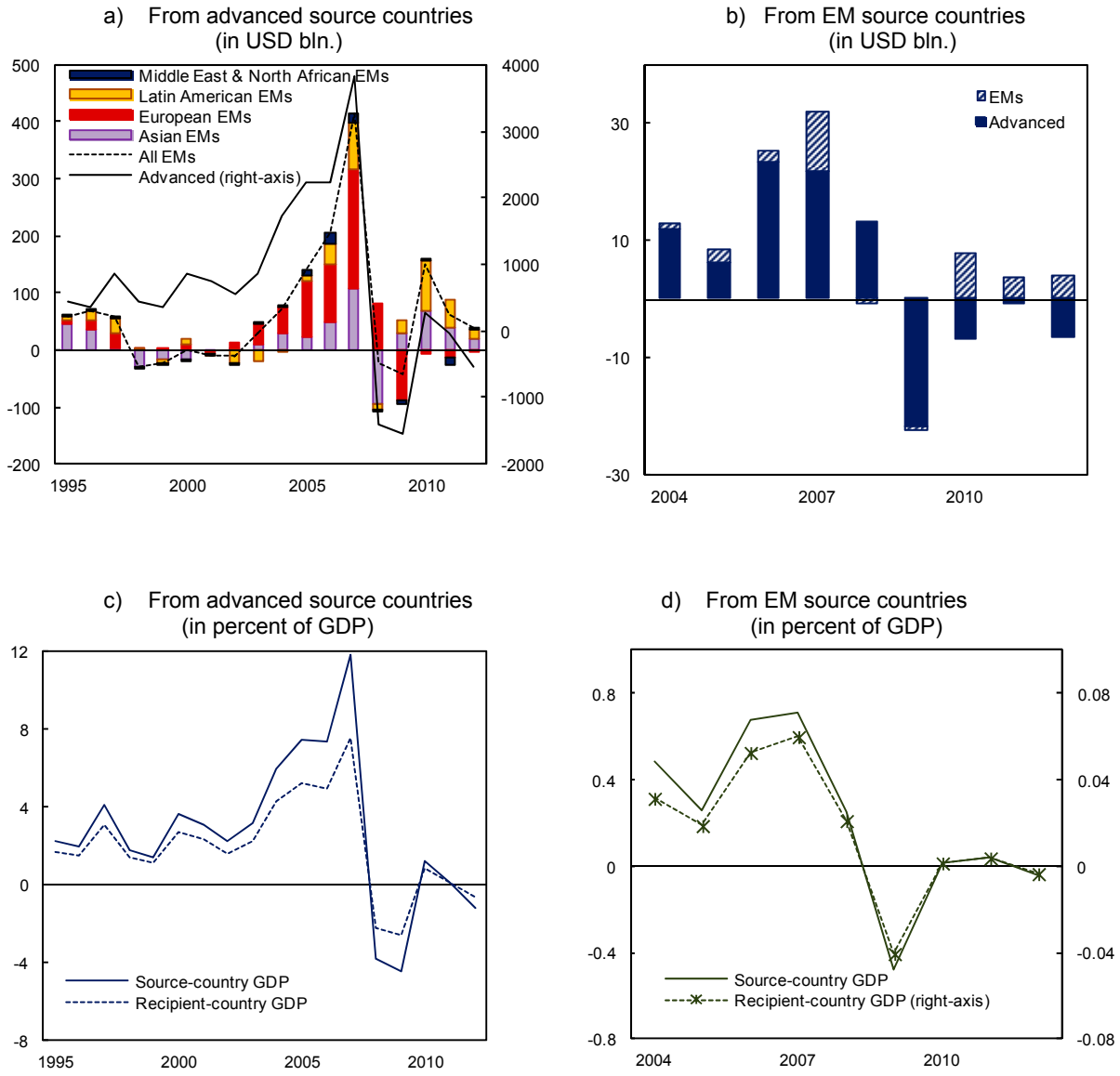
[15] Since not all source (recipient) countries impose outflow (inflow) restrictions at the same time, using aggregate data on outflows or inflows would not allow us to identify the effect of *simultaneous* source- and recipient country measures without assuming that they are simply additive (which, as discussed below, is not the case).

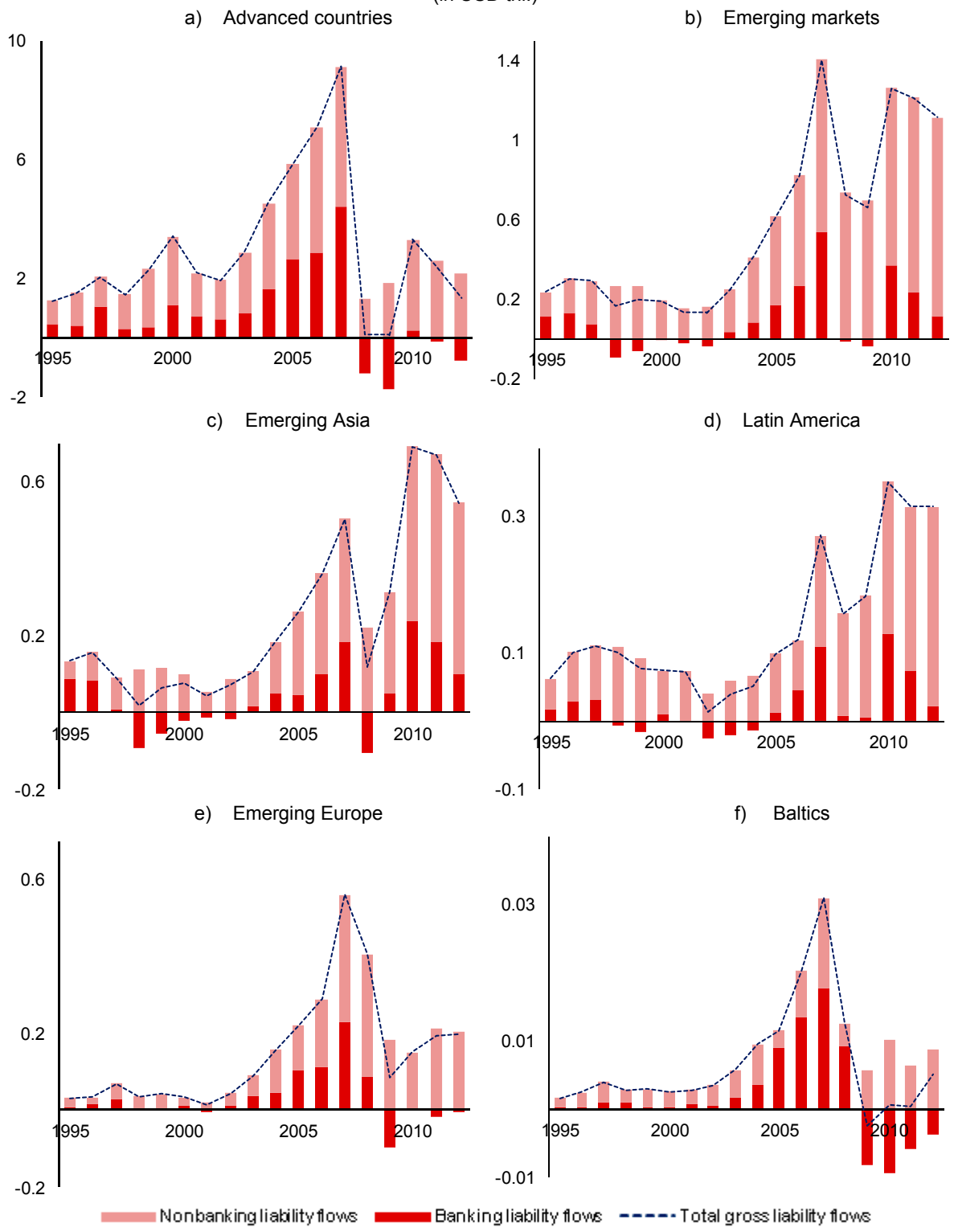
[16] Of the large net capital inflow (or "surge") observations in EMs over 1995-2011 as identified in Ghosh et al. (2014a), about 40 percent have been driven predominantly by (net) bank flows as opposed to (net) nonbank flows. Further, the share of bank-flow driven surges has increased over the years—from some 38 percent in 1995-99 to about 43 percent in 2005-11.

Figure 1. Cross-Border Bank Asset Flows, 1995–2012



Source: BIS Locational Statistics.
Note: Statistics reflect exchange rate adjusted changes in the total stock (amounts outstanding) of assets (all instruments). Advanced and EME source countries in the Figure include those for which data is available from 1995 and 2004 onward, respectively (see Table A1).

Figure 2. Cross-Border Bank and Nonbank Liability Flows, 1995–2012
(in USD tril.)



Source: BIS Locational Statistics and IFS database (based on BPM5 presentation).
Notes: Bank liability flows for recipient regions computed as the sum of gross bank asset flows from all source countries to that region. Nonbank liability flows computed as the difference between total (gross) liability flows to the region (obtained from IFS) and bank liability flows.

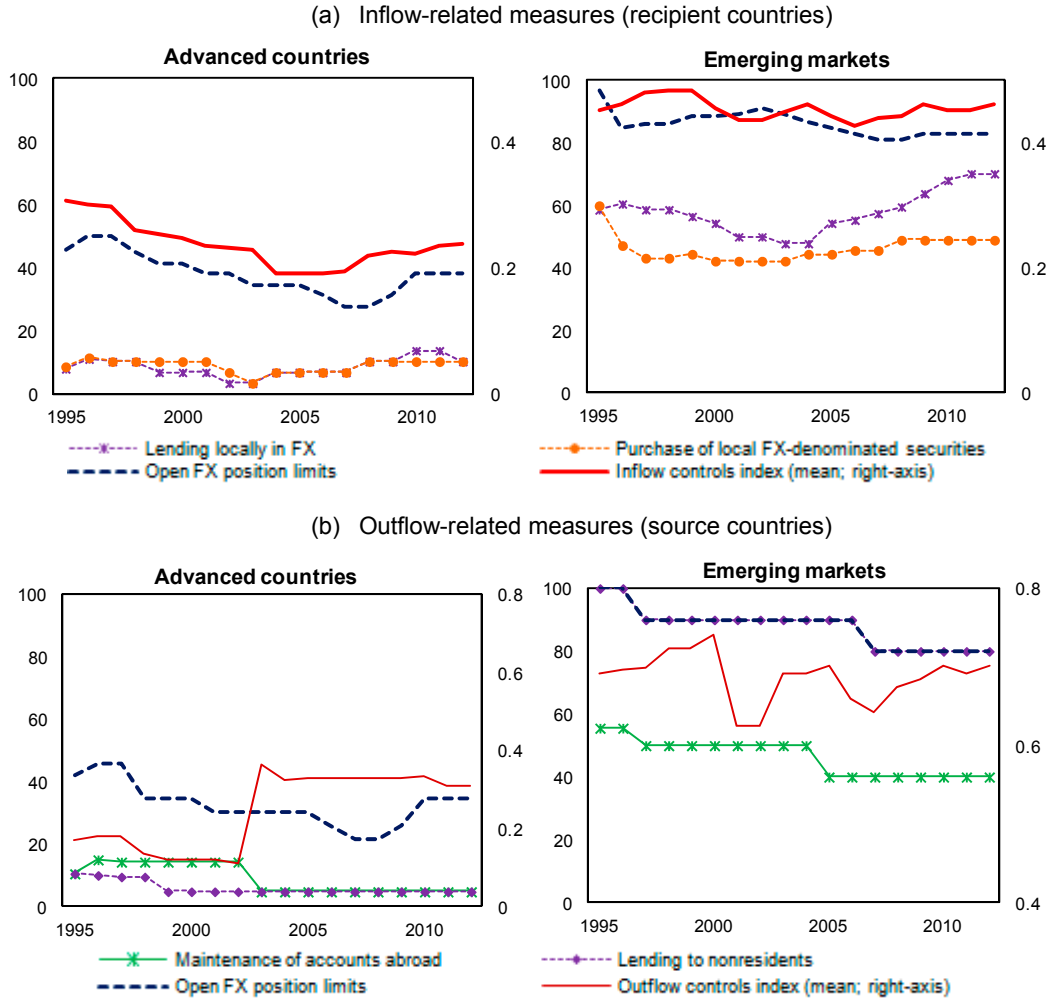
Along with the rise in banking flows has been an increasing trend of using prudential measures likely to affect capital inflows—especially in EMs. For example, Figure 3[a] shows that the proportion of EMs in the sample with some form of restriction on lending locally in FX increased from about 50 percent in 2001 to 57 percent in 2007, and further to 70 percent in 2012. Similarly, the proportion of EMs with restrictions on purchase of locally issued securities denominated in FX increased from 42 percent in 2001 to 46 percent in 2007, and to 49 percent in 2012. These statistics, however, mask important variations across regions. FX-related regulations are much more common in Asia, and the least prevalent in emerging Europe, though the trend seems to have reversed somewhat in the latter after the GFC (see Appendix). By contrast, capital controls on inflows generally declined in EMs for the most part of 2000s, but have become relatively more prevalent post-GFC.

Both FX-related prudential measures and capital inflow controls are, however, much less common in advanced countries—though there seems to have been a slight increase in the former in recent years, possibly because of the fallout from the GFC. (For example, France, Italy and Portugal adopted open FX position limits in 2009-10.) Similarly, CARs on outflows seem to be much less prevalent in advanced source countries as compared to EM source countries, but there exists considerable cross-country and time variation across different measures even among the former (Figure 3[b]). For instance, of the restrictions considered here, the United Kingdom has in place only the open FX position limits on banks, while Iceland has imposed an extensive set of outflow controls since 2008. Some other countries have mild capital controls (on outflows) in the form of registration requirements for public offerings of securities by foreign issuers, or restrictions targeting specific sectors such as insurance companies or pension funds. Overall, the existence of prudential measures and capital controls (pertaining to both inflows and outflows) tends to be positively correlated, though the correlation is less strong for advanced countries (Table 1).

