

WP/14/8

IMF Working Paper

Effectiveness of Capital Outflow Restrictions

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IMF Working Paper

Strategy, Policy, and Review Department

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January 2014

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Abstract

This paper examines the effectiveness of capital outflow restrictions in a sample of 37 emerging market economies during the period 1995-2010, using a panel vector autoregression approach with interaction terms. Specifically, it examines whether a tightening of outflow restrictions helps reduce net capital outflows. We find that such tightening is effective if it is supported by strong macroeconomic fundamentals or good institutions, or if existing restrictions are already fairly comprehensive. When none of these three conditions is fulfilled, a tightening of restrictions fails to reduce net outflows as it provokes a sizeable decline in gross inflows, mainly driven by foreign investors.

JEL Classification Numbers: F3, F65, E5

Keywords: Capital flows, Capital controls, Emerging economies

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I. INTRODUCTION¹

1. **There is a renewed interest among academics and policymakers in the use of capital account restrictions for managing large and often volatile capital flows.** In the run-up to the global financial crisis, many countries, particularly in Central and Eastern Europe, experienced capital inflow-fueled booms that initially led to appreciation pressures, tied the hands of monetary policy makers, and, finally, resulted in busts as inflows dried up or reversed. Such boom-bust cycles have hit a number of emerging market economies over the years and often ended in protracted growth slowdowns (Reinhart and Reinhart, 2008). Capital flow restrictions are one policy alternative that could help manage capital flows.²
2. **The literature on capital account restrictions focuses on inflow restrictions despite the fact that outflow restrictions could also be an effective policy tool.** Several studies have shown that in many cases a tightening of inflow restrictions successfully reduced appreciation pressures, allowed for more independent monetary policy, and tilted the composition of flows toward longer term investments (Dooley, 1996; Ariyoshi et al 2000; Baba and Kokenyne 2011; Magud, Reinhart, and Rogoff, 2011; and Ostry et al, 2011). A tightening of outflow restrictions, in turn, could help reduce net outflows once inflow pressures reverse, providing time for more fundamental policy adjustment.
3. **Event studies find only limited evidence for the effectiveness of a tightening of outflow restrictions in reducing net capital outflows.** Such studies suggest that tightening often either failed to visibly affect capital flows altogether or did so only for a short time (Ariyoshi et al, 2000; Magud et al, 2011). One widely cited exception is the case of Malaysia, where following a tightening of restrictions in September 1998, capital flight came to a halt, allowing reserves to rise back to pre-crisis levels, the exchange rate to stabilize, and interest rates to fall. A more recent case that is widely seen as a success is the control tightening in Iceland at the height of the global financial crisis in November 2008, which limited capital outflows and allowed the *krona* to stabilize. In other cases - including in Thailand in 1997 and the Ukraine in 2008 - the tightening of restrictions did not visibly alleviate outflow pressures (Box 1 discusses these four cases in more detail). The conclusions that can be drawn from event studies should not be overestimated, however. Inference is complicated by the fact that restrictions are often introduced or tightened in reaction to rising capital flows and it is not known how flows would have evolved had controls not been adjusted.

¹ We would like to thank Ranil Salgado, Vivek Arora, and participants at an IMF seminar in 2011 for valuable comments. We are grateful to Tushara Ekanayake and Emmanuel Hife for excellent research assistance and to Pascal Towbin and Sebastian Weber for sharing their Matlab toolkit for panel VARs with interaction terms.

² The term “capital flow restrictions” encompasses restrictions to inflows and outflows for both residents and non-residents. A tightening of outflow restrictions in the index we use in this paper could reflect a tightening in outflow restrictions for residents or non-residents or both.

4. **The few studies that analyze the workings of outflow restrictions econometrically find some evidence in favor of their effectiveness in limited country samples.** Miniane and Rogers (2007) find capital flow restrictions to be ineffective in insulating countries from foreign monetary policy shocks. However, this study does not distinguish between inflow and outflow restrictions. Binici and others (2010) focus on outflow restrictions and find that these are more effective in advanced economies than in other countries, perhaps due, in part, to better institutional and regulatory quality.³ A concern regarding this paper is that it treats capital flow restrictions as exogenously determined. Since outflow restrictions tend to be introduced in response to rising capital outflows, a failure to allow for endogeneity in the regressions would likely bias the results toward depicting restrictions as less effective than they are.

³ Conversely, one could reasonably expect restrictions to be more effectively implementable in less developed countries in which financial transactions are typically less complex financial markets are smaller.

Box 1. Selected Country Experiences with Outflow Restrictions

This Box examines the experiences of Thailand (1997), Malaysia (1998), the Ukraine (2008-09) and Iceland (2008) with imposing or tightening capital outflow restrictions during crisis episodes. In all cases the desire of the authorities to reduce capital outflows and stabilize exchange rates was a premier motive for the tightening.

Thailand

Faced with speculative attacks during the Asian crisis, and amidst concerns that excessive interest rate hikes would hamper economic activity, the Thai authorities imposed capital flow restrictions in May 1997 to restrict speculators' access to funds denominated in domestic currency. While these measures were mainly aimed at foreign speculators, the restrictions also affected residents. The measures included limits on forward transactions, export surrender requirements, and requirements for baht proceeds from sales of stocks to be converted at the onshore exchange rate. The implementation of these restrictions in Thailand did not succeed in halting the depreciation of the exchange rate (50 percent six months after implementation) and the dramatic decline in reserves (20 percent six months after implementation); interest rates continued to rise after restrictions were implemented. Furthermore, substantial differentials between offshore and onshore rates provided incentives for investors to circumvent the restrictions. The authorities had to abandon the peg in July 1997, and lifted restrictions altogether in January 1998 (Ariyoshi et al., 2000, and Edison and Reinhart, 2000).

Malaysia

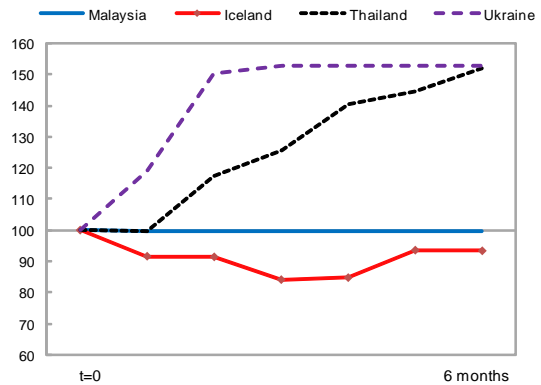
Amid concerns about the fragility of Malaysia's financial sector, the ringgit came under attack in the fall of 1998. After trying to attenuate outflows by increasing interest rates, the authorities imposed a comprehensive set of restrictions in September 1998 that closed all legal channels for offshore trading of the national currency. While these measures were mainly aimed at foreign speculators, the restrictions also affected residents. The restrictions included measures to limit the international convertibility of the ringgit such as a requirement of a 12-month waiting period for non-residents to convert ringgit proceeds from the sale of Malaysian securities (Ariyoshi et al., 2000, Abdelal and Alfaro, 2003, and Sharma, 2003). The restrictions provided room for the authorities to accumulate reserves amid a stable exchange rate and enact policies aimed at revitalizing the economy, such as reducing interest rates.

Iceland

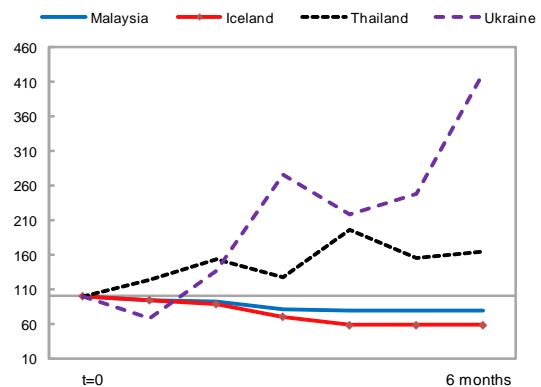
Following the onset of the global financial crisis in 2007-08 and the collapse of Iceland's three largest commercial banks — with very large short-term

Evolution of Economic Indicators Following Tightening of Outflow Restrictions
($t=0$ is month in which outflow control restrictions were tightened)

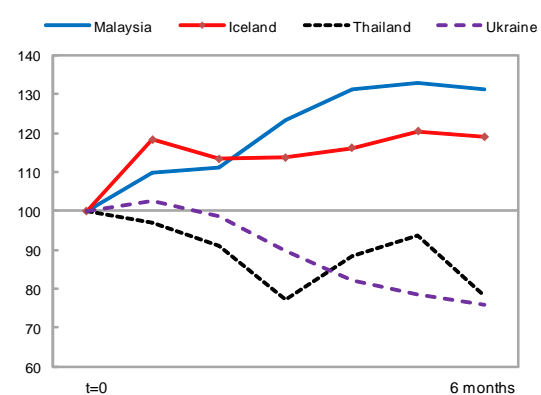
Nominal Exchange Rates
(Index=100 at $t=0$)



Nominal Interest Rates
(Index=100 at $t=0$)



International Reserves
(Index=100 at $t=0$)



Source: IFS

foreign liabilities (600% of GDP) — the government introduced comprehensive outflow restrictions in November 2008 to stabilize the exchange rate. Measures included restrictions on capital transactions for residents and nonresidents alike, such as bans on the movement of capital with some exceptions below ISK 10 million and on the conversion of offshore krona to foreign exchange. Foreign exchange transactions with respect to external trade remained unrestricted. The exchange rate stabilized shortly after restrictions were imposed. The restrictions also provided room for a number of other stabilization policies including the easing of monetary policy to help revitalize the economy. The authorities intend to lift restrictions gradually as conditions allow.

Ukraine

The 2008 crisis affected Ukraine through a collapse of exports, a sharp deterioration of the terms of trade, and a reversal of capital inflows, amidst vulnerabilities that were building up in the financial sector. At the peak of the crisis, in an attempt to stem outflows and defend the exchange rate, the central bank introduced a number of measures including the imposition of exchange restrictions and a 5-day waiting period for non residents to convert hryvnia proceeds from investment transactions to foreign currency. While some measures may have helped alleviate exchange rate pressures temporarily, they failed to alleviate a need for massive central bank intervention (causing international reserves to plummet 30 percent six months after the tightening of exchange restrictions). Policy slippages that constrained the government's ability to restore confidence in the financial system also undermined by the effectiveness of the capital flow restrictions.

