



***Capital Flow Waves:  
Surges, Stops, Flight  
and Retrenchment***

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(mid-revision version)

# Motivation: What causes “waves” in capital flows?

- Substantial volatility in cross-border capital flows
  - Long history of “waves”, of booms and busts
- Can have substantial economic costs
  - Surges correlated with real estate booms, banking crises, debt defaults, inflation and currency crises
    - Aizenman and Jinjarek (2009), Caballero (2010), Reinhart and Reinhart (2009)
  - Sudden stops correlated with currency depreciations, slower growth and higher interest rates
    - Edwards (2005), Freund and Warnock (2007)
- But can also stabilize economies
  - Evidence from Global Financial Crisis, during which some countries benefited from “retrenchment”.
- Our question: What causes these extreme movements or “waves” in capital flows?

# This paper – the first of a series – has two main contributions.

## 1. Identify and Describe

New methodology to identify capital flow episodes

- Other work uses net capital flow proxies
- Our methodology analyzes gross capital flows disaggregated by home and foreign fin'l assets

## 2. Understand

An understanding of these episodes will help guide policy and theory

- Evaluate relevance of theoretical models on capital flow volatility, crises and surges, as well as recent emphasis on global factors driving Great Recession
- Global versus contagion versus domestic factors

# Outline

## 1. Measuring Capital Flow Episodes

- Previous work
- Our approach

## 2. Explaining the Episodes

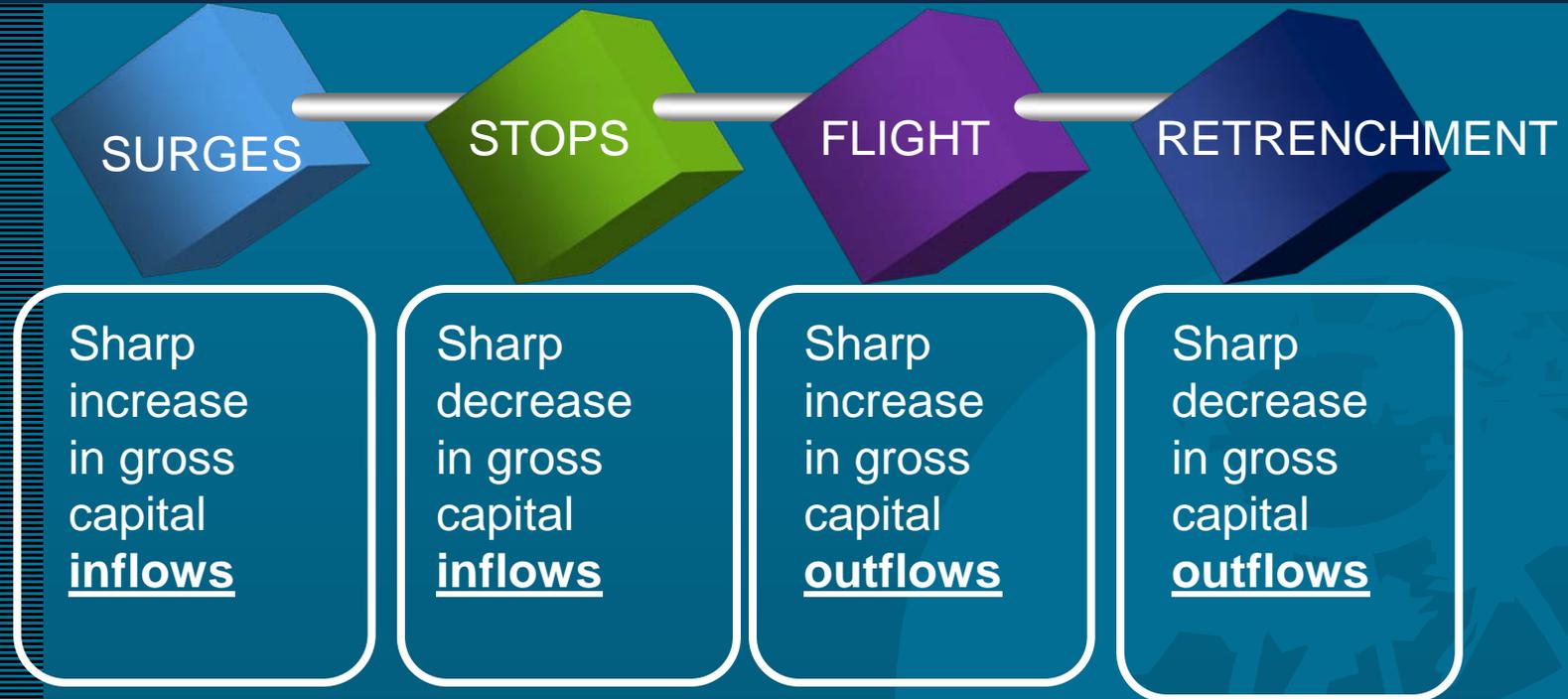
- The theory
- The evidence

## 3. Conclusions, Update and Next Steps

***Measuring Capital  
Flow Episodes***



# Our Approach



- Builds on literature on “sudden stops”, similar approach in recent work on “bonanzas”
- Calvo (1998), Calvo et al. (2004), Reinhart and Reinhart (2009), Caballero (2010)