Have these restrictions been successful in curtailing flows? Figure 4[a] presents a snapshot of countries with below and above median capital controls, and bilateral cross-border bank asset flows (in logarithmic terms).[17] On average, bilateral flows are significantly lower if restrictions on capital outflows and inflows are in place in source and recipient countries, respectively. The combined presence of these measures further dampens flows. Similarly, prudential restrictions on maintenance of accounts abroad and on lending to nonresidents in source countries have a significant association with bank outflows, while FX-related measures in recipient countries also seem to discourage inflows. These statistics are however unconditional averages; in what follows, we explore the link between source and recipient country CARs and bank flows more formally through regression analysis.

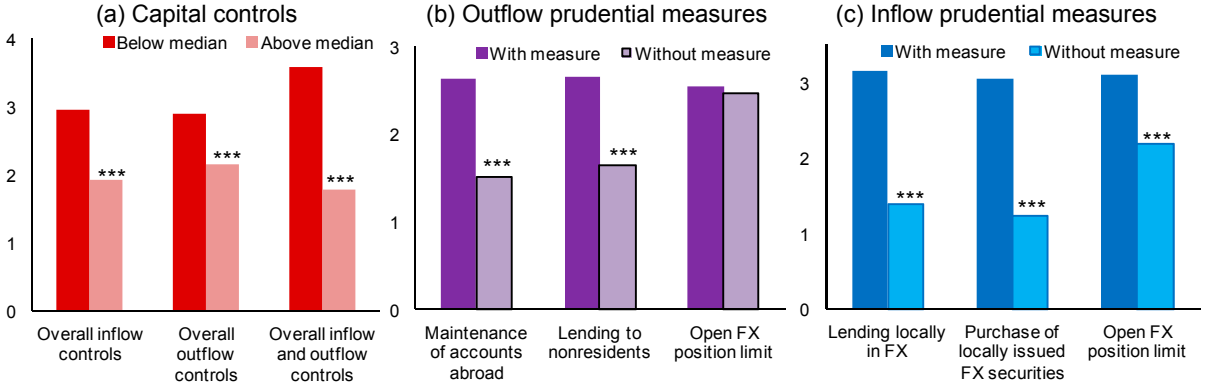
[17] Following existing literature (e.g., Papaioannou, 2009; Herrmann and Mihaljek, 2010), when taking the log, we transform the negative asset flow observations by taking the log of the absolute value and then changing the sign. This transformation preserves the original sign on the flow observations, and retains symmetry in the data. The share of zero observations here is quite small (about 9 percent), so their exclusion from the estimation does not pose any significant issues. The results presented below are, however, robust to including the zero observations by adding a small constant to all flow values and then taking the log.

Figure 3. Capital Controls and Prudential Measures, 1995–2012
(in percent of observations)



Source: Based on IMF's AREAER and the OECD Code of Liberalization of Capital Movements (various issues).
Note: Prudential measures reflect the proportion of countries in the sample with the specific measure in place. Controls indices reflect the overall outflow/inflow restrictiveness. In Figure 3[b], the jump in the outflow controls index for advanced countries in 2003 is mainly because of measures introduced by some EU countries on the purchase of securities abroad by insurance companies and pension funds.

Figure 4. Cross-Border Bank Flows, Capital Controls, and Prudential Measures, 1995–2012



Note: Bank flows measured as log of exchange rate adjusted changes in the total stock (amounts outstanding) of assets (all instruments). *** indicates statistically significant different means between the two groups at the 1 percent level.

Table 1. Correlation between Capital Controls and Prudential Measures, 1995–2012

	Restrictions on outflows							
Advanced source countries	Overall	Bond controls	Equity controls	DI controls	FC controls	Maintenance acc. abroad	Lending to nonresidents	Open FX limits
Overall	1.00							
Bond controls	0.93***	1.00						
Equity controls	0.91***	0.93***	1.00					
DI controls	0.39***	0.33***	0.35***	1.00				
Financial credit controls	0.82***	0.66***	0.60***	0.12**	1.00			
Maintenance of acc. abroad	0.17***	0.03	0.06	0.56***	0.12**	1.00		
Lending to nonresidents	0.32***	0.18***	0.20***	0.57***	0.25***	0.80***	1.00	
Open FX position limits	-0.04	-0.09*	-0.06	0.08	-0.01	0.15***	0.27***	1.00
EM source countries								
Overall	1.00							
Bond controls	0.87***	1.00						
Equity controls	0.88***	0.87***	1.00					
DI controls	0.62***	0.33***	0.38***	1.00				
Financial credit controls	0.67***	0.58***	0.56***	0.12	1.00			
Maintenance of acc. abroad	0.42***	0.37***	0.45***	0.05	0.43***	1.00		
Lending to nonresidents	0.67***	0.57***	0.55***	0.26***	0.80***	0.35***	1.00	
Open FX position limits	0.52***	0.44***	0.46***	0.26***	0.54***	0.35***	0.69***	1.00
	Restrictions on inflows							
Advanced recipient countries	Overall	Bond controls	Equity controls	DI controls	FC controls	Lending locally in FX	Purchase of FX securities	Open FX limits
Overall	1.00							
Bond controls	0.77***	1.00						
Equity controls	0.79***	0.59***	1.00					
DI controls	0.45***	0.08*	0.29***	1.00				
FC controls	0.77***	0.59***	0.43***	0.10**	1.00			
Lending locally in FX	0.27***	0.27***	0.10**	-0.13***	0.44***	1.00		
Purchase of local FX sec.	0.38***	0.38***	0.16***	-0.12***	0.61***	0.85***	1.00	
Open FX limits	0.21***	0.17***	0.08*	-0.03	0.27***	0.28***	0.29***	1.00
EM recipient countries								
Overall	1.00							
Bond controls	0.91***	1.00						
Equity controls	0.84***	0.79***	1.00					
DI controls	0.53***	0.29***	0.38***	1.00				
FC controls	0.73***	0.63***	0.45***	0.17***	1.00			
Lending locally in FX	0.53***	0.52***	0.52***	0.20***	0.44***	1.00		
Purchase of local FX sec.	0.53***	0.52***	0.51***	0.15***	0.40***	0.57***	1.00	
Open FX limits	0.31***	0.30***	0.29***	0.27***	0.15***	0.29***	0.26***	1.00

Note: ***, **, and * indicate statistical significance of the correlation coefficients at the 1, 5, and 10 percent levels, respectively; DI=Direct investment; FC=Financial credit.

III. DO CAPITAL ACCOUNT RESTRICTIONS MATTER?

We begin by examining the association between bank asset flows and CARs on capital outflows in source countries, and on capital inflows in recipient countries, individually. To do so, we draw on existing literature and estimate the following gravity-type models:

$$F_{ijt} = X'_{it}\alpha + X'_{jt}\beta + \gamma S_{it} + \mu_{ij} + \lambda_t + \varepsilon_{ijt} \quad (1)$$

$$F_{ijt} = X'_{it}\alpha + X'_{jt}\beta + \omega R_{jt} + \mu_{ij} + \lambda_t + \eta_{ijt} \quad (2)$$

where F_{ijt} is (the log of) gross bank asset flows from source country i to recipient country j in year t; X_i and X_j include control variables for source and recipient countries, respectively; S_i and R_j are source and recipient country's outflow and inflow related CARs, respectively, that are likely to affect bilateral bank flows between them; μ_{ij} are the source-recipient country

specific effects to capture time-invariant factors that may affect bilateral flows, but could also be correlated with the regressors (such as geographical distance, political and cultural ties, etc.); λ_t are time effects to capture common shocks across country pairs; and ε_{ijt} and η_{ijt} are random error terms. We estimate (1) and (2)—which constitute our benchmark models—by including the relevant CARs individually to avoid potential multicollinearity issues.

Following existing literature on cross-border bank flows (e.g., Papaioannou, 2009; Blank and Buch, 2010; Herrmann and Mihaljek, 2010; Bruno and Shin, 2013), our control variables include several proxies for source country "push" and recipient country "pull" factors. These include (log) real GDP and real GDP per capita (to proxy for the economic size and level of economic development, respectively), real interest rate (to reflect return on investment), and real GDP growth rates of both source and recipient countries. In addition, we include the current account balance, expressed in percent of GDP (to reflect the external financing need), and the exchange rate regime (equal to one if the country has a pegged regime, and zero otherwise) of the recipient country.[18]

While the aggregate nature of our control and CAR variables (which tend to respond to the total, rather than the bilateral, volume of flows) helps to identify their effect on cross-border flows, we nevertheless lag (by one period) all source and recipient country-specific variables when estimating (1) and (2) to mitigate potential reverse causality concerns (endogeneity of CARs is also addressed through the instrumental variable approach below).[19] Further, considering the long time span of our data and the possible correlation in the error term, we cluster standard errors at the country-pair level.

For comparative purposes, we first estimate (1) and (2) by the Ordinary Least Squares (OLS) without controlling for country-pair or year effects, but include several time-invariant country-pair specific variables, as well as global factors (such as global market uncertainty—proxied by the VIX index—and commodity prices) that could potentially affect cross-border capital flows. We then estimate the benchmark model as specified above with country-pair and year effects (CPFE/TE).[20]

A. Source Country Restrictions

The OLS results for (1), presented in Table 2 (col. [1]), show that the estimated coefficients for most control variables are of the expected sign and are statistically significant.[21] Among

[18] In the robustness analysis, we also include in the model several bilateral time-varying variables that could plausibly affect bilateral capital flows (e.g., the total trade between the pair of countries).

[19] Formal panel data tests of serial correlation (e.g., Wooldridge, 2010) do not indicate the presence of serial correlation in the errors, lending support to the use of lagged variables in (1) and (2).

[20] In the CPFE estimations, inference about the association between cross-border flows and CARs is derived from the time series variation in the latter, since all cross-country variation is absorbed by the CPFE.

[21] The (within) R-squared statistic is consistent with those obtained in other studies examining the determinants of cross-border bank flows (e.g., Papaioannou, 2009; Herrmann and Mihaljek, 2010; Ghosh et al., 2012). Studies generally obtain a higher R-squared when estimating the bilateral cross-border stock (rather than flow) of bank assets as a function of similar explanatory variables (e.g., Buch, 2003; Blank and Buch, 2007, 2010). This is also true when we estimate the model using the stock of bank assets (amount outstanding) as the dependent variable in the robustness analysis below (the obtained R-squared is then about 0.7).

the specific variables, global market uncertainty has a significantly negative effect on bank flows—with a 1 percent increase in the VIX index decreasing flows by about 8 percent. Geographical distance between the country pair also reduces flows, likely capturing the impact of informational asymmetries between countries (Ghosh and Wolf, 2000; Buch, 2003; Portes and Rey, 2005). An increase in source and recipient country sizes (proxied by real GDP and land area) and their real growth rates leads to significantly larger flows between them. Recipient countries with higher real per capita GDP attract significantly larger flows (suggesting that institutional quality matters; Dell'Ariccia et al., 2008; Papaioannou, 2009; Binici et al., 2010), while source countries with higher real GDP per capita appear to remit relatively smaller flows. Higher real interest rate and larger external financing need of the recipient country also imply larger inflows: a 100 basis points rise in the real interest rate and a 1 percentage point increase in the external financing need, for instance, are associated with about 10 and 6 percent larger inflows, respectively; while the estimated coefficient of source country real interest rate is statistically insignificant. The estimated coefficient of recipient country exchange rate regime is positive (implying larger flows to countries with less flexible regimes), but statistically insignificant.

The estimated coefficient on the variable of interest—the overall restrictiveness on capital outflows in the source country—is negative and statistically significant (at the 1 percent level) in the OLS regression, implying that moving from the 25th to the 75th percentile of the index is associated with about 70 percent lower outflows. The result remains similar if we estimate the benchmark model with country-pair and year effects (CPFE/TE)—the estimated coefficient for the overall restrictiveness on capital outflows in the source country now implies about 77 percent lower outflows if we move from the bottom to the top quartile of the index (col. [2]). With the inclusion of CPFE/TE, however, the time invariant (country-pair specific) variables drop from the model, and some variables (e.g., source country's real GDP and real GDP per capita, and recipient country's external financing need and real GDP per capita) lose statistical significance. By contrast, the estimated coefficients of source country real interest rate and recipient country exchange rate regime turn statistically significant, implying that a 100 basis points increase in the former reduces bank outflows by about 20 percent, while the existence of a pegged exchange rate in the recipient country implies a six-fold increase in flows relative to a floating regime.

Going beyond the overall capital outflow controls index, the results for more disaggregated measures show that controls on bond, equity, direct investment and financial credit outflows are associated with significantly lower bank outflows (cols. [3]-[6]). Moving from the bottom to the top quartile of these indices reduces flows by some 50-100 percent. These results are in line with Binici et al. (2010), who use aggregate (instead of bilateral) data on capital flows, and find that controls on debt and equity outflows reduce these flows by 57-63 percent. That different types of outflow controls are associated with lower outflows suggests that these measures are able to target the different components of cross-border bank asset flows (loans,

debt, equity and direct investment that are captured in the data).[22] Among the prudential measures considered here, the estimated effect of restrictions on lending to nonresidents—which could equally be classified as a financial sector capital control—is negative and statistically significant, while those of maintenance of accounts abroad and open FX position limits are statistically insignificant (cols. [7]-[9]).