5. **This paper investigates econometrically whether, and under what conditions, a tightening of outflow restrictions can be used effectively to reduce net capital outflows.** An additional criterion of effectiveness is the extent to which control tightening facilitates exchange rate and interest rate stabilization, and allows policymakers to gain monetary policy independence. The analysis covers a sample of 37 emerging market economies during 1995-2010. We use a panel vector autoregression (PVAR) methodology to allow for the endogeneity of capital flow restrictions. In order to identify conditions for effectiveness, we follow Towbin and Weber (2011) and add interaction terms to the baseline PVAR. The interaction terms are calculated as products between the right hand side variables and indicators of structural characteristics that might determine the effectiveness of restrictions. This allows us to compute impulse response functions that are conditional upon these characteristics.

6. **Candidate conditions include institutional quality, macroeconomic fundamentals, and the tightness of pre-existing restrictions.** This choice of conditions was inspired in part by studies that conjectured that initial conditions such as solid macroeconomic conditions (i.e., fiscal surpluses, low inflation, or robust GDP growth) or strong institutions (i.e., political stability or government effectiveness) should receive part of the credit for the fact that Malaysia got through its crisis better than many other countries (Dornbusch, 2001, Hutchinson, 2001, and Johnson et al., 2006). The choice was also inspired by the thought that restrictions may need to be fairly tight to be effective in the context of rising economic strains that typically surrounds the tightening of outflow restrictions.

7. **Our findings suggest that a tightening of outflow restrictions is effective if it is supported by strong macroeconomic fundamentals or good institutions, or if pre-existing restrictions are already fairly comprehensive.**⁴ When estimating the PVAR in the absence of any interaction terms, we find that a tightening of outflow restrictions on average reduces gross capital outflows. However, there is also a contraction in gross inflows – mainly driven by non-resident investors – which is larger in size than the contraction in outflows. We thus find that for the average country, a tightening of outflow restrictions is ineffective as net outflows increase as a result of it. However, adding interaction terms reflecting a variety of structural country characteristics, we find that restrictions are effective if important preconditions are in place: in countries with good macroeconomic fundamentals, a tightening of restrictions leads to a sizable reduction in net capital outflows. This result is robust to a variety of specification changes. Similarly, a tightening of restrictions is effective in countries with strong institutions, although our findings are slightly less clear cut and robust in this case. Finally, restrictions are effective if the outflow control index is already fairly high at the time of control tightening; in other words, restrictions work if they attain a sufficiently comprehensive level. When none of these three conditions is fulfilled, a tightening of restrictions is ineffective.

8. **The paper does not investigate the impact of long-standing restrictions on capital flows, nor does it assess the benefits and costs of capital flow management measures.** Klein (2012) finds some empirical evidence that longstanding inflow restrictions are effective in lowering values of variables associated with financial vulnerability. We are not aware of similar work on longstanding outflow restrictions.

9. **The paper is organized as follows:** Section II presents the data and our empirical approach. Section III presents the estimation results, section IV discusses robustness, and Section V concludes.

II. DATA AND EMPIRICAL APPROACH

10. **The analysis covers 37 emerging markets that were chosen based on data availability** (Table 1). In particular, for a country to be included in our sample, quarterly data for the period 1995Q1-2010Q4 had to be available for all major variables in our model.⁵ We measure outflow restrictions using Fund staff's narrow de jure restrictiveness index.⁶

⁴ The three findings are independent of each other.

⁵ The sample has been selected on the basis of data availability at the required frequencies. An important criterion has been the start of the data set before the Asian financial crisis during which a variety of emerging market economies implemented capital outflow restrictions in order to prevent capital flight. We exclude countries with capital control indices that were zero throughout the sample period.

⁶ The index was used in the studies underpinning the IMF's new institutional view on capital controls: <http://www.imf.org/external/pubs/ft/survey/so/2012/POL120312A.htm>.

Building on the index proposed by Schindler (2009), this index distinguishes outflow from inflow restrictions and is available for a large sample of countries over an extended period of time.⁷ Table 2 provides definitions and sources, Table 3 presents summary statistics of selected variables, and Table 4 shows outflow restrictions based on the Schindler index for the countries in our sample.

11. **The paper uses net capital flow concepts in line with standard IFS terminology, and gross capital flow concepts following Schindler (2009).** IFS classifies net capital inflows as the sum of net flows of assets and net flows of liabilities. Net flows of assets is the sum of outward FDI, portfolio investment assets, and other investment assets; net flows of liabilities the sum of inward FDI, portfolio investment liabilities, and other investment liabilities.⁸ In the literature, net flows of assets is often called “gross outflows,” and net flows of liabilities “gross inflows.” This terminology can be confusing, however, since it allows “gross inflows” and “gross outflows” to be either positive or negative, while normally gross concepts cannot be negative. In this paper, we therefore use crude measures of gross inflows and gross outflows. In the absence of a better alternative, we follow Schindler (2009) in assuming that any net inflow of assets (liabilities) represents a gross inflow of assets (liabilities) of the same magnitude, and that any net outflow of assets (liabilities) represents a gross outflow of assets (liabilities) of the same magnitude. We thus define gross flows as follows: gross inflows reflects inflows of funds related to changes in the holdings of assets and liabilities, subject to the adjustment that when changes in assets or liabilities give rise to an outflow, the respective flow is set to zero (formally: gross inflows = $\max(\text{net assets flows}, 0) + \max(\text{net liabilities flows}, 0)$). Similarly, gross outflows reflects outflows of funds related to changes in the holdings of assets and liabilities, subject to the adjustment that when changes in assets or liabilities give rise to an inflow, the respective flow is set to zero (formally: gross outflows = $\max(-\text{net assets flows}, 0) + \max(-\text{net liabilities flows}, 0)$). Gross in- and outflows will thus never be negative.

⁷ The index uses publicly available information from the IMF’s Annual Report on Exchange Arrangements and Exchange Restriction (AREAER). It exploits the IMF’s post 1996 disaggregated reporting of different categories of capital transactions. The difference between the Schindler index and staff’s narrow restrictiveness index is that the former includes a limited qualitative assessment of restrictions while the latter does not. For the period of the availability of the Schindler index (up to 2005), the correlation between the two indices is 92 percent. As the index is only available at annual frequency, the annual value was assigned for each quarter in that year.

⁸ In IFS, all entries under assets denote net transactions between residents and non-residents concerning claims on non-residents; and all entries under liabilities denote net transactions between residents and non-residents concerning claims on residents. For all asset components and all liabilities components, a positive sign signals an inflow into the home economy while a negative sign denotes an outflow.

Table 1. Country Sample

Argentina	Iceland	Poland
Armenia	India	Romania
Bangladesh	Indonesia	Russia
Bolivia	Israel	South Africa
Brazil	Jordan	Sri Lanka
Bulgaria	Kazakhstan	Thailand
Chile	Korea	Philippines
China	Latvia	Turkey
Colombia	Lithuania	Ukraine
Croatia	Malaysia	Venezuela
Czech Republic	Mexico	Singapore
Estonia	Morocco	
Hungary	Peru	

Table 2. Definitions and Sources of Variables

Variable	Description	Source
Net inflows	Net assets plus net liabilities, in percent of GDP	IMF, IFS
Outflow/inflow control indices	Index of Financial Openness: ranges 0-1, from least to most regulated	IMF staff compilation based on Schindler (2009)
Industrial production index	Seasonally adjusted	IMF, IFS
Interest rate	Nominal, three months	Haver Analytics
Real GDP	In 2005 US dollars	IMF, WEO
Inflation	End of period, percent change	IMF, WEO
Real exchange rate	USD per LCU (CPI based)	IMF, IFS
Institutional quality	Government effectiveness	World Bank, WGI
Macroeconomic fundamentals	Growth	IMF, WEO
	Inflation	IMF, WEO
	Fiscal balance, in percent of GDP	IMF, WEO
	Current account, in percent of GDP	IMF, WEO
Capital market size	Stock market capitalization, in percent of GDP	Standard & Poor's

Table 3. Summary Statistics of Selected Variables, 1995-2010

Variable	Mean	Standard Deviation	10th Percentile	25th Percentile	50th Percentile	75th Percentile	90th Percentile
Outflow control index	0.6	0.4	0.0	0.3	0.8	1.0	1.0
Net inflows/GDP	3.1	11.1	-5.0	-0.7	1.4	6.6	12.8
Gross inflows/GDP	10.1	19.3	0.0	1.1	4.8	12.3	21.1
Gross outflows/GDP	7.0	17.4	0.0	0.3	2.0	6.7	12.8
Net assets/GDP	-5.4	18.6	-1.6	0.1	1.7	5.9	13.7
Net liabilities/GDP	8.5	19.5	-1.0	0.8	4.1	11.2	20.0
Macro fundamentals index	16.0	5.3	9.0	12.3	16.3	19.8	22.5
o/w GDP growth (y/y percent change)	3.5	4.8	-2.7	1.1	4.2	6.4	8.9
Inflation (y/y percent change)	6.5	6.3	0.1	2.3	6.5	8.9	10.9
Current account surplus (as a share of GDP)	-0.1	1.9	-2.0	-1.1	-0.3	0.7	2.2
Fiscal surplus (as a share of GDP)	-2.4	4.4	-7.3	-4.8	-2.8	-0.5	2.6
Government effectiveness index	0.3	0.7	-0.6	-0.2	0.1	0.7	1.2

Table 4. Outflow Restrictions (Schindler), 1995 and 2010

	1995	2010		1995	2010
Argentina	0.33	0.83	Korea	0.67	0.00
Armenia	0.50	0.00	Latvia	0.00	0.00
Bangladesh	0.50	0.83	Lithuania	0.00	0.33
Bolivia	0.00	0.67	Malaysia	0.83	1.00
Brazil	0.25	0.67	Mexico	0.42	0.83
Bulgaria	0.83	0.00	Morocco	0.58	1.00
Chile	0.83	0.50	Peru	0.00	0.00
China	0.83	1.00	Poland	0.58	1.00
Colombia	0.75	0.83	Romania	0.83	1.00
Croatia	0.67	0.58	Russia	0.75	0.00
Czech Republic	0.67	0.75	South Africa	0.80	0.17
Estonia	0.00	0.00	Sri Lanka	0.00	0.17
Hungary	0.83	0.60	Thailand	0.75	0.92
Iceland	0.00	0.92	Philippines	0.80	1.00
India	0.83	1.00	Turkey	0.75	1.00
Indonesia	0.20	0.50	Ukraine	0.42	0.83
Israel	0.58	0.00	Venezuela	0.80	1.00
Jordan	0.58	0.00	Singapore	0.17	0.33
Kazakhstan	0.67	1.00			

12. **A deterioration of macroeconomic conditions or a reduction in net inflows typically precedes the use of outflow controls.**

Table 5 lists 24 periods of significant outflow control tightening in our sample. About two thirds of these are associated with deterioration in macroeconomic conditions and/or net capital outflows. Further, Figure 1 illustrates that control tightening episodes tend to cluster around crisis periods such as the Asian crisis, the Argentinean economic crisis and the global financial crisis.