# Some Data Specifics

- Main data: IMF's IFS
  - Augment with data from country authorities
  - Correct/clean some data
- Working dataset: 58 countries, quarterly 1990-2009
- Baseline definitions:
  - Gross inflows: sum of inflows of direct investment, portfolio inflows & other inflows
  - Gross outflows: sum of outflows of direct investment, portfolio, and other outflows (reserve accumulation omitted in baseline)

# Our Approach

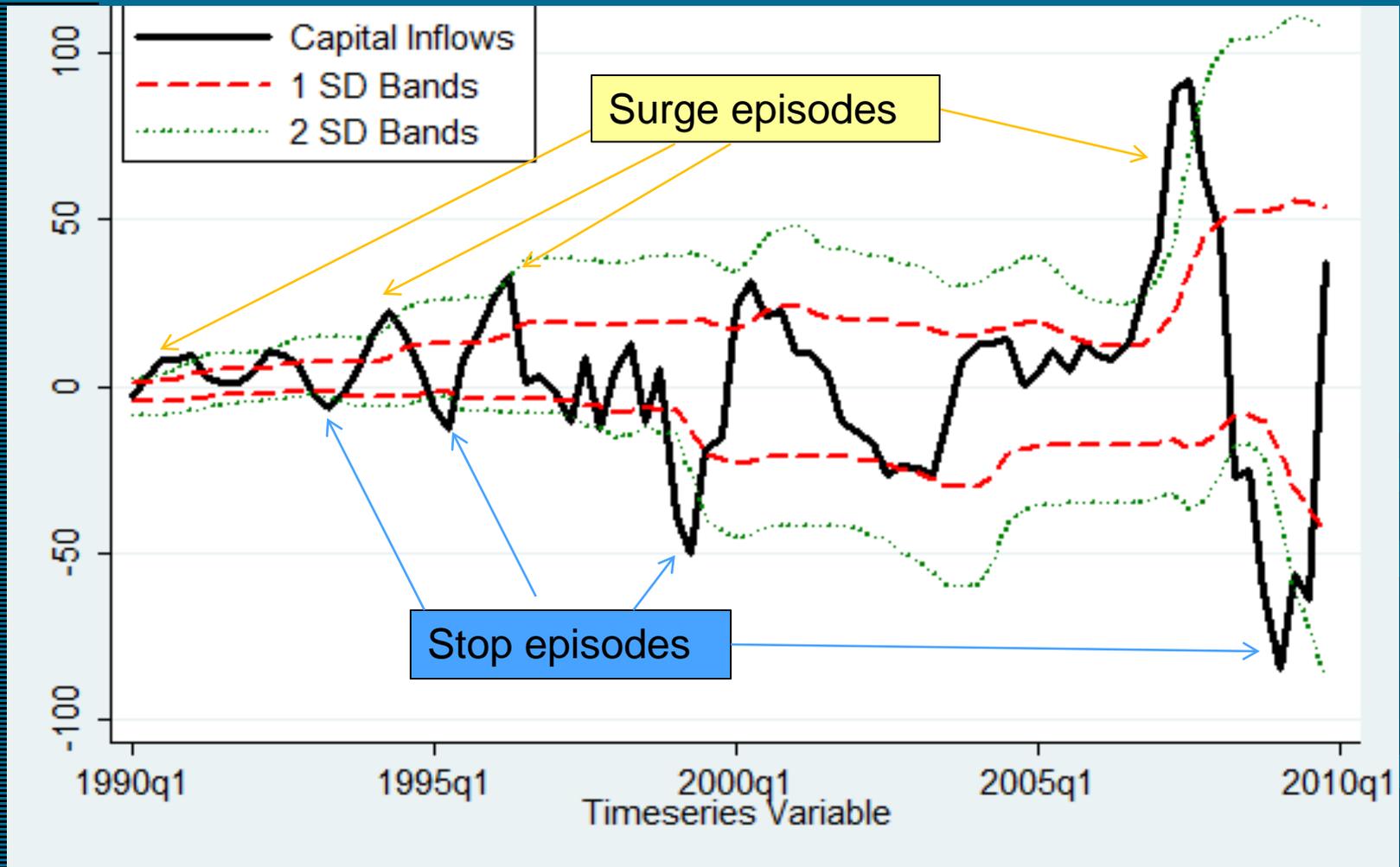
- More specifically, to calculate a surge or stop:
  - Let  $C_t$  be a 4-quarter moving sum of gross capital inflows from foreigners (GINFLOW):

$$C_t = \sum_{i=0}^3 GINFLOW_{t-i}$$

$$\Delta C_t = C_t - C_{t-4}$$

- A surge is when  $\Delta C_t$  increases more than 1 standard deviation above its rolling historical mean, provided:
  - $\Delta C_t$  increases at least 2 stdev at some point in episode
  - The entire episode lasts more than 1 quarter
  - Country has at least 4 years of data to calculate historic mean
- Stop is defined symmetrically