B. Recipient Country Restrictions

What about the impact of CARs on inflows imposed by recipient countries and the volume of bank flows received? The estimation results for (2) suggest a varying impact of different measures on inflows (Table 3). The estimated coefficient for the overall capital inflow controls index is significantly negative (at the 5 percent level) in the CPFE/TE estimation, implying that moving from the lower to the top quartile of the index would be associated with a reduction in bank asset flows by about 50 percent (col. [2]). Bond inflow controls also have a statistically significant association with bank inflows—moving from the 25th to 75th percentile on the bond inflow controls index lowers bank inflows by about 64 percent (col. [3]). The estimated coefficients for equity and direct investment inflow control indices are, however, wholly statistically insignificant, but that of financial credit inflow controls is marginally insignificant (with a p-value of 0.11; cols. [3]-[5]). This suggests a somewhat asymmetric effect of such controls—their adoption by the source country tends to significantly reduce banking outflows (as noted above), while their imposition by the recipient country does not appear to have a statistically strong impact on inflows, perhaps partly reflecting differences in institutional/administrative capacity across the source and recipient countries mostly imposing controls.[23]

Importantly, FX-related prudential measures are strongly related with lower cross-border bank flows: inflows are about 70-80 percent lower in the presence of restrictions on lending locally in FX, and open FX position limits in the recipient countries. Inasmuch as domestic lending in foreign currency largely relies on foreign (especially, bank) financing—as in emerging Europe before the GFC—these findings are intuitive, and support those of earlier studies that report a significant effect of such restrictions on local FX-denominated lending by banks, as well as on the composition of external liabilities (e.g., Ostry et al., 2012b).

[22] While loans (targeted directly by financial credit controls) tend to be the dominant component of cross-border bank flows, restrictions on direct investment flows, by limiting the establishment of branches/subsidiaries abroad, could also affect loans by limiting intrabank transactions.

[23] Binici et al. (2010) find a similar result that outflow controls on direct investment/equity (and in their case also debt) flows have a statistically much stronger impact than inflow controls. Using aggregate measures of capital account openness, Hermann and Mihaljek (2010) and Ghosh et al. (2012) find that lower openness in EMs significantly reduces bank inflows.

Table 2. Cross-Border Bank Flows and Source Country CARs, 1995–2012

	Capital controls						Prudential measures		
	OLS	CPFE/TE	CPFE/TE	CPFE/TE	CPFE/TE	CPFE/TE	CPFE/TE	CPFE/TE	CPFE/TE
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Log (Real GDP$_i$)	0.840***	7.790	8.962	7.489	8.978	7.797	13.269	9.216	9.323
	(0.114)	(8.507)	(8.512)	(8.533)	(8.480)	(8.506)	(8.506)	(8.500)	(8.575)
Log (Real GDP$_j$)	0.472***	15.334***	15.341***	15.338***	15.647***	15.344***	15.400***	15.422***	15.472***
	(0.103)	(4.277)	(4.285)	(4.280)	(4.267)	(4.276)	(4.259)	(4.272)	(4.281)
Log (Real GDP per capita$_i$)	-0.310*	-10.073	-11.523	-9.844	-11.494	-10.368	-16.054	-11.721	-12.338
	(0.180)	(10.288)	(10.291)	(10.316)	(10.277)	(10.277)	(10.279)	(10.304)	(10.330)
Log (Real GDP per capita$_j$)	0.782***	4.121	4.029	4.062	3.886	4.115	3.986	3.939	3.893
	(0.128)	(4.220)	(4.230)	(4.226)	(4.199)	(4.221)	(4.199)	(4.213)	(4.228)
Real GDP growth$_i$	0.162***	0.398***	0.382***	0.389***	0.390***	0.401***	0.354***	0.371***	0.382***
	(0.059)	(0.098)	(0.098)	(0.098)	(0.098)	(0.098)	(0.098)	(0.098)	(0.098)
Real GDP growth$_j$	0.559***	0.459***	0.460***	0.459***	0.459***	0.458***	0.459***	0.459***	0.460***
	(0.040)	(0.053)	(0.053)	(0.053)	(0.053)	(0.053)	(0.053)	(0.053)	(0.053)
Real interest rate$_i$	0.045	-0.192**	-0.206**	-0.184*	-0.180*	-0.206**	-0.248**	-0.204**	-0.200**
	(0.050)	(0.097)	(0.097)	(0.097)	(0.097)	(0.097)	(0.097)	(0.097)	(0.097)
Real interest rate$_j$	0.103***	0.095**	0.096**	0.095**	0.095**	0.095**	0.096**	0.095**	0.096**
	(0.030)	(0.042)	(0.042)	(0.042)	(0.042)	(0.042)	(0.041)	(0.042)	(0.042)
Exchange rate regime$_j$	0.074	1.829***	1.830***	1.827***	1.868***	1.823***	1.848***	1.837***	1.836***
	(0.301)	(0.521)	(0.521)	(0.520)	(0.520)	(0.521)	(0.518)	(0.520)	(0.521)
Current account bal./GDP$_i$	-0.060***	0.041	0.041	0.041	0.044	0.041	0.041	0.042	0.041
	(0.022)	(0.041)	(0.041)	(0.041)	(0.041)	(0.041)	(0.041)	(0.041)	(0.041)
Capital outflow controls$_i$	-2.442***	-2.978***							
	(0.518)	(1.020)							
Bond outflow controls$_i$			-1.446*						
			(0.837)						
Equity outflow controls$_i$				-2.316***					
				(0.863)					
Direct investment outflow controls$_i$					-4.019***				
					(0.992)				
Financial credit outflow controls$_i$						-1.438***			
						(0.527)			
Lending to nonresidents$_i$							-5.505***		
							(1.167)		
Maintenance of accounts abroad$_i$								-1.459	
								(1.144)	
Open FX position limits$_i$									0.419
									(0.626)
Log (Distance$_{ij}$)	-1.374***								
	(0.183)								
Log (Area$_i$ x Area$_j$)	0.251***								
	(0.069)								
Common language$_{ij}$	0.051								
	(0.352)								
Common border$_{ij}$	1.470*								
	(0.795)								
Off-shore countries$_{ij}$	1.742***								
	(0.326)								
Free trade agreement$_{ij}$	0.509								
	(0.347)								
Log (VIX)	-7.933***								
	(0.437)								
Commodity price index	1.027								
	(0.977)								
Country-pair fixed/Year effects	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	22,257	22,257	22,257	22,257	22,257	22,257	22,257	22,257	22,257
R2	0.04	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
No. of source (recipient) countries	31 (76)	31 (76)	31 (76)	31 (76)	31 (76)	31 (76)	31 (76)	31 (76)	31 (76)
Country-pairs	1,943	1,943	1,943	1,943	1,943	1,943	1,943	1,943	1,943

Note: Dependent variable is (log of) bank asset flows from country i to j. All variables except for VIX and commodity price index are lagged one period. Constant is included in all specifications. R2 reported for CPFE estimations is the within-R2. Clustered standard errors (by country-pair) are reported in parentheses. ***, ** and * indicate statistical significance at the 1, 5, and 10 percent levels, respectively.

Table 3. Cross-Border Bank Flows and Recipient Country CARs, 1995–2012

	Capital controls						Prudential measures		
	OLS	CPFE/TE	CPFE/TE	CPFE/TE	CPFE/TE	CPFE/TE	CPFE/TE	CPFE/TE	CPFE/TE
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Log (Real GDP$_i$)	0.797***	10.061	10.104	10.083	10.101	10.034	10.066	10.105	10.091
	(0.114)	(8.474)	(8.455)	(8.475)	(8.467)	(8.472)	(8.467)	(8.481)	(8.482)
Log (Real GDP$_i$)	0.445***	16.807***	16.650***	15.463***	15.171***	16.156***	15.620***	15.982***	16.181***
	(0.105)	(4.338)	(4.280)	(4.291)	(4.284)	(4.302)	(4.264)	(4.372)	(4.316)
Log (Real GDP per capita$_i$)	0.169	-13.228	-13.316	-13.265	-13.301	-13.203	-13.326	-13.306	-13.278
	(0.142)	(10.235)	(10.217)	(10.239)	(10.231)	(10.235)	(10.225)	(10.244)	(10.244)
Log (Real GDP per capita$_j$)	0.809***	2.316	2.765	3.901	4.224	2.841	3.715	3.299	2.959
	(0.138)	(4.290)	(4.223)	(4.234)	(4.238)	(4.251)	(4.206)	(4.334)	(4.268)
Real GDP growth$_i$	0.195***	0.382***	0.382***	0.382***	0.382***	0.382***	0.382***	0.382***	0.382***
	(0.058)	(0.098)	(0.098)	(0.098)	(0.098)	(0.098)	(0.098)	(0.098)	(0.098)
Real GDP growth$_i$	0.561***	0.465***	0.458***	0.460***	0.460***	0.465***	0.465***	0.458***	0.461***
	(0.041)	(0.053)	(0.053)	(0.053)	(0.053)	(0.053)	(0.053)	(0.053)	(0.053)
Real interest rate$_i$	0.021	-0.202**	-0.201**	-0.202**	-0.201**	-0.202**	-0.200**	-0.202**	-0.202**
	(0.050)	(0.097)	(0.097)	(0.097)	(0.097)	(0.097)	(0.097)	(0.097)	(0.097)
Real interest rate$_j$	0.116***	0.089**	0.092**	0.096**	0.098**	0.087**	0.086**	0.093**	0.092**
	(0.030)	(0.042)	(0.042)	(0.042)	(0.042)	(0.042)	(0.042)	(0.042)	(0.042)
Exchange rate regime$_i$	0.106	1.955***	1.936***	1.836***	1.841***	1.909***	1.866***	1.869***	1.805***
	(0.300)	(0.520)	(0.518)	(0.521)	(0.521)	(0.521)	(0.518)	(0.519)	(0.522)
Current account bal./GDP$_i$	-0.054**	0.043	0.034	0.042	0.042	0.046	0.050	0.044	0.036
	(0.022)	(0.041)	(0.041)	(0.041)	(0.041)	(0.041)	(0.041)	(0.041)	(0.041)
Capital inflow controls$_j$	0.083	-1.998**							
	(0.466)	(0.989)							
Bond inflow controls$_i$			-2.023***						
			(0.658)						
Equity inflow controls$_j$				-0.092					
				(0.749)					
Direct investment inflow controls$_i$					0.674				
					(0.784)				
Financial credit inflow controls$_i$						-0.863			
						(0.534)			
Lending locally in FX$_j$							-1.792***		
							(0.666)		
Purchase of locally issued FX securities$_i$								-0.494	
								(0.757)	
Open FX position limits$_i$									-1.110*
									(0.653)
Log (Distance$_{ij}$)	-1.427***								
	(0.183)								
Log (Area$_i$ x Area$_j$)	0.271***								
	(0.069)								
Common language$_{ij}$	0.246								
	(0.351)								
Common border$_{ij}$	1.301								
	(0.804)								
Off-shore countries$_{ij}$	1.676***								
	(0.325)								
Free trade agreement$_{ij}$	0.449								
	(0.347)								
Log (VIX)	-7.716***								
	(0.433)								
Commodity price index	-0.106								
	(0.951)								
Country-pair fixed/Year effects	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	22,257	22,257	22,257	22,257	22,257	22,257	22,257	22,257	22,257
R2	0.04	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
No. of source (recipient) countries	31 (76)	31 (76)	31 (76)	31 (76)	31 (76)	31 (76)	31 (76)	31 (76)	31 (76)
Country-pairs	1,943	1,943	1,943	1,943	1,943	1,943	1,943	1,943	1,943

Note: Dependent variable is (log of) bank asset flows from country i to country j. All variables are lagged one period. Constant is included in all specifications. R2 reported in the CPFE estimations is the within-R2. Clustered standard errors (at the country-pair level) are reported in parentheses. ***, ** and * indicate statistical significance at the 1, 5, and 10 percent levels, respectively.

IV. RESTRICTIONS AT BOTH ENDS

The analysis above establishes a strong and significant association between outflow and inflow restrictions and flows from source to recipient countries. To determine the extent to which these restrictions can *jointly* influence cross-border flows, we modify the benchmark specification to simultaneously include both outflow and inflow related CARs, as follows:

$$F_{ijt} = X'_{it}\alpha + X'_{jt}\beta + \xi S_{it} + \psi R_{jt} + \mu_{ij} + \lambda_t + \nu_{ijt} \quad (3)$$

where the definition of all variables remains the same as above.

Doing so, the estimated coefficients of outflow and inflow restrictions remain very similar—both in terms of magnitude and statistical significance—to those reported above (Table 4). Thus, for instance, overall, bond, equity, direct investment and financial credit controls, and restrictions on lending to nonresidents on the source side are statistically significant and imply a reduction in outflows of about 50-100 percent across different specifications. On the recipient side, inflow controls (overall and bond) are again associated with significantly lower cross-border flows by about 50-60 percent (cols. [2]-[3]). Among measures specific to the financial sector, the impact of restrictions on lending to nonresidents in source countries, and on local FX lending in recipient countries, is statistically significant even when considered jointly with CARs from the other side (cols. [6]-[9]).