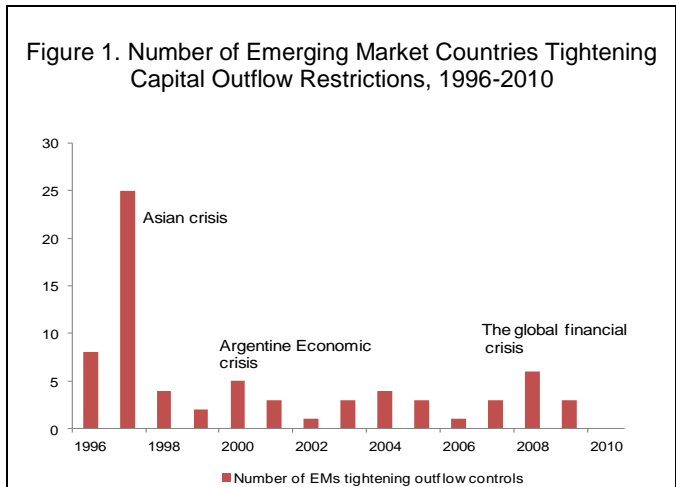


Table 5. Selected Characteristics of Countries that use Outflow Controls

Country	Outflow Control	Crisis (curr or +/- 1 period)	Macroeconomic Fundamental	Net flows	Preexisting control
	Tightening Episodes				
	1/	3/	4/	5/	6/
Argentina	1997	1			
	2001	1	1	1	
	2002	1	1		1
	2003-2004	1			1
Bangladesh	1997				1
Bolivia	2007 ²				
Brazil	1997-1998	1		1	
	2000				
	2003		1	1	
	2009		1	1	
Bulgaria	1997	1	1		
	2001		1		1
Chile	1997	1	1		1
	2008 ²				
China	1997	1			1
	2000		1		1
Colombia	1997	1		1	1
	1999	1		1	1
	2004				1
Croatia	1996		1		1
	1999	1	1		
	2003		1	1	1
	2007		1	1	
	2008		1	1	
Czech Republic	1996 ²	1	1		1
	2003 ²				

Table 5 cont. Selected Characteristics of Countries that use Outflow Controls

Country	Outflow Control	Crisis (curr or +/- 1 period)	Macroeconomic Fundamental	Net flows	Preexisting control
	Tightening Episodes				
	1/	3/	4/	5/	6/
Hungary	1997			1	1
	2005 ^{2/}				
Iceland	2006			1	
	2000				
	2008	1		1	1
	2009	1		1	1
India	1997		1		1
Indonesia	1997	1	1	1	
	2000	1	1		
	2008			1	
Israel	1997		1	1	
Kazhakstan	1996, 1997	1			1
Korea	1997	1	1	1	
	1998	1	1		1
	2005			1	1
Lithuania	2008 ^{2/}				
Malaysia	1997	1			1
Mexico	1996 ^{2/}	1			
	1997	1		1	
	2005			1	1
Morroco	1996				1
	1997				1
	2002 ^{2/}		1		1
Poland	1997		1		1
	2004		1	1	1
	2009			1	1
Romania	1996, 1997	1	1		1
Russia	1997	1			1
	2004 ^{2/}				1
South Africa	1997		1		1
Sri Lanka	1996		1		1
Thailand	1997	1		1	1
	2004 ^{2/}		1		1
Philippines	1996	1			1
	1997	1	1	1	1
Turkey	1997	1			
	1998	1		1	
	2001	1	1		
	2005				1
Venezuela	1997	1	1		
	2007			1	
Singapore	1997 ^{2/}		1		
	1998				
	2000				
	2008		1	1	

1/ Column 1 shows the years in which there was at least a one standard deviation increase in Outflow index (OCI).

2/ There was an increase in Outflow index (OCI) by more than 10% although this was less than one standard deviation.

3/ The country experienced a systemic, debt, or currency crisis either during, the year before or after the year of imposition of outflow controls.

Data on crisis is from 'IMF Working Paper "Systemic Banking Crises Database: An Update" Luc Laeven and Fabian Valencia (2012)

4/ "1" is a deterioration in macrofundamentals during or in the year before the outflow control tightening episode.

5/ "1" is a decrease in net flow by at least 1 standard deviation during or in the year before the outflow control tightening episode.

6/ "1" means the level of the OCI at the time of the outflow control tightening episode is above the sample median.

13. **The baseline model is a PVAR that includes the capital control index alongside important controls such as a variety of capital flow variables.** This approach, previously used by Miniane and Rogers (2007), allows treating all variables as potentially endogenous.⁹ In particular, in the baseline panel VAR, we assume that the relationships between the variables of interest are governed by a system of structural equations that, ignoring the constant term, can be written as:

$$A_0 y_t = A_1 y_{t-1} + \dots + A_p y_{t-p} + \varepsilon_t, \quad (1)$$

where y_t is a $(k \times 1)$ vector of endogenous variables including, in the benchmark specification, the outflow control index, industrial production, the interest rate, inflation, the local currency/USD exchange rate as well as a variable capturing net capital flows as a share of GDP (Table 2).¹⁰ The net capital flow variable is selectively replaced by gross inflows and gross outflows as well as net flows of assets and net flows of liabilities in different specifications to gain a better understanding of how a control tightening affects inflows and outflows as well flows of resident and non-resident investments. Here, $l = 1, \dots, p$ is the number of lags of the endogenous variables included in the VAR, ε_t is a $(k \times 1)$ vector of shocks assumed to be uncorrelated with one another, and A_l is a $(k \times k)$ matrix of coefficients.

14. **Impulse response functions are identified by means of a Choleski ordering according to which capital flow restrictions can affect all variables contemporaneously with the exception of output.** The Choleski ordering embodies assumptions about contemporaneous relationships between the endogenous variables in the PVAR. Our baseline ordering is as follows: 1) output, as captured by industrial production, 2) capital outflow control index, 3) real exchange rate, 4) interest rate, 5) inflation, and 6) net capital flows. In this ordering, capital flows are allowed to respond contemporaneously to changes in capital flow restrictions while capital flow restrictions are assumed to respond to changes in flows only with a lag. This ordering reflects the view that well-administered restrictions should be fully effective immediately, on the other hand, the decision to use outflow restrictions takes more time. A case could also be made for an ordering in which capital flows affect restrictions contemporaneously and restrictions affect flows only with a lag. This ordering, while assuming quick policy decision-making, would allow for potential delays in measures to become fully effective (this is plausible especially since we use a de jure rather than a de

⁹ Some studies of capital (inflow) restrictions tried to address endogeneity by using generalized methods of moments (GMM). The consistency of GMM hinges on the assumption that instruments are not weak. This assumption is violated when the variables show high persistence, as is the case for capital flow restrictions.

¹⁰ We use industrial production rather than GDP since for a number of countries GDP data are not available at quarterly frequency.

facto index of restrictions) and for delays in responses by investors to changes in restrictions.¹¹ As both orderings thus have their respective merits, we test the robustness of our results to this alternative ordering (and others).

15. **We augment the baseline specification with interaction terms to determine whether the response to a control tightening depends on structural country characteristics and policies.** The augmented PVAR is based on a panel interaction VAR framework as in Towbin and Weber (2011). The framework can be understood as a generalized panel VAR regression that allows the dynamic interaction between the endogenous variables to vary deterministically with structural country characteristics. We include candidates of structural characteristics in the matrix $indic_i \in (cc, qi, mf)$.¹² The indicator cc represents the index of capital control restrictiveness, and qi , and mf are, respectively, indicators of institutional quality and the quality of macroeconomic fundamentals. In particular, A_l in (1) is no longer modeled as a $(k \times k)$ matrix of coefficients but is now given by

$$\theta_l = \beta_l + \mu_l * indic_i \quad (2)$$

where β_l and μ_l are $(k \times k)$ matrices of coefficients.¹³ In other words, the PVAR now includes not only the right hand side variables of the baseline PVAR but also interaction terms of each of these variables with the structural characteristics in $indic_i$, one at a time, that might be conducive to more effective outflow restrictions. The system in (1) and (2) thus allows conditioning the dynamic relationships between the endogenous variables in the PVAR on a set of structural country characteristics. What is more, we can now derive conditional impulse response functions that can be evaluated at different points of the sample distribution of the respective structural characteristic. In particular, we can evaluate impulse response functions to a control tightening at the 25th and the 75th percentile of each indicator's sample distribution to understand whether the effect of a control tightening is indeed conditional upon the respective indicator.

III. ESTIMATION RESULTS

16. **We begin the empirical analysis by estimating the PVAR in the absence of any interaction terms.** We estimate both the baseline PVAR and the augmented PVAR using two lags and Runkle's bootstrapping technique (Runkle, 1987).¹⁴ In order to allow for

¹¹ Cardoso and Goldfajn (1997) assume that investors may take time to react to changes in restrictions.

¹² All four components of $indic_i$ are calculated as time-invariant country specific averages of the respective country characteristics.