While the joint significance of inflow and outflow measures suggests that it is possible to work at either—or both—ends of the flows, it is important to recognize that the estimated effects are not fully additive. By construction, the log specification implies that the combined impact of simultaneous inflow and outflow restrictions will be less than the sum of the individual implied effects. For example, in Table 4 (col. [1]), moving from the 25th to the 75th percentile on the source country overall outflow controls index (while holding the recipient country inflow index constant) is associated with a reduction in flows by about 80 percent, while a similar increase for the recipient country bond inflow controls index (while holding the source country outflow index constant) is associated with a reduction in flows by about 50 percent; the estimated impact of both measures together, however, is 90 percent (rather than 120 percent). That the joint impact of the measures may not be fully additive is plausible since in practice there may be some overlap in the flows that the source and recipient country restrictions attempt to target.

To explore this issue further, Table 5 re-estimates the impact of source and recipient country measures by segmenting the data according to whether the other end is relatively more or less open (overall controls index is below or above the 75th percentile). The top panel of Table 5 shows that outflow related measures generally have a quantitatively larger and statistically significant impact when the recipient country is more open to inflows (cols. [1]-[8]) than when it is already mostly closed (cols. [9]-[16]). Likewise, the bottom panel of Table 5 shows that inflow-related CARs have a quantitatively larger and statistically significant impact when the source country is more open to outflows, than when it is mostly closed. The incremental impact of inflow or outflow restrictions is thus weaker (and statistically insignificant) once the other side is already relatively closed, which makes intuitive sense.

Table 4. Cross-Border Bank Flows, Source and Recipient Country CARs, 1995–2012

	CPFE/TE	CPFE/TE	CPFE/TE	CPFE/TE	CPFE/TE	CPFE/TE	CPFE/TE	CPFE/TE	CPFE/TE
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Log (Real GDP$_i$)	7.753	8.965	7.490	8.998	7.742	7.769	13.244	7.765	7.794
	(8.507)	(8.491)	(8.534)	(8.473)	(8.505)	(8.502)	(8.498)	(8.503)	(8.515)
Log (Real GDP$_j$)	16.712***	16.547***	15.356***	15.368***	16.059***	15.516***	15.570***	15.506***	16.071***
	(4.331)	(4.282)	(4.288)	(4.267)	(4.293)	(4.257)	(4.240)	(4.258)	(4.310)
Log (Real GDP per capita$_i$)	-10.015	-11.544	-9.844	-11.532	-10.296	-10.414	-16.107	-10.123	-10.081
	(10.285)	(10.269)	(10.316)	(10.270)	(10.275)	(10.268)	(10.265)	(10.279)	(10.293)
Log (Real GDP per capita$_j$)	2.507	2.880	4.053	4.203	3.037	3.922	3.794	3.927	3.166
	(4.280)	(4.223)	(4.230)	(4.207)	(4.242)	(4.198)	(4.176)	(4.197)	(4.259)
Real GDP growth$_i$	0.399***	0.382***	0.390***	0.390***	0.401***	0.401***	0.354***	0.398***	0.398***
	(0.098)	(0.098)	(0.098)	(0.098)	(0.098)	(0.098)	(0.098)	(0.098)	(0.098)
Real GDP growth$_j$	0.464***	0.458***	0.459***	0.459***	0.463***	0.464***	0.464***	0.464***	0.460***
	(0.053)	(0.053)	(0.053)	(0.053)	(0.053)	(0.053)	(0.053)	(0.053)	(0.053)
Real interest rate$_i$	-0.192**	-0.206**	-0.184*	-0.180*	-0.206**	-0.204**	-0.246**	-0.190**	-0.192**
	(0.097)	(0.097)	(0.520)	(0.520)	(0.521)	(0.518)	(0.515)	(0.517)	(0.522)
Real interest rate$_j$	0.089**	0.092**	0.095**	0.097**	0.087**	0.086**	0.086**	0.086**	0.091**
	(0.042)	(0.042)	(0.041)	(0.041)	(0.041)	(0.041)	(0.041)	(0.041)	(0.041)
Exchange rate regime$_j$	1.951***	1.931***	1.828***	1.873***	1.897***	1.854***	1.878***	1.860***	1.799***
	(0.519)	(0.518)	(0.520)	(0.520)	(0.521)	(0.518)	(0.515)	(0.517)	(0.522)
Current account bal./GDP$_j$	0.042	0.033	0.041	0.044	0.046	0.050	0.050	0.050	0.036
	(0.041)	(0.041)	(0.041)	(0.041)	(0.041)	(0.041)	(0.041)	(0.041)	(0.041)
Capital outflow controls index$_i$	-2.999***							-2.990***	-2.985***
	(1.016)							(1.018)	(1.021)
Capital inflow controls index$_j$	-2.027**								
	(0.989)								
Bond outflow controls index$_i$		-1.472*							
		(0.832)							
Bond inflow controls index$_j$		-2.035***							
		(0.659)							
Equity outflow controls index$_i$			-2.317***						
			(0.863)						
Equity inflow controls index$_j$			-0.109						
			(0.748)						
Direct investment outflow controls index$_i$				-4.020***					
				(0.992)					
Direct investment inflow controls index$_j$				0.678					
				(0.785)					
Financial credit outflow controls index$_i$					-1.443***	-1.446***			
					(0.526)	(0.526)			
Financial credit inflow controls index$_j$					-0.872				
					(0.534)				
Lending to nonresidents$_i$							-5.489***		
							(1.168)		
Lending locally in FX$_j$						-1.801***	-1.780***	-1.799***	
						(0.666)	(0.662)	(0.667)	
Open FX position limits$_j$									-1.116*
									(0.652)
Country-pair fixed/Year effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	22,257	22,257	22,257	22,257	22,257	22,257	22,257	22,257	22,257
R-squared	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
No. of source (recipient) countries	31 (76)	31 (76)	31 (76)	31 (76)	31 (76)	31 (76)	31 (76)	31 (76)	31 (76)
No. of country-pairs	1,943	1,943	1,943	1,943	1,943	1,943	1,943	1,943	1,943

Note: Dependent variable is (log of) bank asset flows from country i to country j. All variablesare lagged one period. Constant is included in all specifications. R2 reported in the CPFE estimations is the within R2. Clustered standard errors (at the country-pair level) are reported in parentheses. ***, ** and * indicate statistical significance at the 1, 5, and 10 percent levels, respectively.

Table 5. Cross-Border Bank Flows and CARs by Openness, 1995–2012

	More open recipient countries								Less open recipient countries							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
Outflow controls$_i$	-2.966**								-2.297							
	(1.182)								(2.469)							
Bond outflow controls$_i$		-0.705								-2.694						
		(0.963)								(2.064)						
Equity outflow controls$_i$			-1.814*								-2.529					
			(0.997)								(2.159)					
Direct investment outflow controls$_i$				-4.717**								-1.513				
				(1.103)								(2.301)				
Financial credit outflow controls$_i$					-1.586**								-0.853			
					(0.611)								(1.258)			
Lending to nonresidents$_i$						-4.664***								-4.167*		
						(1.359)								(2.357)		
Maintenance of acc. abroad$_i$							-1.156								-0.977	
							(1.258)								(2.831)	
Open FX position limits$_i$								0.653								-1.478
								(0.737)								(1.305)
CPFE/TE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	16,934	16,934	16,934	16,934	16,934	16,934	16,934	16,934	5,323	5,323	5,323	5,323	5,323	5,323	5,323	5,323
R2	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06
	More open source countries								**Less open source countries**							
Inflow controls$_j$	-2.478**								2.863							
	(1.027)								(4.348)							
Bond inflow controls$_j$		-2.383**								2.162						
		(0.675)								(3.519)						
Equity inflow controls$_j$			-0.219								-1.942					
			(0.796)								(2.831)					
Direct investment inflow controls$_i$				0.712								2.605				
				(0.842)								(2.649)				
Financial credit inflow controls$_i$					-1.029*								0.089			
					(0.562)								(1.926)			
Lending locally in FX$_j$						-2.154***								0.709		
						(0.707)								(2.051)		
Purchase of local FX sec.$_j$							-0.777								3.897	
							(0.775)								(3.179)	
Open FX position limits$_j$								-1.065								-2.208
								(0.716)								(1.843)
CPFE/TE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	19,374	19,374	19,374	19,374	19,374	19,374	19,374	19,374	2,883	2,883	2,883	2,883	2,883	2,883	2,883	2,883
R2	0.06	0.06	0.05	0.05	0.06	0.06	0.05	0.06	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05

Note: Dependent variable is (log) bank asset flows from country i to j. More (less) open recipient countries are those with below (above) 75th percentile overall inflow controls index. More (less) open source countries are those with below (above) 75th percentile overall outflow controls index. All specifications include control variables as in Tables 2-4, country-pair and year effects, and constant. Clustered standard errors (by country-pair) are reported in parentheses. ***, ** and * indicate significance at the 1, 5, and 10 percent levels, respectively.

Importantly, however, the results do not imply that inflow and outflow restrictions are mutually redundant (so that they should not operate on both ends). Rather, the results remain similar if we exclude the fully open recipient countries (i.e., those with no inflow restrictions) when estimating the effect of outflow measures, and exclude fully open source countries (i.e., those with no outflow restrictions) when estimating the effect of inflow measures (Table 6). While the number of observations declines in this exercise, the estimated impact and statistical significance of the different measures are barely affected. The effectiveness of inflow or outflow restrictions is thus not dependant on the other side of the transaction being *fully* open—only on the other side not being fully closed.[24]

[24] We draw similar implications if instead of splitting the sample by openness, we include an interaction term between the measures and a dummy variable indicating if the other side is more open/closed.

Table 6. Cross-Border Bank Flows and CARs by Openness—Excluding Fully Open, 1995–2012

	More open recipient countries								Less open recipient countries							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
Outflow controls$_i$	-3.210**								-2.297							
	(1.321)								(2.469)							
Bond outflow controls$_i$		-0.738								-2.694						
		(1.071)								(2.064)						
Equity outflow controls$_i$			-1.920*								-2.529					
			(1.115)								(2.159)					
Direct investment outflow controls$_i$				-5.117***								-1.513				
				(1.200)								(2.301)				
Financial credit outflow controls$_i$					-1.816***								-0.853			
					(0.681)								(1.258)			
Lending to nonresidents$_i$						-5.270***								-4.167*		
						(1.580)								(2.357)		
Maintenance of acc. abroad$_i$							-1.554								-0.977	
							(1.358)								(2.831)	
Open FX position limits$_i$								1.246								-1.478
								(0.832)								(1.305)
CPFE/TE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	13,869	13,869	13,869	13,869	13,869	13,869	13,869	13,869	5,323	5,323	5,323	5,323	5,323	5,323	5,323	5,323
R2	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06
	More open source countries								**Less open source countries**							
Inflow controls$_j$	-3.303**								2.863							
	(1.570)								(4.348)							
Bond inflow controls$_j$		-3.435***								2.162						
		(1.055)								(3.519)						
Equity inflow controls$_j$			-0.052								-1.942					
			(1.219)								(2.831)					
Direct investment inflow controls$_i$				-0.229								2.605				
				(1.210)								(2.649)				
Financial credit inflow controls$_i$					-0.791								0.089			
					(0.773)								(1.926)			
Lending locally in FX$_j$						-2.720*								0.709		
						(0.955)								(2.051)		
Purchase of local FX sec.$_j$							-1.971*								3.897	
							(1.195)								(3.179)	
Open FX position limits$_j$								-3.078***								-2.208
								(0.942)								(1.843)
CPFE/TE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	10,884	10,884	10,884	10,884	10,884	10,884	10,884	10,884	2,883	2,883	2,883	2,883	2,883	2,883	2,883	2,883
R2	0.06	0.07	0.06	0.06	0.06	0.07	0.06	0.07	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05

Note: Dependent variable is (log) bank asset flows from country i to j. More (less) open recipient countries are those with below (above) 75th percentile overall inflow controls index. More (less) open source countries are those with below (above) 75th percentile overall outflow controls index. From both more open recipient and source countries, those with full openness (i.e., no inflow and outflow controls, respectively) are excluded. All specifications include control variables as in Tables 2-4, country-pair and year effects, and constant. Clustered standard errors (by country-pair) are reported in parentheses. ***, ** and * indicate significance at the 1, 5, and 10 percent levels, respectively.

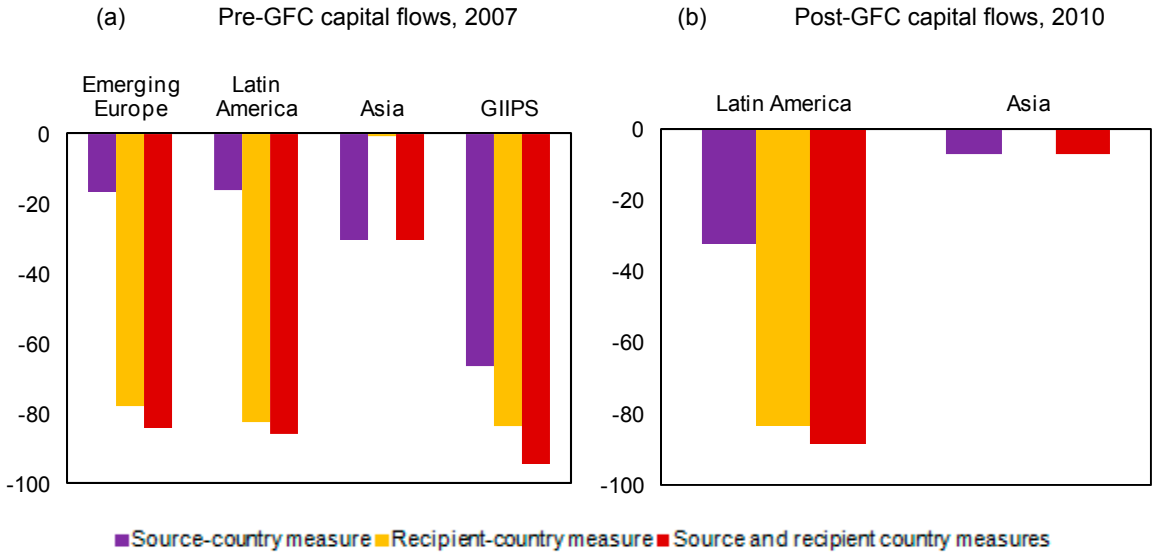
A. Counterfactual analysis

To illustrate more clearly the implications of the results obtained above, we simulate some counterfactual scenarios of the level of pre-GFC flows to various regions under greater use of CARs in both source and recipient countries. We do so by using the estimates reported in Table 4 (col. [6]) of financial credit outflow controls in source countries, and of restrictions on lending locally in FX in recipient countries, and considering three different scenarios. Specifically, we assess the *change* in (predicted) flows if (i) all source countries had financial credit outflow controls in place, while holding everything else, including recipient country inflow restrictions, at the actual 2007 level; (ii) all recipient countries had restrictions on lending locally in FX in place, while holding everything else, including source country outflow restrictions, at the actual 2007 level; and (iii) all source and recipient countries had imposed financial credit outflow controls and FX lending restrictions, respectively, holding other variables at the 2007 level.

The simulations suggest that flows to emerging Europe in 2007 would have been about 20 percent lower if its source countries (largely other European countries) had financial credit outflow controls in place; about 80 percent lower if all recipient countries had imposed restrictions on lending locally in FX; and about 85 percent lower if all source and recipient countries had imposed the financial credit control and FX lending restrictions, respectively (Figure 5[a]). Similar estimates are obtained for the Eurozone peripheral countries (Greece, Ireland, Italy, Portugal and Spain), where it is estimated that flows might have been almost 95 percent lower if all source and recipient countries had imposed financial credit outflow controls and FX lending restrictions in 2007, respectively.

The effect of all source countries imposing the financial credit outflow control (compared to the actual level of restrictions in 2007) comes out to be smaller for Latin America, as a few relevant source countries already had some financial credit outflow restriction in place. (Of course, more intensive restrictions in source countries would imply a larger effect, but that cannot be captured here because of the binary nature of our CARs.) The impact of imposing FX lending restrictions in the recipient country is however substantial for the region, and lowers inflows by some 80 percent. By contrast, for Asia, the effect of action by all recipient countries comes out to be smaller since most of these countries already had some type of restriction on local FX lending in 2007—but that by source countries comes out to be relatively larger (reducing flows by over 30 percent). Looking at the effectiveness of measures in controlling the post-GFC surge in flows to Asian and Latin American EMs, a similar picture emerges whereby we find that action by all source and recipient countries would have lowered flows by about 10 and 90 percent, respectively (Figure 5[b]).

Figure 5. Potential Impact of CARs on Cross-Border Bank Flows
(in percent)



Note: Figure obtained using estimates reported in Table 4 (col. [6]) and summing predicted values for all countries in the identified region. Left and right hand panels show the change in predicted flows (in percent) if all source countries imposed a financial credit outflow control; if all recipient countries imposed restriction on FX lending; and if all source and recipient countries imposed these measures together in 2007 and 2010, respectively.

B. Sensitivity Analysis

To examine the robustness of the results obtained above, we conduct a battery of sensitivity checks. These include estimating alternate specifications with additional control variables and different samples, using alternate formulations of the dependent and CAR variables, and addressing potential endogeneity concerns through the instrumental variables approach.

Alternate specifications

Table 7 shows that the benchmark results are reassuringly robust to the inclusion of other variables in the model that could potentially affect the volume of cross-border bank flows. For example, controlling for source and recipient country institutional quality; financial development (proxied alternately by stock market capitalization, private credit, and deposit money bank assets to GDP ratios); financial soundness (proxied by bank return on assets and on equity); bank concentration and stability (proxied by the fraction of assets held by the three largest commercial banks in the country and bank z-score, respectively); and contagion effects through a common lender (i.e., exposure of source country to other countries experiencing a financial crisis; Van Rijckeghem and Weder, 2003; Hermann and Mihaljek, 2010), we find that the estimated coefficients of CARs remain mostly similar to those in Tables 2 and 3 in both magnitude and statistical significance (cols. [2]-[6]). Taking into account the volume of bilateral trade between the country-pair, and their direct exchange rate relationship against each other (as in Ghosh et al., 2014b) does not affect the results much either.[25] The results also carry through if we control more generally for recipient country time-varying characteristics when estimating the impact of outflow related measures by including recipient country-year fixed effects (and vice versa for inflow measures; col. [8]).[26]

In addition, while the inclusion of EMs as source countries permits greater variation in our CAR variables, the results remain similar if we restrict the source countries to advanced countries only (col. [9]). They are also largely unaffected if we restrict the recipient country sample to EMs only, and exclude offshore financial centers (both advanced and EM) or post-GFC years from the sample when international bank deleveraging occurred (cols. [10]-[12]).

Alternate dependent variables

Defining the dependent variable in (log) real terms (deflated by US CPI) does not have much impact on the results (col. [13]), nor does using data on total cross-border *stock* of bank assets instead of flows (col. [14]). In fact, the latter strengthens the results in most cases: the

[25] The results remain similar if other variables such as source/recipient country population; fiscal balance, external debt and foreign reserves (to GDP) ratios; polity index; and a measure of real exchange rate overvaluation are included in the model. The coefficients for these variables are generally in line with those reported in earlier studies: e.g., recipient countries with better institutional quality, greater financial development and soundness, higher reserves and fiscal balance, and lower external debt attract more flows. The estimated coefficients for bilateral trade flows, bank stability and concentration, and common lender effects are, however, statistically insignificant (detailed results are available upon request).

[26] We cannot control for time-varying characteristics of *both* source and recipient countries simultaneously by including source and recipient country-year fixed effects together since the effect of our CAR measures—which vary by country-year—would not be identified. To consider potential nonlinear effects of CARs, however, we interact them with economic size and financial development of source/recipient countries but find the interaction terms to be statistically insignificant.

estimated coefficients of almost all inflow related measures (including equity and financial credit controls, as well as restrictions on purchasing locally issued securities in FX, which were statistically insignificant above) become significantly negative. Moving from the 25th to the 75th percentile on outflow related measures reduces the bilateral stock of bank assets by some 12-15 percent. Similarly, moving from the 25th to the 75th percentile on inflow related measures reduces the bilateral stock of bank assets by about 8-23 percent.

The benchmark results reported in Tables 2 and 3 pertain to total bank asset flows from source countries, comprising flows to the banking and nonbanking sectors in the recipient countries. While the former typically dominate the latter, CARs (and other variables) could potentially have a differential effect on the two types of flows. Thus, Blank and Buch (2010) find that banks' cross-border assets against banks respond more to financial variables (like interest rate differential), and less to real variables, than those against nonbanks. Similarly, prudential measures (that primarily target banks) in recipient countries may have less influence on inflows to the nonbanking sector than to the banking sector. To examine whether this is the case, we re-estimate (1) and (2) taking the (log) flows to the nonbanking sector as the dependent variable. The sample size drops by about one-fifth in these estimations due to lack of data availability; the estimation results however do suggest some differences. As might be expected, financial sector specific measures are not significantly related with flows to the nonbanking sector—on the source side, equity and financial credit outflow controls appear to somewhat restrain lending to the nonbanking sector (col. [15]), while on the recipient side, controls on bond inflows are associated with lower inflows.

Alternate CAR measures

As noted above, the de jure CAR measures used here are based on the existence of a restriction, with no differentiation by their intensity. While this is unavoidable given the available information, some restrictions are less likely to be material or binding, with a correspondingly lower impact on flows. As a robustness test, here we construct some alternative CAR indices, where relatively mild regulations such as registration requirements or restrictions on investments in only a few selected sectors for national security purposes are considered as no restrictions. The results are similar to those reported above. For example, Table 7 (col. [16]) shows that with the alternate measures, the estimated coefficients of all outflow related CAR measures are almost the same as those reported in Table 2. On the inflow side, the results for overall and bond inflow controls remain similar to those reported in Table 3, while the estimated coefficient for direct investment inflow controls now also becomes statistically significant (at the 10 percent level).

Endogeneity

An important concern when estimating the effect of CARs on capital flows is that of reverse causality—i.e., countries may strengthen CARs in response to a surge in capital inflows (or

outflows).[27] Since we focus on bilateral components of total capital flows (whereas the imposition of CARs tend to be in response to the aggregate volume of flows)—unless bilateral flows are perfectly correlated across country pairs—reverse causality is less likely to be a concern in our case than it is in other studies which consider aggregate flows. Moreover, to the extent that there is any such endogeneity, it is likely to *reduce* the estimated coefficients of capital controls and prudential measures. The strong findings above on both source and recipient country restrictions are therefore despite, rather than because of, any potential endogeneity (which would tend to bias the results toward finding no effect).

Nevertheless, following earlier studies, we use the first lag of CARs in all estimations above to mitigate potential endogeneity concerns. Here we also consider three alternate approaches for robustness purposes. First, instead of a one-year lag, we use 5-year lagged average of the measures. Second, we exclude from the sample several major source countries (such as the US, UK, and Germany) that may dominate the flows, thereby driving the restrictions countries impose. Third, we apply an instrumental variable two-stage least squares (IV-2SLS) approach. For the first and second cases, we find that the results remain very similar to those reported above (these are therefore not reported here). For the third case, we require at least one valid instrument that is correlated with CARs in (1) and (2), but is not expected to affect the dependent variable directly. We consider two such variables as our potential instruments: monetary (or central bank) independence, and the presence of a democratic left-wing government in country *i* (or *j*) in year *t.* Existing studies (e.g., Grilli and Milesi-Ferretti, 1995) find these variables to be important determinants of capital controls: countries with lower monetary independence and a left-wing government are more likely to implement capital controls. There is, however, no *a priori* reason to believe that both these variables would be directly related to the amount of cross-border bank flows (especially, since we control for per capita income as a proxy for institutional quality/polity in all specifications).

We obtain information on monetary freedom from the Heritage Foundation's Economic Freedom Index, which ranks countries on a scale of 0 to 100—with larger values depicting greater monetary independence. A particular advantage of this data is its comprehensive and up-to-date availability, and cross-country and temporal comparability. Information on the presence of a left-wing government is obtained from Beck et al. (2001), and is summarized as a binary variable (with one indicating a left-wing government, and zero otherwise).

We begin by using only monetary freedom as our instrument since data availability on whether the government is left-wing or center/right-wing is relatively limited. The validity of this instrument is supported by the results from the first stage of the IV-2SLS estimation: the estimated coefficient of monetary freedom is negative and significant (at the 1 percent level) in almost all specifications, indicating the lower prevalence of CARs in countries with greater monetary freedom (Table 8, panel A). The other control variables included in the first

[27] Another potential source of endogeneity arises if capital controls and bank flows are determined by some omitted third factor (e.g., institutional quality). We, however, control for such endogeneity bias by including country-pair fixed effects in the benchmark estimations (which capture the effect of time-invariant and slow moving factors), as well as by augmenting the benchmark specification with a range of variables, as discussed above (Table 7, cols. [2]-[8]).

(continued…)

stage regression for outflow (inflow) restrictions are those relevant for the source (recipient) countries—such as economic size, real GDP growth rate, real per capita income, real interest rate, exchange rate regime, and current account balance—and are also generally statistically significant (results not shown).[28] The F-test of the hypothesis that the estimates in the first stage regression are jointly equal to zero is thus strongly rejected, and the R-squared across specifications is about 0.9, offering evidence on the appropriateness of our instrument and the overall fit of the first stage regression.

The results obtained from the second stage of the estimation—using the predicted values of CARs from the first stage regression—are mostly in line with the benchmark results reported in Tables 2 and 3. On the source side, the overall restrictiveness on capital outflows remains significantly important, as do restrictions on bond, equity, direct investment, and financial credit outflows (Table 8, panel B). Among prudential measures, the estimated coefficient of restrictions on lending to nonresidents remains significantly negative. The magnitude of the estimated coefficients implies that moving from the lower to the top quartile on the (predicted) outflow control measures reduces flows by about 50-100 percent. On the recipient side, the second stage results imply a significantly negative effect of overall capital inflow controls, as well as of bond inflow controls, on bank inflows. The estimated coefficients for restrictions on lending locally in FX and open FX position limits also remain significantly negative. Together these estimates imply a reduction in inflows by some 50-85 percent if we move from the lower to the top quartile of the (predicted) measures.

The second stage estimation results hold if we control for institutional quality/polity or financial development of source and recipient countries, in addition to including income per capita. The results also remain similar when we include the existence of left-wing government as an instrument in the first stage estimations, where, as expected, the variable itself is generally positively and significantly associated with the existence of capital controls (Table A4, panel A). In fact, we use the availability of the second instrument to further establish the validity of our main monetary freedom instrument by following the "easy-to-interpret" overidentification test proposed by Acemoglu et al. (2001). Specifically, while instrumenting CARs with the left-wing government variable in the first stage, we add the monetary freedom variable as an exogenous regressor in the second stage. If monetary freedom has a direct effect on cross-border bank flows, we would expect it to be statistically significant in the second stage. By contrast, in all cases, we find the estimated coefficient of the monetary freedom variable to be wholly statistically insignificant (Table A4, panel B), which supports its excludability from the second stage estimation, and confirms that its impact on cross-border bank flows likely works through capital controls.