¹³ For a more detailed explanation on the estimation and inference procedure see Towbin and Weber (2011).

¹⁴ We test the robustness of our results to different lag structures in the robustness section.

the heterogeneity of intercepts, we include a full set of country and time fixed effects. The confidence intervals around our point estimates reflect the minimum distance that covers 90 percent of the estimates from 1,000 simulations. Impulse response functions are derived to examine the average response of the main endogenous variables in the model to an exogenous tightening in outflow restrictions. In all cases, the shock is normalized to represent an increase of 0.25 in the index (a control tightening).¹⁵

17. **We find no evidence that a tightening of outflow restrictions is effective on average in our sample.** We estimate the benchmark model first including net inflows as a capital flow variable, and subsequently including net flows in assets and net flows in liabilities as well as, finally, gross inflows and gross outflows.¹⁶ The impulse responses of these capital flow measures are compiled in Figure 2 along with the evolution of the outflow control index. Solid lines represent impulse responses obtained from the OLS point estimates, dashed lines show 90 percent confidence bands. We see that a control tightening reduces gross outflows as intended. However, gross inflows also fall, leading to an increase in net inflows (or a fall in net outflows) that is small and insignificant. The results further suggest that residents respond to the tightening by repatriating investment while non-residents reduce their investments in the domestic economy.. The reaction by non-residents could reflect the expectation that the tightening of outflow restrictions will make non residents' future repatriation of potential investments more difficult.¹⁷

18. **However, a tightening of outflow restrictions could be effective in countries with favorable macroeconomic fundamentals.** This might be the case for example because markets may interpret good macroeconomic fundamentals as an indication of sound policymaking and the ability to address economic challenges effectively. In this situation

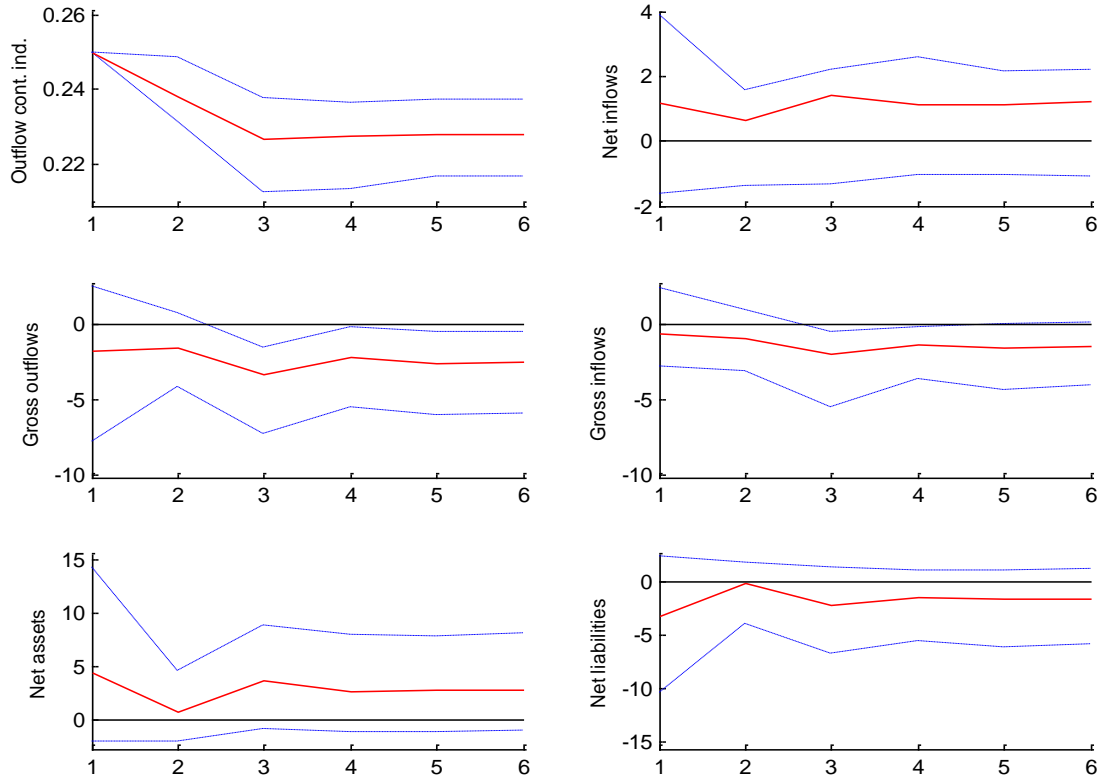
¹⁵ In our sample, the index ranges between 0 (open) and 1 (closed), with a mean of 0.63 and a standard deviation of 0.35 (Table 3).

¹⁶ We analyze the impact of an outflow control tightening on net capital inflows as well as net flows of assets and liabilities and the gross inflow and outflow concepts defined as discussed above. While outflow restrictions are typically designed to affect outflows they can also have an impact on inflows. In identifying the effectiveness of a control tightening our focus is therefore mostly on its impact on net capital inflows.

¹⁷ It is important to note that the results are symmetric in nature. In other words, to the extent that a control tightening raises net inflows, a controls loosening lowers net inflows. Given that in our sample includes many episodes of outflow control liberalization (see Table 4), it could in principle be the case that these are the ones driving the results. We tested the relevance of this concern by conditioning the impulse response functions on a dummy variable that takes the value one if a control tightening occurs in the initial period. The results are fully consistent with those found in the symmetric analysis. If anything, they indicate that control tightenings tend to be somewhat more effective than loosening. However, in both cases, the result holds that their effectiveness depends on a range of factors such as macroeconomic fundamentals, institutions and pre-existing controls (see below).

investors could still consider the country as an attractive investment destination.¹⁸ This argument is in line with results presented in Forbes (2011) suggesting that capital flow restrictions work mainly through changes in investor expectations and sentiment.

Figure 2. Impulse Responses to an Unexpected Increase in the Outflow Controls Index



Solid line OLS point estimates. Dashed lines are 90% confidence bands. The shock to the outflow control index is normalized to be equal to 0.25. The responses of all variables are changes in percent of GDP.

¹⁸ In the case of Korea, the capital inflow control measures deployed in June and November 2010 were associated with an increase in equity prices and appreciation of the won, consistent with an increase (rather than a reduction) in inflows IMF (2011).

19. **In order to test this hypothesis, we construct a time-varying composite index of macroeconomic fundamentals.** We rank the countries in the sample along four dimensions - growth, inflation, fiscal and current account balances - and compute a country's overall fundamentals rank at time t as the simple average of its four ranks in that period. Estimating the PVAR with interaction terms based on this measure then allows us to derive conditional impulse response functions which we evaluate at different points of their sample distribution to study how the effects of outflow restrictions differ between countries with stronger (75th percentile) and weaker (25th percentile) fundamentals relative to the rest of the sample. While our ranking procedure can only inform about the relative quality of fundamentals in relation to the sample distribution, our sample of 37 - mainly emerging - economies appears sufficiently large to be representative of the emerging market universe. In particular, the 75th percentile (25th percentile) of the sample distribution displays an average growth rate of 6.4 (1.1) percent, an average inflation rate of 8.9 (2.3), an average current account balance of 0.7 (-1.1) percent of GDP and an average fiscal balance of -0.5 (-4.8) percent of GDP (Table 3).

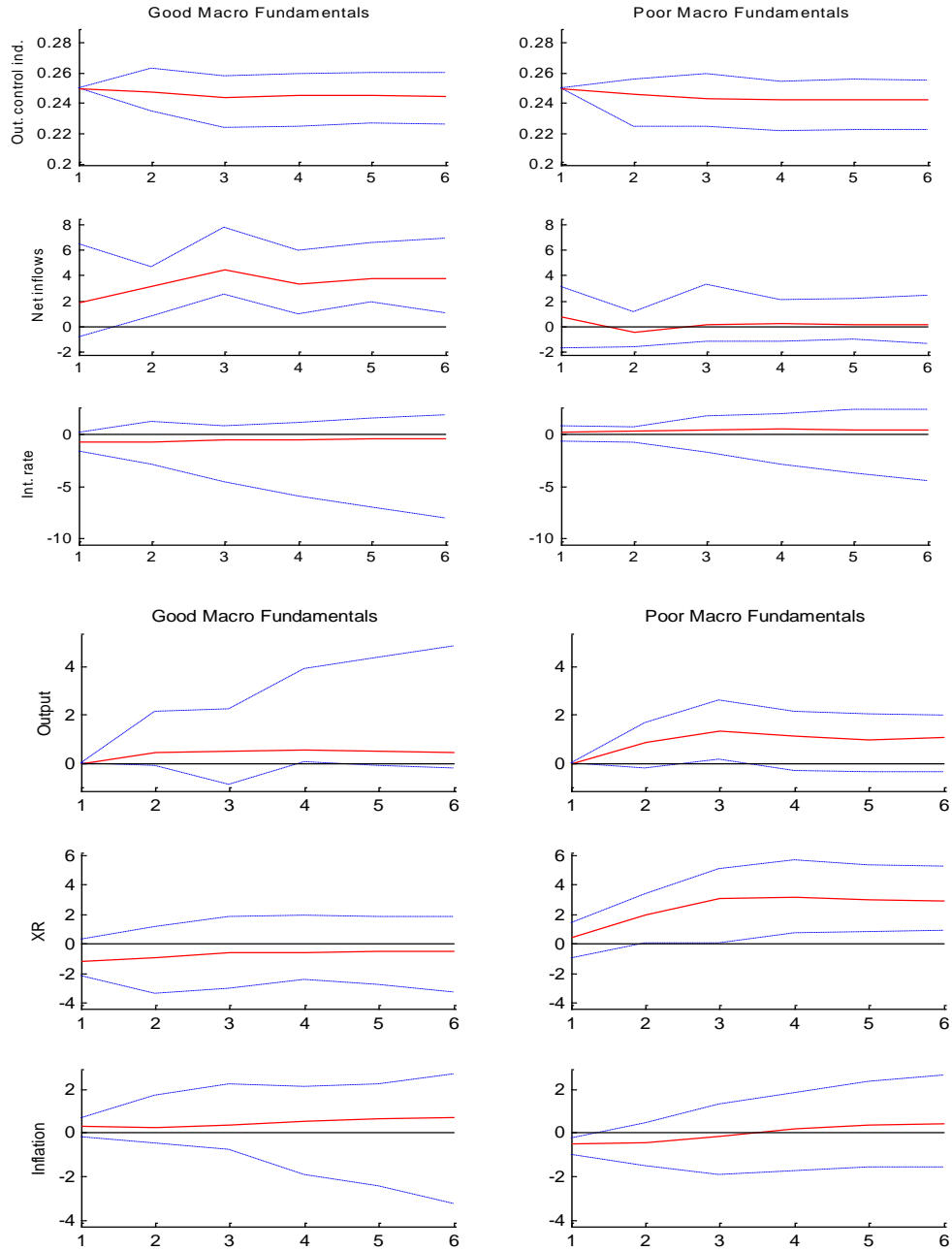
20. **We find that restrictions are effective in countries with better macroeconomic fundamentals.** The findings suggest that a control tightening increases net inflows at the peak by 4 percent of GDP, keeping them elevated for more than one and a half years (Figures 3a and 3b). There is only a small and statistically insignificant decline in gross inflows, and the substantial fall in gross outflows dominates. At the same time, the real exchange rate appreciates, and interest rate falls, even if not in a statistically significant manner. There is also a substantial boost in industrial production, thanks possibly to higher net capital inflows and lower interest rates. In sum, the results suggest that a control tightening leads to an increase in net capital inflows that halts the depreciation of the exchange rate and gives policy space to allow for lower interest rates, boosting economic activity.