Overall, these findings support the robustness of our results to potential endogeneity bias, and suggest that CARs—both capital controls and prudential measures—in source and recipient countries can play an important role in moderating large cross-border bank flows.

[28] We do not include country fixed effects in the first stage because our instruments are slow moving variables, but include region-specific and year effects, as well as the first lag of CARs to capture their persistence.

Table 7. Cross-Border Bank Flows and CARs: Robustness Analysis

	Benchmark	Inst. quality[a]	Financial dev.[c]	Financial soundness[d]	Bank stability[e]	Common lender[f]	Bil. ERR & trade[b]	CYFE[g]	Adv. source[h]	EME recipient[i]	Excl. offshore[j]	Pre-GFC sample[k]	Real flows (log)[l]	Stock of assets[m]	Nonbank flows[n]	Alternate CARs[o]
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
Outflow restrictions																
Overall capital controls	-2.978***	-3.535***	-3.461***	-3.371***	-4.201***	-3.031***	-2.582**	-2.926***	-2.850**	-2.218*	-2.794***	-4.121***	-2.972***	-0.266***	-1.873	-3.617***
Bond controls	-1.446*	-1.622*	-1.967**	-2.743***	-3.674***	-1.470*	-1.100	-1.412*	-1.746*	-1.968*	-1.345	-2.854***	-1.434*	-0.276***	-0.967	-1.721**
Equity controls	-2.316***	-2.658***	-2.703***	-2.656***	-3.570***	-2.330***	-2.070**	-2.231***	-2.689**	-2.422**	-2.215**	-3.826***	-2.308***	-0.325***	-2.354*	-2.587***
Direct investment controls	-4.019***	-4.177***	-4.346***	-3.119**	-2.719*	-4.042***	-4.008***	-4.298***	-3.673**	-3.052**	-3.983***	-4.116***	-4.034***	0.066	-0.085	-4.019***
Financial credit controls	-1.438***	-1.777***	-1.312**	-1.497***	-1.707***	-1.465***	-1.274**	-1.391***	-1.182**	-0.886	-1.374***	-1.575**	-1.433***	-0.129***	-0.996*	-1.438***
Lending to nonresidents	-5.505***	-5.365***	-5.338***	-3.705***	-4.131**	-5.537***	-5.357***	-5.476***	-6.172**	-6.947***	-5.503***	-6.339***	-5.511***	-0.060	-1.947	
Maintenance of acc. abroad	-1.459	-1.414	-1.802	-0.012	-0.300	-1.473	-1.348	-1.402	-1.192	-1.332	-1.444	-1.442	-1.461	-0.150*	3.681***	
Open FX position limit	0.419	0.349	0.093	-1.180*	-1.228*	0.484	0.395	0.470	0.337	0.761	0.463	3.089***	0.430	-0.164***	-0.437	
Inflow restrictions																
Overall capital controls	-1.998**	-1.147	-1.185	-1.585	-0.630	-1.995**	-2.353**	-2.157**	-2.361**	-2.666**	-2.027**	-3.120**	-1.999**	-0.568***	-1.766	-2.256**
Bond controls	-2.023***	-1.592**	-2.020***	-2.629***	-1.634*	-2.022***	-2.271***	-2.089***	-2.197**	-2.075***	-2.001***	-0.956	-2.025***	-0.175**	-1.345*	-1.688**
Equity controls	-0.092	0.207	0.136	0.210	0.526	-0.090	-0.447	-0.143	-0.001	-1.170	-0.068	-0.499	-0.089	-0.297***	0.301	-0.965
Direct investment controls	0.674	0.775	1.407	0.980	0.990	0.674	0.581	0.530	0.198	-0.366	0.913	-1.238	0.671	0.030	-0.318	-1.360*
Financial credit controls	-0.863	-0.242	0.035	-0.566	-0.205	-0.861	-0.921*	-0.944*	-1.079*	-0.556	-0.929*	-2.297***	-0.865	-0.225***	-0.732	-0.790
Lending locally in FX	-1.792***	-1.689**	-1.672**	-1.741**	-1.585**	-1.790***	-2.070***	-1.773***	-1.854**	-4.256***	-2.064***	-1.749*	-1.794***	-0.153***	-0.895	
Purchase of local FX sec.	-0.494	-0.549	-0.268	-0.780	-0.222	-0.494	-0.865	-0.430	-0.670	-1.986**	-0.653	-1.958**	-0.498	-0.262***	0.272	
Open FX position limit	-1.110*	-1.151*	-0.830	-1.621**	-1.682**	-1.110*	-1.222*	-1.134*	-1.095	-1.766*	-1.105*	-0.215	-1.097*	-0.257***	-0.633	
Country-pair/year effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	22,257	21,898	20,656	19,853	18,989	22,257	22,028	22,257	19,111	12,194	21,815	13,913	22,257	23,270	17,419	22,257
No. of source countries	31	31	31	31	31	31	31	31	21	31	31	27	31	31	28	31
No. of recipient countries	76	74	74	76	76	76	76	76	76	47	76	75	76	76	76	76

Note: Table presents robustness for benchmark models (1) and (2). Col. [2], for example, presents the results of CARs when (source and recipient country) institutional quality is added to the benchmark specifications. Dependent variable is (log of) bank asset flows from country i to j unless otherwise stated. All specifications include control variables listed in Tables 2-4, and country-pair and year effects. Sample size varies across specifications based on data availability for the variables. Standard errors are clustered at country-pair level in all specifications. *, **, and *** indicate statistical significance at 10, 5, and 1percent levels, respectively.

a/ Institutional quality for source and recipient countries is added to the benchmark specification (reported in Tables 2 and 3).

b/ Bilateral exchange rate regime and bilateral (log) real trade between country pair is added to the benchmark specification.

c/ Stock market capitalization for source/recipient countries is added to the benchmark specification. Results remain similar if private credit, or deposit money bank assets (to GDP) are used as financial development indicators.

d/ Return on assets and equity variables for source and recipient countries are added to the benchmark specification.

e/ Measures for bank stability (z-score) and bank concentration for source and recipient countries are added to the benchmark specification.

f/ Common lender variable is added to the benchmark specification.

g/ Source (recipient) country-year effects are added in the estimations with inflow (outflow) related CARs.

h/ Sample excludes EME source countries.

i/ Sample excludes advanced recipient countries.

j/ Sample excludes those source and recipient countries which are off-shore financial centers.

k/ Estimated sample is restricted up to 2007.

l/ Dependent variable is (log) real flows from source country i to recipient country j.

m/ Dependent variable is (log) total stock of bank assets (amount outstanding) of source country in recipient country.

n/ Dependent variable is (log) flows to the nonbank sector in recipient country.

o/ Alternate capital controls indices with mild restrictions treated as zero are used.

Table 8. Cross-Border Bank Flows and CARs: IV-2SLS Estimates, 1995–2012

	[A] First stage estimates[a]															
	Outflow related measures								Inflow related measures							
Dependent variable	Overall	Bonds	Equity	DI	FC	Nonres. lending	Acc. abroad	Open FX limit	Overall	Bonds	Equity	DI	FC	Local FX lending	Local FX sec.	Open FX limit
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
Monetary freedom	-0.001***	-0.001***	-0.002***	-0.002***	-0.001***	0.001***	-0.000***	0.001***	-0.001***	-0.000***	-0.000***	-0.000***	-0.001***	-0.001***	-0.000	-0.000***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Observations	22,257	22,257	22,257	22,257	22,257	22,257	22,257	22,257	22,252	22,252	22,252	22,252	22,252	22,252	22,252	22,252
R2	0.937	0.920	0.937	0.935	0.914	0.957	0.947	0.918	0.938	0.920	0.917	0.896	0.881	0.918	0.929	0.918
F-test (p-value)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	[B] Second stage estimates[b]															
Overall controls	-3.222***								-2.081**							
	(1.080)								(1.039)							
Bond controls		-1.570*								-2.145***						
		(0.888)								(0.707)						
Equity controls			-2.453***								-0.094					
			(0.905)								(0.797)					
Direct investment controls				-4.347***								0.729				
				(1.091)								(0.856)				
Financial credit controls					-1.567***								-0.948			
					(0.558)								(0.592)			
Lending to nonresidents						-6.243***										
						(1.317)										
Maint. of accounts abroad							-1.621									
							(1.255)									
Open FX position limits								0.481								-1.182*
								(0.670)								(0.697)
Lending locally in FX														-1.922***		
														(0.717)		
Purchase of local FX securities															-0.593	
															(0.813)	
CPFE/TE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	22,257	22,257	22,257	22,257	22,257	22,257	22,257	22,257	22,252	22,252	22,252	22,252	22,252	22,252	22,252	22,252
R2	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05

a/ Panel A reports the first stage estimation results for outflow and inflow related CARs in cols. (1)-(8) and (9)-(16), respectively, where monetary freedom in source/recipient countries is used as an instrument. Log of real GDP and real GDP per capita, real GDP growth, real interest rate, current account balance, exchange rate regime, lagged CAR, and regional dummies for the source side are included in cols. (1)-(8), while those for the recipients are included in cols. (9)-(16). All regressors are lagged one period. The sample size drops slightly in cols. [9]-[16] because of data unavailability for a few countries for some years. Constant and year effects are included in all specifications. F-test (p-value) reports the joint significance of all regressors. Robust standard errors are reported in parentheses. *** indicates statistical significance at the 1percent level.

b/ Panel B reports the two-stage least squares estimates with (log of) bank asset flows from country i to country j as the dependent variable. CARs are predicted values obtained from the corresponding first stage regression in Panel A. Control variables as specified in Table 4 (lagged real GDP (log), real per capita income (log), real GDP growth rate, and real interest rate of both source and recipient countries; current account balance and exchange rate regime of recipient country; country pair and year effects), as well as constant are included in all specifications. Standard errors computed with jackknife (1,943 replications) are reported in parentheses. ***, ** and * indicate statistical significance at the 1, 5, and 10 percent levels, respectively.

V. CONCLUSION

This paper examines whether cross-border capital flows can be regulated by imposing capital account restrictions at both (source and recipient country) ends, as was originally advocated by John Maynard Keynes and Harry Dexter White, and is currently mandated for some measures under Basel III reciprocity. To this end, we use data on bilateral cross-border bank flows from 31 source to 76 recipient countries—both advanced and EMs—over 1995–2012, and combine this information with a comprehensive dataset on different types of capital controls and prudential measures (that can act like capital controls) in these countries.

Our empirical results suggest that capital account restrictions at both ends can significantly influence the volume of cross-border bank flows. On the source side, restrictions on outflows—specifically, bond, equity, direct investment and financial credit controls, and restrictions on the financial sector to lend to nonresidents—are associated with significantly smaller flows. On the recipient side, controls on bond inflows, as well as prudential measures such as restrictions on local FX lending and open FX position limits, are associated with significantly smaller inflows.

Controlling simultaneously for both source- and recipient-country capital account restrictions, their estimated impact remain largely unchanged. While the effects of simultaneous inflow and outflow restrictions may not be fully additive, it is possible to operate at both ends of the flow and achieve either a larger reduction in the volume of flows, or the same reduction with less intensive measures at either end. Our (counterfactual) estimates suggest that pre-GFC flows to emerging Europe and the eurozone peripheral countries would have been substantially lower in the presence of financial sector-specific capital account restrictions at either end.

These findings suggest that there may be scope for greater international cooperation in managing large and volatile cross-border flows. Where administrative capacity and treaty obligations permit, tackling flows at both the source and receiving ends can result in globally more efficient outcomes if the cost of imposing restrictions is convex—as seems plausible. In practice, such cooperation would—as Keynes and Whites envisaged—be on a bilateral basis; that is, upon request of the recipient country, the source country authorities would impose measures to curb excessive lending. While the results presented here are encouraging, further research is warranted to fine tune the capital account measures to reflect their intensity across countries, and to analyze how international cooperation may be extended beyond Basel III and European reciprocity principle to better manage volatile cross-border flows.

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ONLINE APPENDIX

A.1 SOURCE-RECIPIENT COUNTRY COOPERATION

In this appendix, we establish that, given the existence of a borrowing externality in the recipient country, a global social planner maximizing the joint welfare of the recipient and source countries would regulate flows at both ends—taxing inflows and outflows.