21. **Relatedly, outflow restrictions could be effective in countries with well functioning institutions.**¹⁹ Indeed, an additional reason why restrictions are effective in economies with strong fundamentals might be that these countries tend to benefit from a favorable institutional environment. Well-functioning institutions may help countries achieve strong macroeconomic fundamentals.²⁰ They may also signal an ability to implement restrictions effectively and in a manner that protects private property and creditor rights. In particular, strong institutions may create more transparency, strengthen the rule of law and limit regulatory uncertainty, for example with respect to exit strategies. A solid institutional environment should thus increase investor confidence.

¹⁹ The findings for macro fundamentals, institutional quality and the comprehensiveness of restrictions are mutually independent although a correlation between the three measures certainly exists,

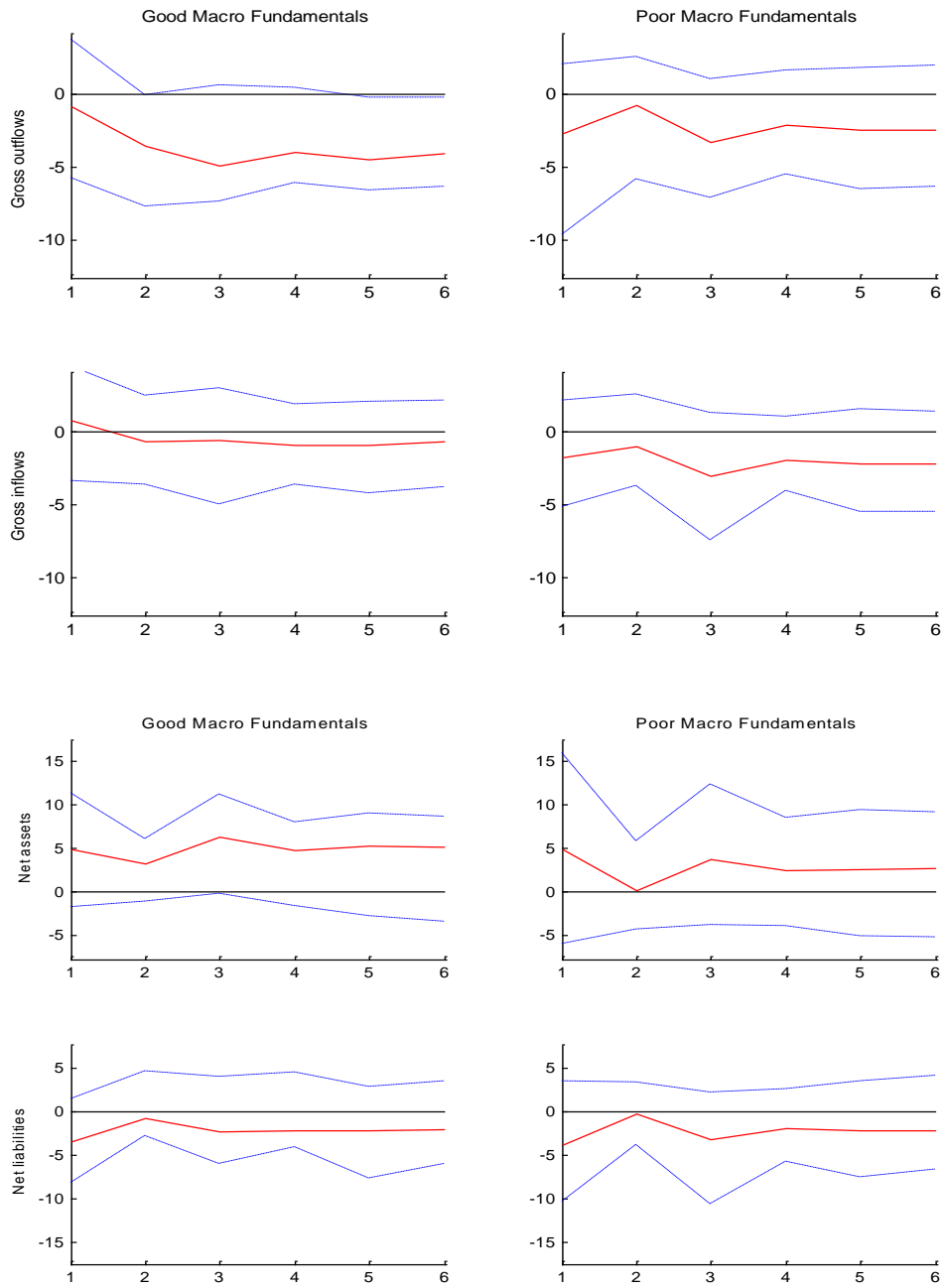
²⁰ North (1990) and Mauro (1995) argue that high levels of corruption and government ineffectiveness negatively affect economic growth. Hall and Jones (1999) document that institutions and government policies determine cross-country differences in investment, productivity, and output per worker. And Acemoglu, Johnson and Robinson (2005) provided evidence that differences in economic institutions are the fundamental cause of differences in long-run growth.

Figure 3a. Impulse Responses by Macroeconomic Fundamentals



Solid line OLS point estimates. Dashed lines are 90% confidence bands. The shock to the outflow control index is normalized to be equal to 0.25. The responses of industrial production and the real exchange rate are in percent. The response of inflation and the interest rate is in percentage points. The responses of all the net inflow variable is in percent of GDP.

Figure 3b. Impulse Responses by Macroeconomic Fundamentals: Including Flows in Net Assets and Net Liabilities as well as Gross Inflows and Gross Outflows Instead of Net Inflows



Solid line OLS point estimates. Dashed lines are 90% confidence bands. The shock to the outflow control index is normalized to be equal to 0.25. The responses of all variables are changes in percent of GDP.

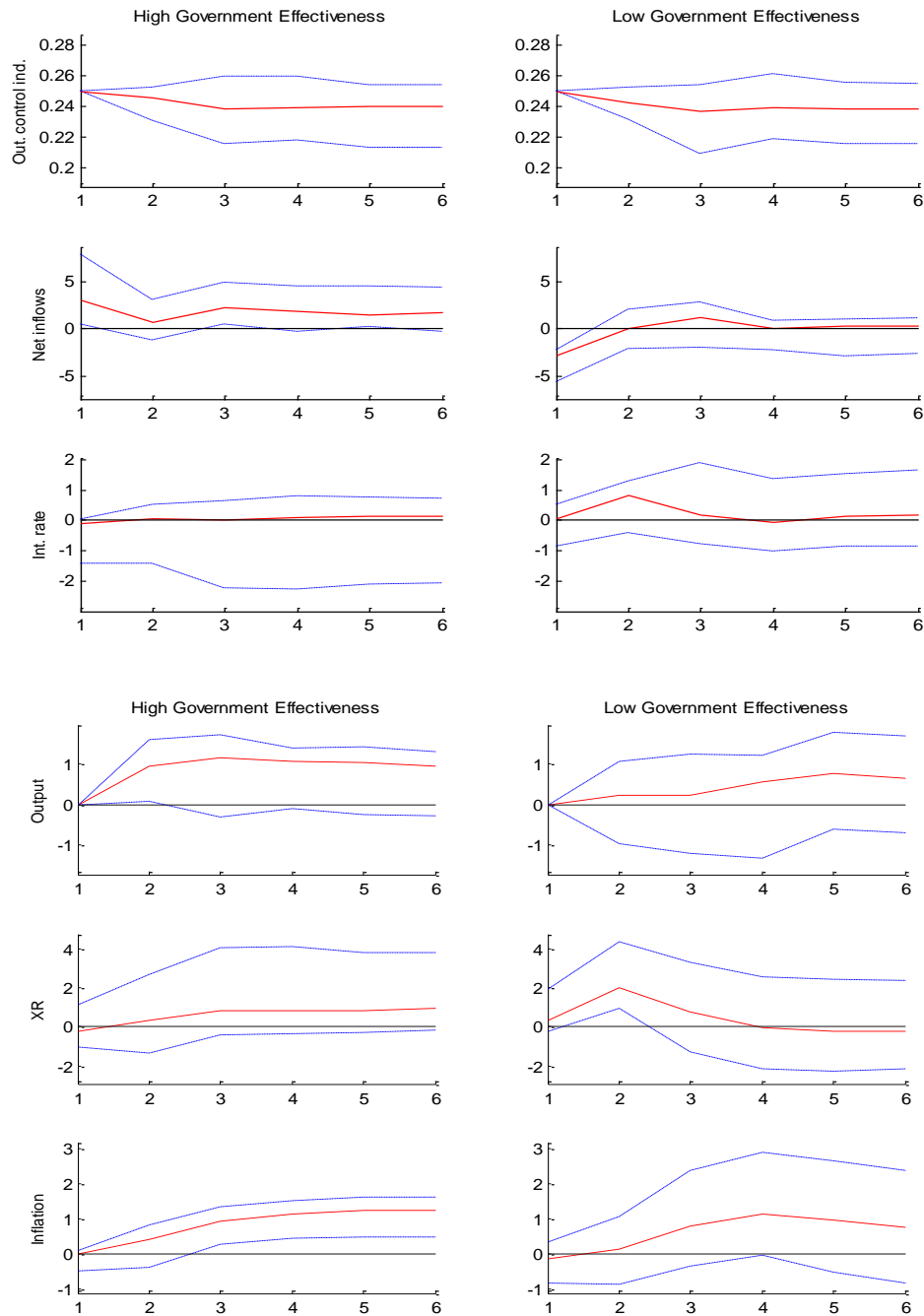
22. **We do indeed find that control tightening is effective in countries with strong institutions**, notwithstanding the fact that the impulse responses are less pronounced than for countries with good fundamentals. We measure the quality of institutions using the World Bank's government effectiveness index.²¹ Figures 4a and 4b present impulse response functions at high and low levels of government effectiveness (75th and 25th percentiles of the indicator or values of 0.7 and -0.2 respectively). We find that restrictions are indeed effective at countering capital flight when institutional quality is high, although the responses of interest rates and the real exchange rate are relatively muted. In particular, net inflows increase by about 3 percent of GDP on impact and 2 percent thereafter in response to the shock. Conversely, restrictions are ineffective in the presence of low institutional quality. Similar results are obtained for different indicators of institutional quality such as measures of political stability, regulatory quality, and control of corruption taken from the Worldwide Governance Indicators project.

23. **Further, the results suggest that further restrictions are effective in countries with fairly comprehensive pre-existing controls.** Stops or reversals in inflows are often sudden events, suggesting feedback effects between investor decisions with correspondingly strong investor incentives to pull funds out. Only comprehensive restrictions might be able to slow such a "rush to the exit." We evaluate impulse response functions at different starting levels of the capital control index. Figures 5a and 5b show the impulse responses to an increase in restrictions starting from high (75th percentile of outflow control intensity or a value of 1) and low (25th percentile of outflow control intensity or a value of 0.3) levels of pre-existing restrictions. Where pre-existing restrictions are fairly comprehensive, net inflows increase significantly – by about 5 percent of GDP on impact and 2.5 percent for the following 6 quarters – when these are further tightened. This is because the control tightening leads to a larger decline in gross outflows than in gross inflows. Surprisingly, the exchange rate depreciates in response to the tightening, the opposite of the expected effect, while interest rates show a fairly muted response. In contrast, where restrictions are tightened but do not attain a minimum level of comprehensiveness, a control tightening shows little effect on gross or net flows. As a result, output increases in response to a tightening in the presence of significant pre-existing controls while it does not in their absence.²²

²¹ This index, based on 17 component sources, measures the quality of public services, the quality of the civil service and the degree of its independence from political pressures, the quality of policy formulation and implementation, and the credibility of the government's commitment to such policies. The index values range from -2.5 (very poor performance) to +2.5 (excellent performance).

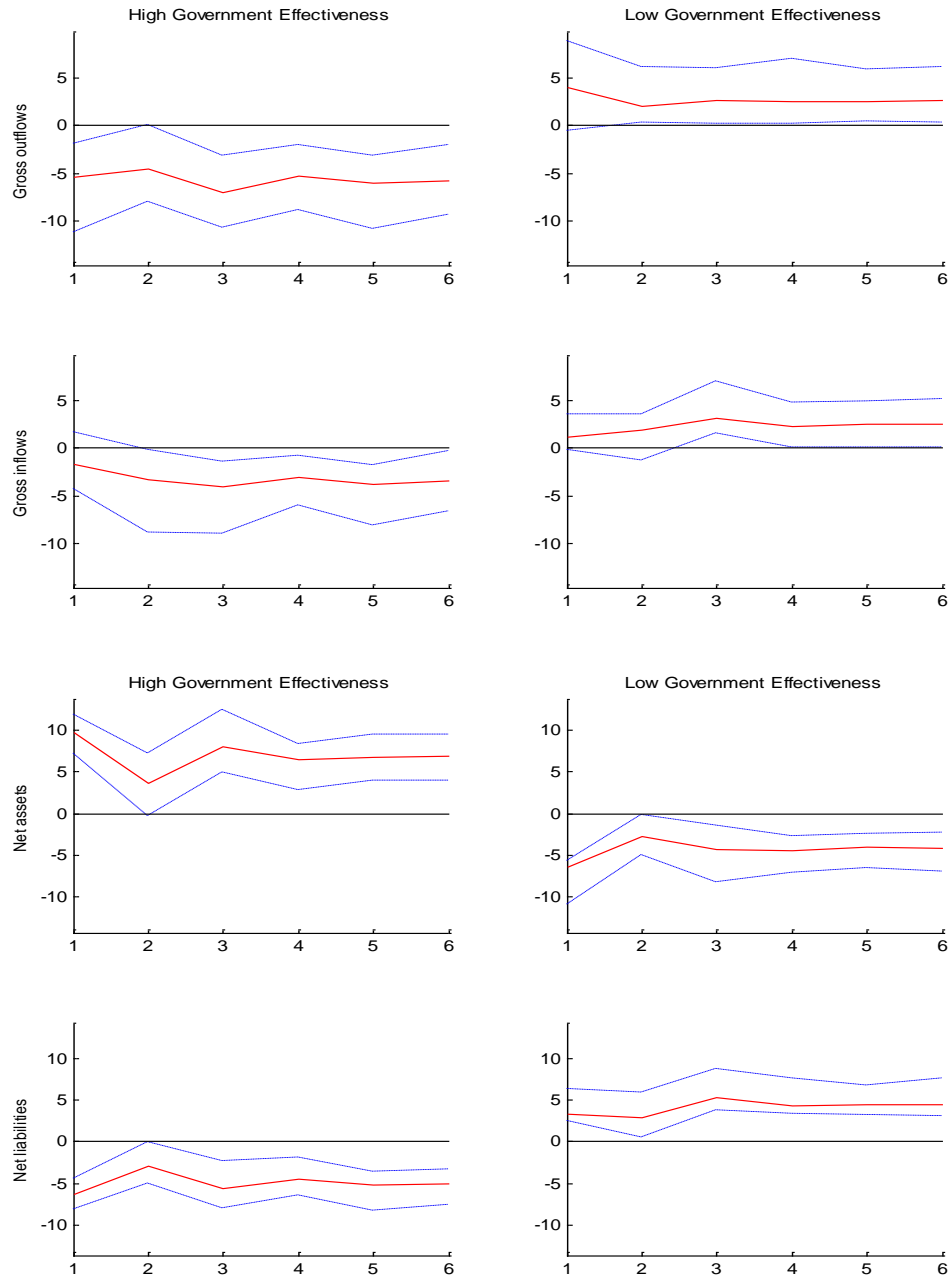
²² Gupta et al (2007) document that the output contraction during a currency crisis is significantly smaller if countries had restrictions on the capital account prior to the crisis.

Figure 4a. Impulse Responses by Government Effectiveness



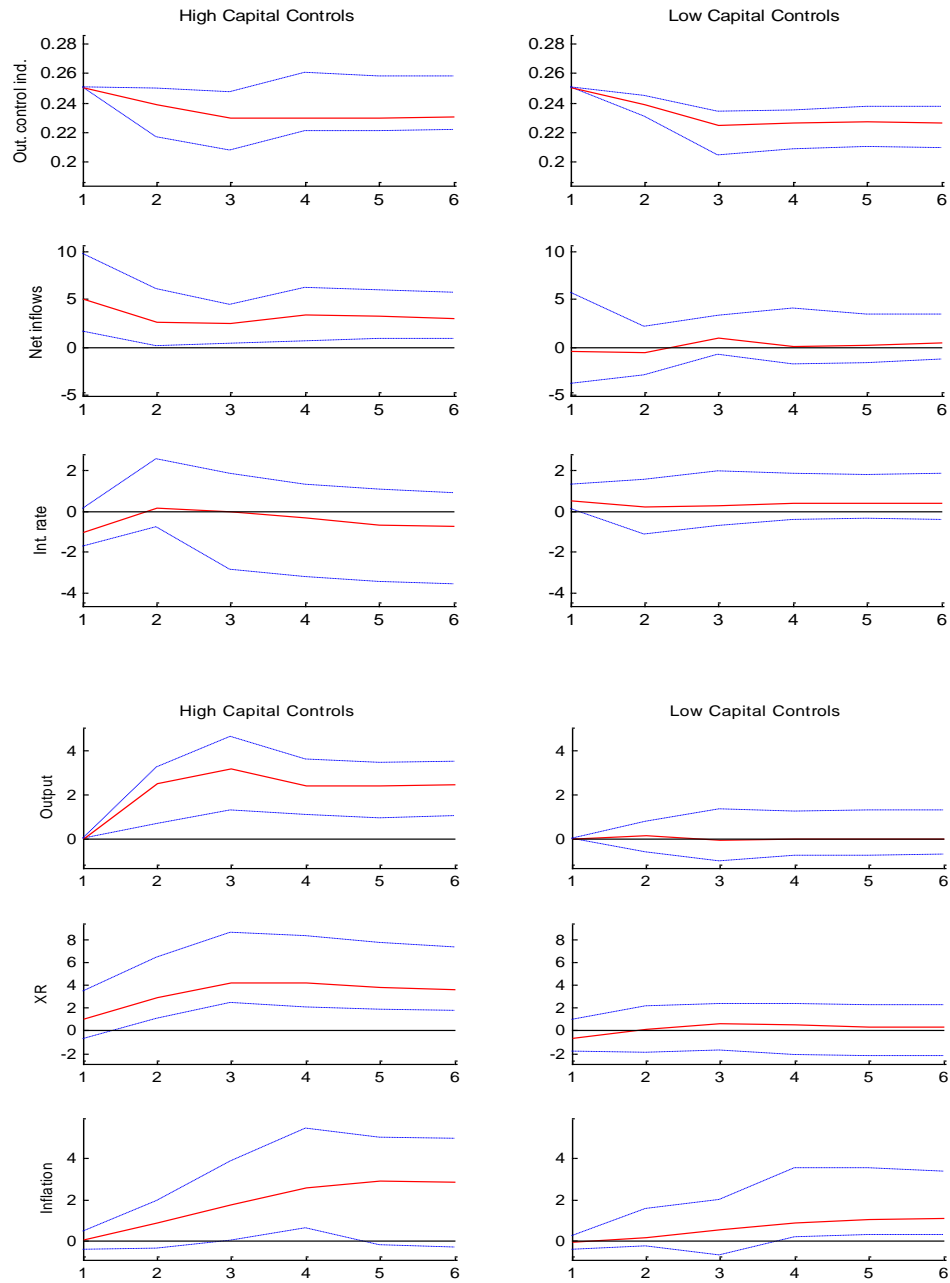
Solid line OLS point estimates. Dashed lines are 90% confidence bands. The shock to the outflow control index is normalized to be equal to 0.25. The responses of industrial production and the real exchange rate are in percent. The response of inflation and the interest rate is in percentage points. The responses of all the net inflow variable is in percent of GDP.