Recipient Country's Problem

Our starting point is the recipient country, where we assume that there is some form of externality such that atomistic agents borrow excessively. We do not need to take a stand on the precise nature of the externality, which may pertain to learning-by-doing (Ghosh and Kim, 2008), aggregate demand (Farhi and Werning, 2013), or—of particular relevance here—financial-stability risks (Jeanne and Korinek, 2010; Korinek, 2010; Bianchi, 2011). Without modeling the externality in detail, we summarize its welfare effect by an equivalent cost, $\xi(b)$, to the agent's lifetime income, where $\xi'(b) \geq 0$, and b is foreign debt.

i) Individual Agent's Problem

The representative agent lives for two periods, maximizing lifetime utility:

$$V(R, I) = Max\, u(c_1) + \beta u(c_2) \tag{A.1}$$

subject to his static budget constraints:

$$c_1 = y_1 + b \tag{A.2}$$

$$c_2 = y_2 - Rb + T - \xi(b) - \delta(\tau) \tag{A.3}$$

where c, y are consumption and endowment income in each period, b is borrowing, R is the gross interest rate faced by the agent, T is the lump sum transfer from the government (in equilibrium, equal to the revenue raised by the tax on inflows, $T = \tau b$, where τ is a proportional tax on borrowing), $\xi(b)$ is the welfare cost of the externality associated with excessive borrowing, and $\delta(\tau)$ is the distortionary cost of capital controls, which is assumed to satisfy $\delta'(\tau) \geq 0, \delta''(\tau) \geq 0, \delta(0) = \delta'(0) = 0$. The interest rate faced by the domestic agent is the world interest rate, $\hat{R}$, plus the inflow tax:

$$R = \hat{R} + \tau \tag{A.4}$$

The agent's lifetime income is:

$$I = Ry_1 + y_2 + T - \xi(b) - \delta(\tau) \tag{A.5}$$

but the agent treats $T - \xi(b) - \delta(\tau)$ as a fixed quantity. The maximization yields the familiar Euler equation:

$$u_c(c_1) = \beta R u_c(c_2) \tag{A.6}$$

Totally differentiating (A.6) and substituting (A.2)-(A.3) yields:

$$db = \frac{\beta(u_c(c_2) - b(\hat{R}+\tau)u_{cc}(c_2))}{u_{cc}(c_1) + \beta(\hat{R}+\tau)^2 u_{cc}(c_2)}(d\hat{R} + d\tau) \equiv b_{\hat{R}} d\hat{R} + b_\tau d\tau; b_{\hat{R}} = b_\tau < 0 \qquad \text{(A.7)}$$

Since the country is a borrower, $b > 0,$ an increase in the world interest rate or the inflow tax reduces borrowing.

ii) National Social Planner's Problem

The national social planner maximizes the representative agent's welfare by choice of the inflow tax: $Max_\tau V(R, I)$ subject to the budget constraints and the private sector's behavior, as summarized in (A.6). The first-order condition for the planner's optimization problem, $dV / d\tau = 0,$ may be written as:

$$\frac{dV}{d\tau} = \frac{dV}{dR}\frac{dR}{d\tau} + \frac{dV}{dI}\frac{dI}{d\tau} = 0$$

Exploiting Roy's identity, and differentiating (A.5) with respect to τ yields:

$$\frac{dV}{d\tau} = \left(-c_1 \frac{dV}{dI}\right)\frac{dR}{d\tau} + \frac{dV}{dI}\left(y_1 \frac{dR}{d\tau} + b_1 + (\tau - \xi')\frac{db}{d\tau} - \delta'(\tau)\right) = 0$$

Re-arranging and using $y_1 - c_1 = -b$:

$$\frac{dV}{d\tau} = \frac{dV}{dI}\left\{b\left(1 - \frac{dR}{d\tau}\right) + (\tau - \xi')\frac{db}{d\tau} - \delta'(\tau)\right\} = 0$$

The first term is simply the increase in the agent's utility from an extra dollar of income, and equals the Lagrange multiplier on the income constraint, $dV / dI > 0,$ while from (A.4), $1 - dR / d\tau = -d\hat{R} / d\tau.$ Hence the optimal capital control may be written as:

$$\tau = \left(\frac{b(d\hat{R} / d\tau)}{(db / d\tau)}\right) + \xi' - \left(\frac{\delta'(\tau)}{-(db / d\tau)}\right) \qquad \text{(A.8)}$$

For a capital recipient country, each of the terms in brackets is positive. The first term corresponds to the "optimal tariff" or terms-of-trade manipulation in trade theory: by imposing an inflow control, the national planner reduces global demand for capital, and therefore the world interest rate—shifting the terms of trade in its favor. The second term is the borrowing externality. The third term encapsulates the cost-benefit trade-off: imposing controls incurs a distortionary cost, but reduces borrowing by $db / d\tau.$

International Cooperation

We now consider the scope for cooperation between source and recipient countries through the imposition of capital account restrictions. The recipient country is as above, while in the source country (denoted by asterisks), the representative agent solves a largely symmetric problem subject to his lifetime income: $I^* = R^* y_1^* + y_2^* + T^* - \delta^*(\tau^*)$ where there is no financial-stability externality (since the country is a creditor) and T^* is the lump-sum tax rebate that equals the tax $\tau^* b$ on capital outflows, which reduces the rate of return to the

representative agent relative to the world interest $R^* = \hat{R} - \tau^*$, and $\delta^*(\tau^*)$ is the distortionary cost of outflow restrictions.

To simplify the algebra, we set $y_1 = y_2^* = 0; y_2 = y_1^* > 0; \beta = \beta^* = 1,$ which ensures that the home country is the debtor, and the foreign country is the creditor, but that the countries are otherwise symmetric (except that only the recipient country faces the borrowing externality).[29] The global planner takes account of the welfare of both the borrower and the creditor, with weights ω and (1-ω), respectively.

$$W = \left\{\omega V(R, I) + (1-\omega)V^*(R^*, I^*)\right\} \tag{A.9}$$

A natural welfare weight to choose would be such that $\omega/(1-\omega) = (dV^*/dI^*)/(dV/dI)$ so that an extra dollar is equally valuable to each party (given the assumed symmetry, this will imply $\omega \approx 1/2$).

The global social planner's first-order conditions imply:

$$\begin{aligned} &dW/d\tau = \omega(dV/dI)\left((y_1 - c_1)dR/d\tau + b + (\tau - \xi')(db/d\tau) - \delta'(\tau)\right) \\ &+(1-\omega)(dV^*/dI^*)\left(y_1^* - c_1^*\right)(dR^*/d\tau) = 0 \end{aligned} \tag{A.10}$$

$$\begin{aligned} &dW/d\tau^* = \omega(dV/dI)\left((y_1 - c_1)dR/d\tau^*\right) \\ &+(1-\omega)(dV^*/dI^*)\left(\left(y_1^* - c_1^*\right)(dR^*/d\tau^*) + b_1 + \tau^*(db_1/d\tau^*) - \delta^{*\prime}(\tau^*)\right) = 0 \end{aligned} \tag{A.11}$$

Using $\omega(dV/dI) = (1-\omega)(dV^*/dI^*)$, $1-(dR/d\tau) = -d\hat{R}/d\tau$, and $1+(dR^*/d\tau) = d\hat{R}/d\tau$, these may be simplified to:

$$\frac{dW}{d\tau} = \frac{dV}{dI}\left(b\left(\frac{dR^*}{d\tau} - \frac{d\hat{R}}{d\tau}\right) + (\tau - \xi')\left(\frac{db}{d\tau}\right) - \delta'(\tau)\right) = 0 \tag{A.12}$$

$$\frac{dW}{d\tau^*} = \frac{dV}{dI}\left(b\left(\frac{d\hat{R}}{d\tau^*} - \frac{dR}{d\tau^*}\right) + \tau^*\left(\frac{db}{d\tau^*}\right) - \delta^{*\prime}(\tau^*)\right) = 0 \tag{A.13}$$

The global planner's first-order conditions (A.12)-(A.13) constitute a pair of simultaneous equations that define the optimal inflow and outflow taxes. Even without specific functional forms, some further insight can be gained by adding these and exploiting the symmetry of the model, which implies that $dR^*/d\tau = dR/d\tau^*; db/d\tau = db/d\tau^*$. Hence:

$$\tau + \tau^* = \xi' - \frac{[\delta'(\tau) + \delta^{*\prime}(\tau^*)]}{-(db/d\tau)} \tag{A.14}$$

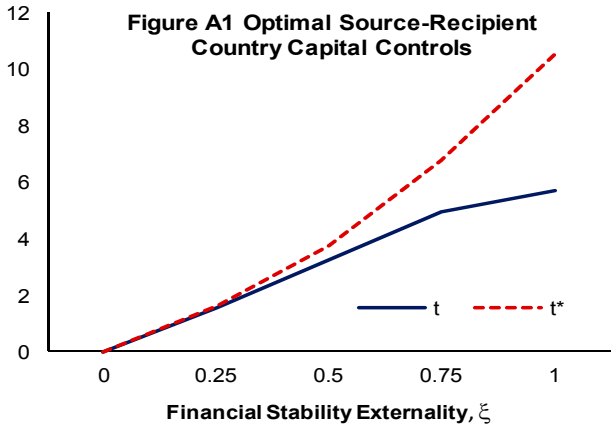
Since $db/d\tau = db/d\tau^*$, if the distortive cost functions are the same in the two countries, then global planner's optimality condition is symmetric in (τ, τ^*). If there were no borrowing externality (or if it did not depend on the level of borrowing), then $\xi' = 0,$ and $\tau = \tau^* = 0.$

[29] To the extent that the debtor incurs a financial-stability cost associated with its borrowing, whereas as the creditor does not, the source country could be considered as inherently "wealthier," and not entirely symmetric to the recipient country.

Provided $\xi' > 0,$ however, the global planner will want to impose both inflow and outflow taxes since he cares equally about the recipient and the source country's welfare.

If the global planner were to impose only inflow controls, this would reduce borrowing (thus the externality for the recipient country), as well as shift the terms of trade in its favor—but at a high distortionary cost of the inflow controls. Meanwhile, the creditor would lose because of the reduction in the world interest rate. Conversely, if the planner were to use only outflow controls, the recipient country would gain because the externality would be reduced without it having to incur the distortionary costs of imposing inflow taxes, but it would lose because of the higher world interest rate. The creditor would however gain from the higher world interest rate, but at the expense of incurring a high distortionary cost of imposing outflow controls. The global optimum will lie between these two extremes involving both inflow and outflow controls because the distortionary costs are assumed to be convex—increasing at an increasing rate in the tax rate—so the total cost of achieving a given reduction in global flows is smaller if a combination of inflow and outflow controls is used (instead of imposing a high tax at either end). Moreover, the recipient country gains (relative to the no-tax equilibrium) because the externality is reduced while some of the distortionary costs of the tax are shifted to the source country, while the source country gains because the terms of trade improvement outweighs the distortionary cost of outflow controls. The use of *simultaneous* inflow and outflow restrictions thus allows Pareto improving outcomes.

Figure A1 shows the optimal inflow and outflow controls when the counterfactual is no inflow or outflow controls (and thus no terms of trade manipulation), and the planner gives equal weight to maximizing the welfare gain of the borrower and the creditor relative to the benchmark of neither inflow nor outflow controls (so the planner is constrained to make only Pareto improvements).[30] Even though it is only the recipient country that faces the excessive borrowing externality, the optimal policy calls for almost equal inflow and outflow controls—indeed outflow controls are used more intensively than inflow controls as ξ becomes large, and the borrower becomes correspondingly poorer.



References

[30] The example assumes log utility, with $\beta = 1, \omega = (1/2), \delta(\tau) = \tau^2, y_1 = y_2^* = 0, y_2 = y_1^* = 1.$

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A.2 DATA AND SUMMARY STATISTICS

Table A1. List of Countries in the Sample

(Reporting) Source Countries		Recipient Countries			
Advanced		**Advanced**			
Australia (1998-2012)	Italy (1995-2012)	Australia	Iceland	Slovenia	
Austria (1995-2012)	Japan (1995-2012)	Austria	Ireland	Spain	
Belgium (1995-2012)	Luxembourg (1995-2012)	Belgium	Israel	Sweden	
Canada (1995-2012)	Netherlands (1995-2012)	Canada	Italy	Switzerland	
Cyprus (2009-12)	Portugal (1998-2012)	Cyprus	Japan	United Kingdom	
Denmark (1995-2012)	Spain (1995-2012)	Denmark	Luxembourg	United States	
Finland (1995-2012)	Sweden (1995-2012)	Finland	Malta		
France (1995-2012)	Switzerland (1995-2012)	France	Netherlands		
Germany (1995-2012)	United Kingdom (1995-2012)	Germany	New Zealand		
Greece (2004-2012)	United States (1995-2012)	Greece	Portugal		
Ireland (1995-2012)		Hong Kong	Singapore		
Emerging markets		**Emerging markets**			
Brazil (2003-12)		Algeria	Ecuador	Latvia	Romania
Chile (2003-12)		Argentina	Egypt	Lebanon	Russian Fed.
India (2002-12)		Armenia	El Salvador	Lithuania	Slovak Rep.
Indonesia (2011-12)		Brazil	Estonia	Macedonia	South Africa
Korea, Rep. (2006-12)		Bulgaria	Georgia	Malaysia	Sri Lanka
Malaysia (2008-12)		Chile	Guatemala	Mexico	Thailand
Mexico (2004-12)		China	Hungary	Morocco	Tunisia
Panama (2003-12)		Colombia	India	Pakistan	Turkey
South Africa (2010-12)		Costa Rica	Indonesia	Panama	Ukraine
Turkey (2001-12)		Croatia	Jamaica	Peru	Uruguay
		Czech Republic	Jordan	Philippines	Venezuela
		Dominican Republic	Korea, Rep.	Poland	

Note: Years in parentheses reflect years of data availability for reporting countries in our sample. The sample of emerging markets is based on those included in the IMF's Vulnerability Exercise for Emerging Markets.