Figure 4b. Impulse Responses by Government Effectiveness: Including Flows in Net Assets and Net Liabilities as well as Gross Inflows and Gross Outflows Instead of Net Inflows



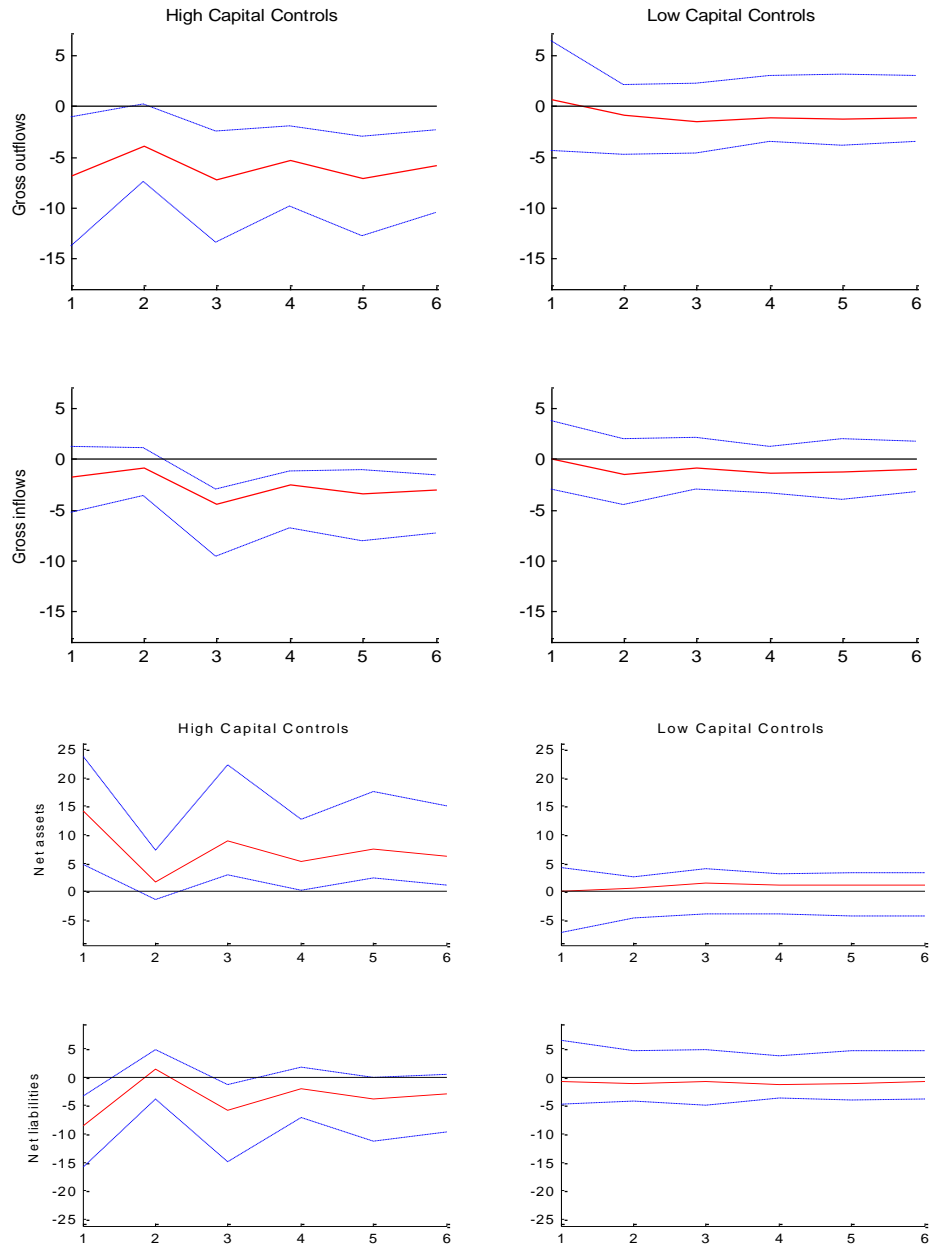
Solid line OLS point estimates. Dashed lines are 90% confidence bands. The shock to the outflow control index is normalized to be equal to 0.25. The responses of all variables are changes in percent of GDP.

Figure 5a. Impulse Responses by Intensity of Capital Outflow Restrictions



Solid line OLS point estimates. Dashed lines are 90% confidence bands. The shock to the outflow control index is normalized to be equal to 0.25. The responses of industrial production and the real exchange rate are in percent. The response of inflation and the interest rate is in percentage points. The responses of all the net inflow variable are in percent of GDP.

Figure 5b. Impulse Responses by Capital Control Intensity: Including Flows in Net Assets and Net Liabilities as well as Gross Inflows and Gross Outflows Instead of Net Inflows



Solid line OLS point estimates. Dashed lines are 90% confidence bands. The shock to the outflow control index is normalized to be equal to 0.25. The responses of all variables are changes in percent of GDP

IV. ROBUSTNESS

24. **We proceed to test the robustness of our results to changes in variable definitions and the econometric specification.** We evaluate robustness by assessing the extent to which these changes affect the impulse responses of net inflows at the 75th percentile of the distribution of each of the indicators (quality of fundamentals, quality of institutions, pre-existing capital flow restrictions intensity). First, we analyze whether our findings still hold if real GDP takes the place of industrial production.²³ This robustness check is conducted to guard against the possibility that the results are affected by the volatility of industrial production or by the fact that in many countries industrial production represents only a small share of economic activity.²⁴ Second, we augment our PVAR (6) to a PVAR (7) that includes an inflow control index as an additional variable; this is to alleviate omitted variable concerns with respect to the correlation between changes in intensity of outflow and inflow restrictions. Third, we test whether our model is sensitive to different lag specifications. Finally, we test the robustness of our findings to different orderings of the variables included in the VAR. In the alternative ordering presented here, we allow outflow restrictions to respond contemporaneously to capital flows.²⁵

25. **The finding that restrictions are effective in countries with strong fundamentals is robust to all checks.** Figure 6a illustrates this result. Neither the substitution of the industrial production variables by GDP nor the inclusion of an index of inflow control intensity nor the change in the ordering of the variables have an important impact on the shape or the magnitude of the impulse response functions. The response is also fairly robust to changes in the lag structure of the PVAR; only when reducing the lag structure to 1 do we see a somewhat pronounced drop in the magnitude of the response.

26. **The response of net flows to restrictions in countries with strong institutions is robust to most checks.** Figure 6b shows that the substitution of industrial production with GDP or the inclusion of an index of inflow control intensity do not alter the shape or the magnitude of the impulse responses much. Changes in the lag structure of the PVAR do affect the shape of the impulse responses but the basic finding that the response of net capital inflows is significantly positive remains. However, the finding that net inflows increase significantly is not always robust to changes in the ordering of the variables. Changing the ordering in such a way as to allow outflow restrictions to respond contemporaneously to

²³ We included industrial production instead of GDP in the first place because GDP is not available at quarterly frequency for all countries in the sample. For this robustness check GDP is extrapolated from annual to quarterly frequency where necessary.

²⁴ For purposes of the robustness check, GDP is assumed to be equal in every quarter of a given year for all countries for which quarterly data is not available.

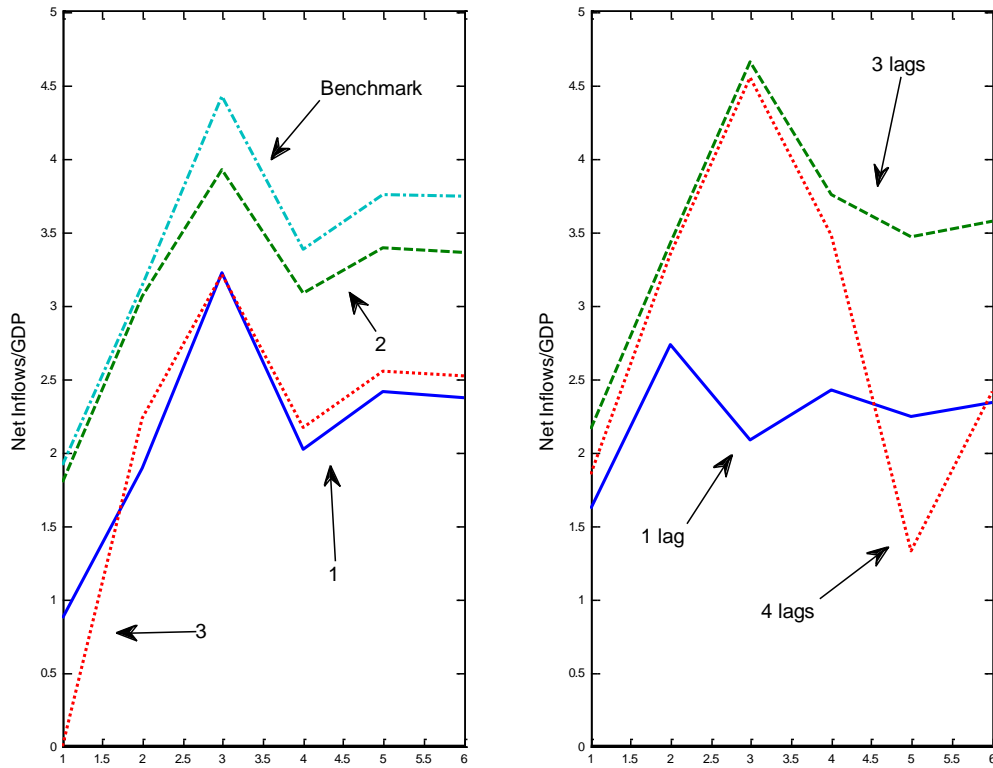
²⁵ In addition, the ordering assumes that restrictions will not respond to changes in net inflows contemporaneously.

capital flows leads to a response that is significantly more muted: the response is no longer positive on impact and peaks at only about 0.5 percent of GDP.