Table A2. Data Description and Sources

Variable	Description	Source
Bank asset flows from country i to country j	Exchange rate-adjusted change in external position of reporting banks in home country vis-à-vis host country, expressed in log of USD (with negative values transformed by taking the log of their absolute value and then changing the sign)	Bank of International Settlements (BIS) Locational Statistics by Residence
Capital controls	Index	Authors' estimates based on IMF's AREAER;
Overall outflow/inflow	Computed as avg. of bond, equity, direct investment, money market, financial credit, collective investment outflow/inflow controls indices	OCED Code of Liberalization on Capital Movements (various issues)
Bond outflow	Computed as avg. of binary variables with one indicating presence of restrictions on purchase of bond and other debt securities abroad by residents, and their sale by nonresidents	
Bond inflow	Computed as avg. of binary variables with one indicating presence of restrictions on purchase of bond and other debt securities by nonresidents, and their abroad sale by residents	
Equity outflow	Computed as avg. of binary variables with one indicating presence of restrictions on purchase of shares or other securities of a participating nature abroad by residents, and their sale by	
Equity inflow	Computed as average of binary variables with one indicating restrictions on purchase of shares or other securities of a participating nature by nonresidents, and their sale abroad by	
Direct investment outflow	Binary variable with one indicating restrictions on outward direct investment	
Direct investment inflow	Binary variable with one indicating restrictions on inward direct investment (or liquidation)	
Financial credit outflow	Binary variable with one indicating restrictions on financial credits by residents to nonresidents	
Financial credit inflow	Binary variable with one indicating restrictions on financial credits to residents by nonresidents	
Prudential measures		IMF's AREAER
Maintenance of accounts abroad	Binary variable equal to one if restriction exists	
Lending to nonresidents	Binary variable equal to one if restriction exists	
Open foreign exchange position limits	Binary variable equal to one if restriction exists (countries with fixed exchange rate where open FX position limit exists but the anchor currency is excluded from the computation of open FX position are coded as not having the restriction in place)	
Lending locally in foreign exchange	Binary variable equal to one if restriction exists	
Purchase of locally issued securities in foreign exchange	Binary variable equal to one if restriction exists	
Real gross domestic product (GDP)	Constant 2005 USD (in log)	IMF's World Economic Outlook (WEO)
Real GDP per capita	Constant 2005 USD (in log)	WEO
Real GDP growth rate	In percent	WEO
Current account balance to GDP	In percent	WEO
De facto exchange rate regime	Fixed/Intermediate=1; Float=0	Ghosh et al. (2014)
Real interest rate	[(1+nominal interest rate)/(1+inflation)]-1	Authors' estimates
Nominal interest rate	Money market or discount rate (depending on data availability)	IFS
Inflation	Change in consumer price index--period average (in percent)	INS
Institutional quality	Average of 12 political risk components	International Country Risk Guide
Monetary freedom	Scale of 0 (low) to 100 (high)	Heritage Foundation Economic Freedom Index (http://www.heritage.org/index/explore?view=by-region-country-year)
Democratic left-wing government	Binary variable equal to one if left-wing govt. in place (zero otherwise)	Database of political institutions (updated Jan. 2013) by Beck et al. (2001).
Polity index	Scale of -10 (autocracy) to 10 (democracy)	Polity IV Project: Center for Systemic Peace
Real bilateral trade	Average of exports from country i to j and of imports of country i from j	IMF's DOTS
Bank private credit to GDP	In percent	Global Development Finance Report 2013
Deposit money bank asset to GDP	In percent	GDFR
Stock market capitalization to GDP	In percent	GDFR
Bank concentration	In percent	GDFR
Bank z-score	Index	GDFR
Return on asset	In percent	GDFR
Return on equity	In percent	GDFR
Common lender effects	External position of reporting banks in country i vis-à-vis crisis country k, as a percent of total external position of reporting banks in country i. Crisis countries are as follows: Mexico (1994-95); Indonesia, Korea, Malaysia and Thailand (1997-98); USA (2007-08); Greece, Ireland, Portugal and Spain (2010-11)	Authors' estimates based on BIS data
VIX	In log	Bloomberg
Commodity price index	Deviation of commodity price index from trend (obtained from HP filter)	Authors' estimates based on WEO
Distance	Geographical distance between country i and j (in log)	Ghosh et al. (2014)
Land area	Log product of land areas of countries i and j	Ghosh et al. (2014)
Common language	Binary variable equal to one if i and j have a common language	Ghosh et al. (2014)
Common border	Binary variable equal to one if i and j have a common border	Ghosh et al. (2014)
Offshore	Number of financial offshore centers in the pair (0, 1, 2)	Ghosh et al. (2014)
Trade agreement	Binary variable equal to one if country pair share a free trade	Ghosh et al. (2014)

Table A3. Summary Statistics of Selected Variables

Variable	Obs	Mean	Median	Std dev	Min	Max
Bank asset flows$_{ij}$ (log)	22,257	2.52	15.20	18.37	-26.44	26.28
Real GDP$_i$ (log)	22,257	27.11	27.14	1.41	23.28	30.26
Real GDP$_j$ (log)	22,257	25.91	25.89	1.67	21.54	30.26
Real GDP per capita$_i$ (log)	22,257	10.22	10.47	0.85	6.40	11.38
Real GDP per capita$_j$ (log)	22,257	9.24	9.25	1.24	6.18	11.38
Real GDP growth$_i$ (in pct.)	22,257	2.47	2.52	2.74	-7.87	10.80
Real GDP growth$_j$ (in pct.)	22,257	3.26	3.49	3.48	-15.06	15.46
Real interest rate$_i$ (in pct.)	22,257	0.99	0.83	2.45	-4.99	18.71
Real interest rate$_j$ (in pct.)	22,257	1.51	1.12	4.21	-19.25	25.84
Current account bal./GDP$_j$ (in pct.)	22,257	-0.53	-1.13	6.11	-24.08	21.12
Exchange rate regime$_j$	22,257	0.74	1.00	0.44	0.00	1.00
Overall outflow controls index$_i$	22,257	0.29	0.25	0.29	0.00	1.00
Bond outflow controls index$_i$	22,257	0.30	0.50	0.33	0.00	1.00
Equity outflow controls index$_i$	22,257	0.28	0.00	0.33	0.00	1.00
DI outflow controls index$_i$	22,257	0.14	0.00	0.35	0.00	1.00
FC outflow controls index$_i$	22,257	0.40	0.00	0.49	0.00	1.00
Maintenance of accounts abroad$_i$	22,257	0.11	0.00	0.31	0.00	1.00
Lending to nonresidents$_i$	22,257	0.12	0.00	0.33	0.00	1.00
Open FX position limit$_i$	22,257	0.36	0.00	0.48	0.00	1.00
Overall inflow controls index$_j$	22,257	0.36	0.25	0.30	0.00	1.00
Bond inflow controls index$_j$	22,257	0.27	0.00	0.39	0.00	1.00
Equity inflow controls index$_j$	22,257	0.37	0.50	0.38	0.00	1.00
DI inflow controls index$_j$	22,257	0.77	1.00	0.42	0.00	1.00
FC inflow controls index$_j$	22,257	0.29	0.00	0.46	0.00	1.00
Lending locally in FX$_j$	22,257	0.36	0.00	0.48	0.00	1.00
Purchase of locally issued FX sec.$_j$	22,257	0.29	0.00	0.46	0.00	1.00
Open FX position limit$_j$	22,257	0.63	1.00	0.48	0.00	1.00

Notes: Based on the estimated sample of the benchmark specification. DI=Direct investment; FC=Financial credit.

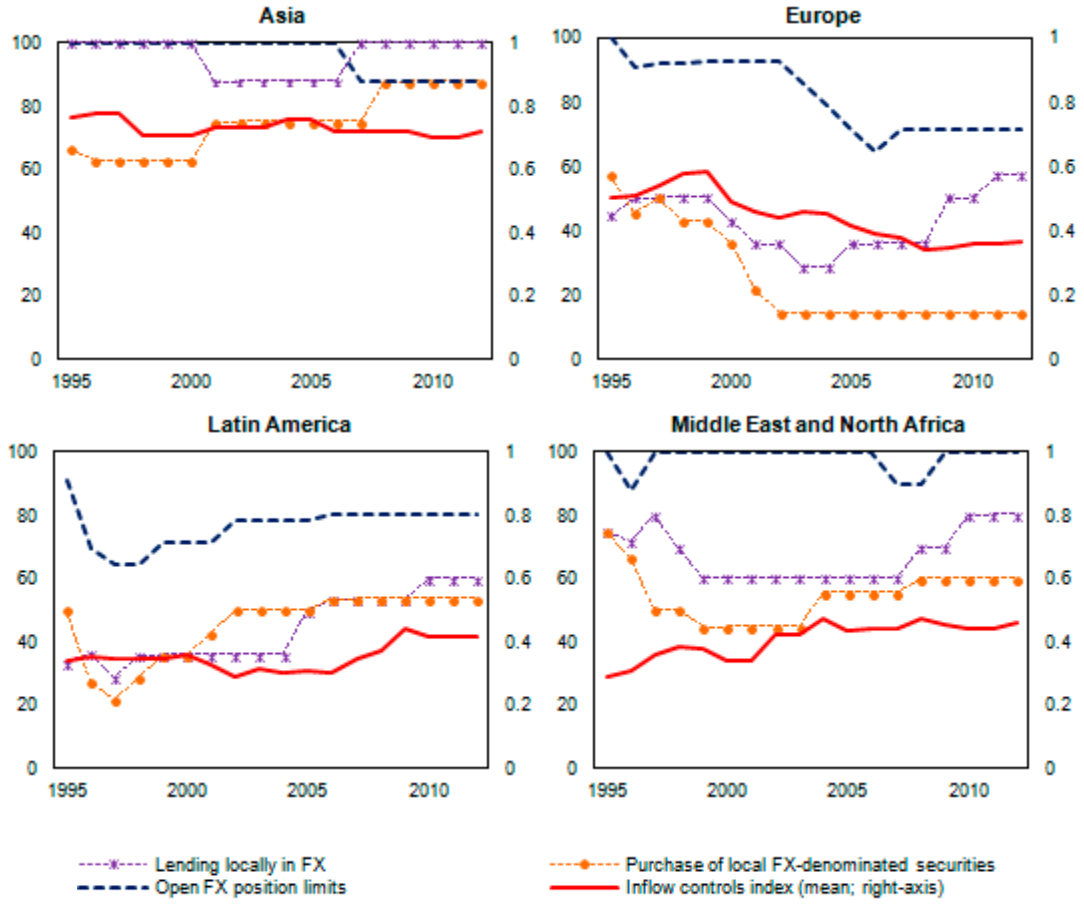
Table A4. IV-2SLS Estimation: Left-Wing Government as Instrument

	[A] First-stage estimates: Left-wing government as instrument[a]															
	Outflow related CARs								Inflow related CARs							
Dependent variable	Overall	Bonds	Equity	DI	FC	Nonres. lending	Acc. abroad	Open FX limit	Overall	Bonds	Equity	DI	FC	Local FX	Local FX	Open FX limit
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
Left-wing govt.	0.011***	0.003	0.003**	0.020***	0.015***	0.010***	0.008***	0.034***	0.004***	0.016***	0.014***	0.007***	0.003	0.016***	-0.003*	0.015***
	(0.001)	(0.002)	(0.001)	(0.002)	(0.003)	(0.001)	(0.001)	(0.003)	(0.001)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.003)
Observations	20,594	20,594	20,594	20,594	20,594	20,594	20,594	20,594	17,345	17,345	17,345	17,345	17,345	17,345	17,345	17,345
R2	0.933	0.917	0.938	0.932	0.910	0.954	0.948	0.915	0.928	0.901	0.904	0.902	0.901	0.915	0.940	0.909
F-test (p-value)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	[B] Second-stage estimates: Monetary freedom as exogenous variable[b]															
Overall controls	-3.975***								-2.428**							
	(1.144)								(1.139)							
Bond controls		-2.089*								-2.492***						
		(0.925)								(0.770)						
Equity controls			-2.873*								0.049					
			(0.936)								(0.857)					
Direct investment controls				-5.593***								0.831				
				(1.163)								(1.049)				
Financial credit controls					-1.941***								-1.570**			
					(0.580)								(0.706)			
Lending to nonresidents						-6.845***										
						(1.355)										
Maint. of accounts abroad							-1.889									
							(1.287)									
Open FX position limits								0.262								-1.225
								(0.674)								(0.783)
Lending locally in FX														-1.898**		
														(0.885)		
Purchase of local FX sec.															-1.313	
															(1.144)	
Monetary freedom	0.018	0.028	0.022	-0.060	0.026	0.010	0.009	0.021		-0.001	-0.003	0.005	0.005	-0.007	0.003	0.004
	(0.043)	(0.043)	(0.043)	(0.045)	(0.043)	(0.043)	(0.043)	(0.043)		(0.021)	(0.021)	(0.021)	(0.021)	(0.021)	(0.021)	(0.021)
CPFE/TE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	20,594	20,594	20,594	20,594	20,594	20,594	20,594	20,594	17,345	17,345	17,345	17,345	17,345	17,345	17,345	17,345
R2	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05

a/ Panel A reports the first stage estimation results for outflow and inflow related CARs in cols. (1)-(8) and (9)-(16), respectively, where the presence of left-wing government in source/recipient countries is used as an instrument. Log of real GDP and real GDP per capita, real GDP growth, real interest rate, current account balance, exchange rate regime, lagged CAR, and regional dummies for the source side are included in cols. (1)-(8), while those for the recipients are included in cols. (9)-(16). All regressors are lagged one period. Constant and year effects are included in all specifications. F-test (p-value) reports the joint significance of all regressors. Robust standard errors are reported in parentheses. ***, ** and * indicate statistical significance at the 1, 5 and 10 percent levels, respectively.

b/ Panel B reports the two-stage least squares estimates with (log of) bank asset flows from country i to country j as the dependent variable. CARs are predicted values obtained from the corresponding first stage regression in Panel A. Control variables as specified in Table 4, country-pair/year effects, and constant are included in all specifications. Standard errors computed with jackknife (1,943 replications) are reported in parentheses. ***, ** and * indicate statistical significance at the 1, 5, and 10 percent levels, respectively.

Figure A2. Inflow-Related Capital Controls and Prudential Measures in EMs, 1995–2012
(in percent of observations)



Source: Based on IMF's AREAER and the OECD Code of Liberalization of Capital Movements (various issues).