27. **The finding that outflow restrictions need to be comprehensive to be effective is relatively robust.** Including real GDP in the regression instead of industrial production does not impact the results notably; neither does the inclusion of an index of inflow control intensity (Figure 6c). The path of the impulse response function is somewhat sensitive to increasing the number of lags in the VAR, but the shapes of the responses only begin to vary after about three quarters. Moreover, the response is positive across the horizon of six quarters in all cases. The most notable change in the response function occurs when changing the ordering of the variables in the VAR, allowing outflow restrictions to be affected contemporaneously by all variables in the VAR. In this case the response of net inflows to an increase in control intensity becomes much smaller. However, the response remains positive across the response horizon and peaks at about 1.2 percent of GDP.

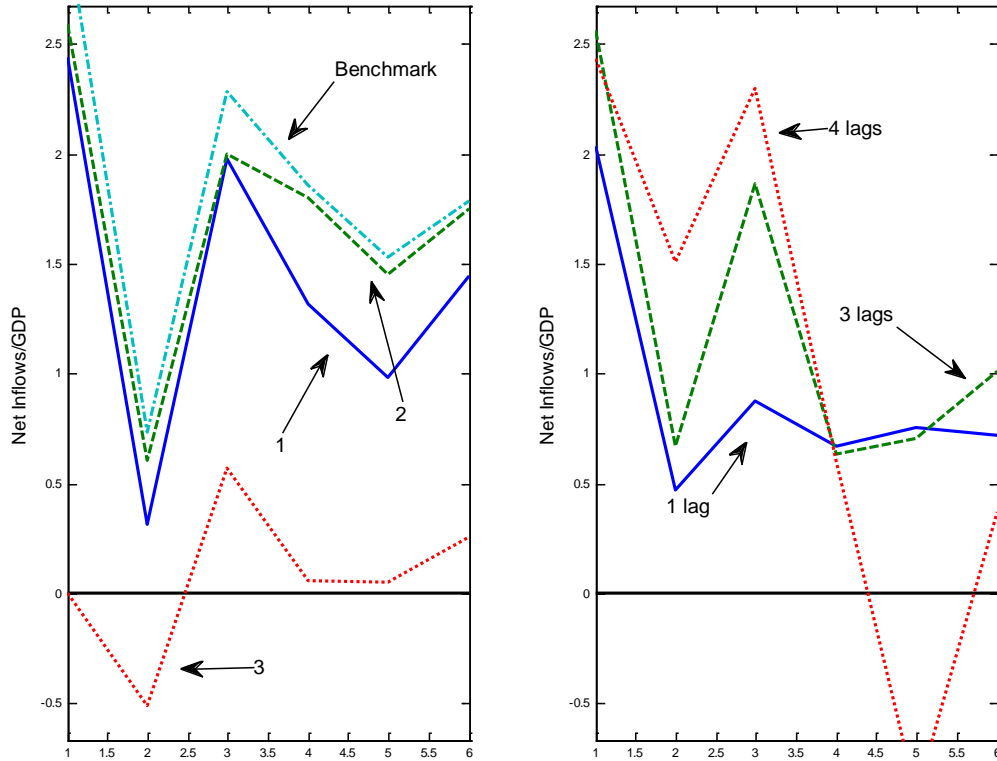
28. **Finally, results are robust to excluding China and India from the analysis.** China and India have had longstanding capital flow restrictions. This suggests that the effectiveness of a tightening of restrictions outflow restrictions may not necessarily depend on restrictions having been in place for a long time.

Figure 6a. Robustness: Net Inflows Response to an Unexpected Increase in the Outflow Controls Index for Good Macroeconomic Fundamentals



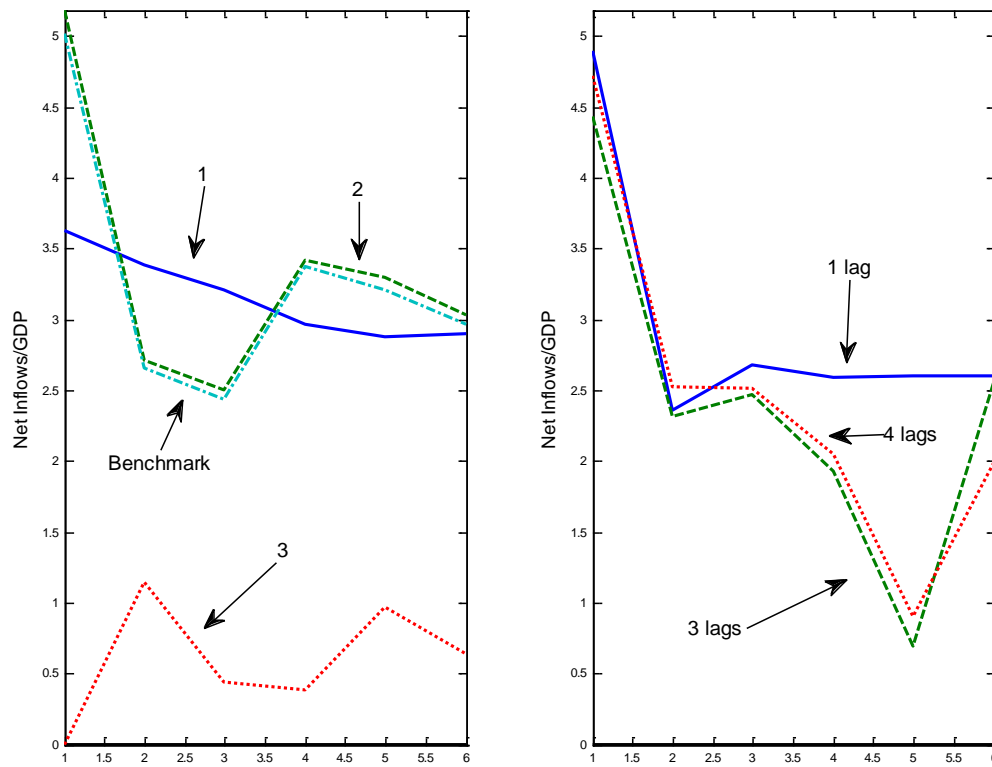
Solid lines represent OLS point estimates. The shock to the outflow control index is normalized to be equal to 0.25. Left figure: 1) VAR (6) including quarterly real GDP instead of industrial production. 2) VAR (7) including index on inflow controls. 3) VAR (6) with capital outflow controls affecting all variables with a lag. Right figure: VAR (6) with different lag specifications.

Figure 6b. Robustness: Net Inflows Response to an Unexpected Increase in the Outflow Controls Index for High Government Effectiveness



Solid lines represent OLS point estimates. The shock to the outflow control index is normalized to be equal to 0.25. Left figure: 1) VAR (6) including quarterly real GDP instead of industrial production. 2) VAR (7) including index on inflow controls. 3) VAR (6) with capital outflow controls affecting all variables with a lag. Right figure: VAR (6) with different lag specifications.

Figure 6c. Robustness: Net Inflows Response to an Unexpected Increase in the Outflow Controls Index for High Capital Control Intensity



Solid lines represent OLS point estimates. The shock to the outflow control index is normalized to be equal to 0.25. Left figure: 1) VAR (6) including quarterly real GDP instead of industrial production. 2) VAR (7) including index on inflow controls. 3) VAR (6) with capital outflow controls affecting all variables with a lag. Right figure: VAR (6) with different lag specifications.

V. CONCLUSION

29. **In this paper, we investigate whether, and under what conditions, a tightening of outflow restrictions helps reduce net capital outflows in a sample of 37 emerging market economies during 1995-2010.** Our main criterion for effectiveness is the impact of a tightening of outflow restrictions on net capital flows. An additional criterion is the extent to which control tightening facilitates exchange rate and interest stabilization, and allows policymakers to regain monetary policy independence.

30. **We use a panel vector autoregression (PVAR) methodology to allow for the endogeneity of capital flow restrictions.** In order to identify preconditions for effectiveness, we add interaction terms to the baseline PVAR which are calculated as products between the right hand side variables and structural characteristics that might determine the effectiveness of restrictions. These include indicators of institutional quality and macroeconomic fundamentals as well as the tightness of pre-existing restrictions. This strategy allows us to compute impulse response functions that are conditional upon the indicator variables and can be evaluated at different percentiles of their sample distributions.

31. **Our findings suggest that a tightening of outflow restrictions can indeed be effective if supported by either strong macroeconomic fundamentals or good institutions, or if existing restrictions are already fairly comprehensive.** When estimating the PVAR in the absence of any interaction terms, we find that a tightening of outflow restrictions on average reduces gross capital outflows. However, there is also a contraction in gross inflows – mainly driven by non-resident investors – which is larger in size than the contraction in outflows. We thus find that for the average country, a tightening of outflow restrictions is ineffective as net outflows increase as a result of it. However, adding interaction terms reflecting a variety of structural country characteristics, we find that restrictions are effective if important preconditions are in place: in countries with good macroeconomic fundamentals, a tightening of restrictions leads to a sizable reduction in net capital outflows. This result is robust to a variety of specification changes. Similarly, a tightening of restrictions is effective in countries with strong institutions, although our findings are slightly less clear cut and robust in these cases. Finally, restrictions are effective if they are sufficiently comprehensive to slow a sudden “rush to the exit.”

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