# Surges & Stops for Brazil



# Comparison to Earlier Methodology

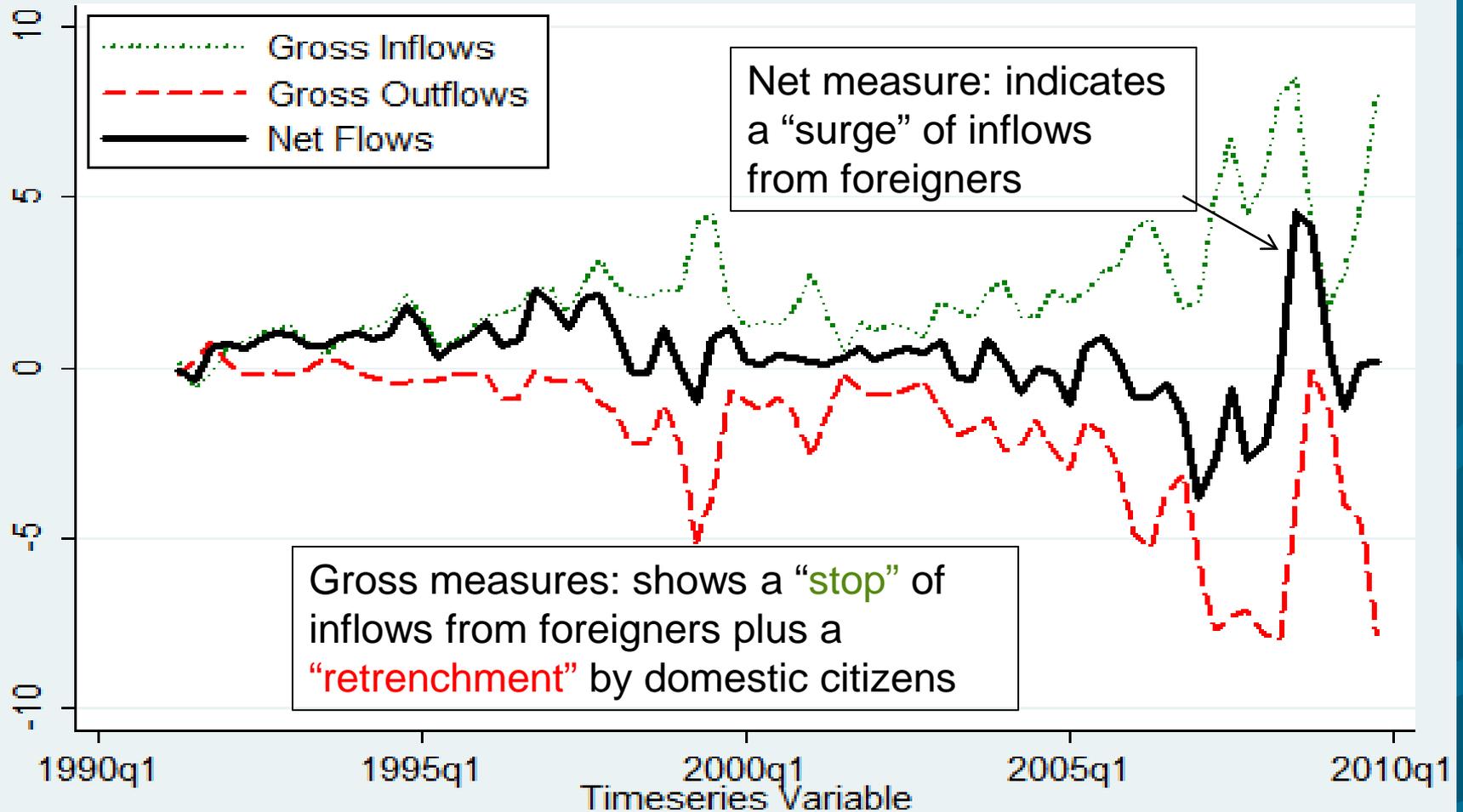
- Main similarities with past work:
  - Focus on periods of “extreme” capital flow movements, not daily flows
  - Define episodes versus rolling historic mean
- Main differences with past work:
  - Use capital flow data rather than current-account based proxies
  - Use data on gross flows instead of net flows
    - Also done in Broner et al (2010), Milesi-Ferretti & Tille (2010)
  - Examine more types of episodes—both sudden increases & decreases in inflows and outflows

# Net vs. Gross Flow Measures

- Previous 'net flows' calculations of surges & stops comingled inflows and outflows and at times produced confusing results
- Example: episodes during the first phase of the Global Financial Crisis (2008Q4 and 2009Q1)
  - Even though global capital flows were drying up, net-flows-based methodology suggests 12 countries had surges. Using gross flows, only 1 country had a surge (an old surge that was ending).
  - Even though almost every country faced a sharp decrease in inflows, only about 35% had stops based on net flows. 80% had stops based on gross flows.
  - KEY ISSUE: Massive retrenchment -- out of foreign assets and back into domestic assets -- distorts 'net' measures of stops & surges
    - Measures based on gross data can disaggregate these effects

# Example: Chile

## Net and Gross Flows for Chile



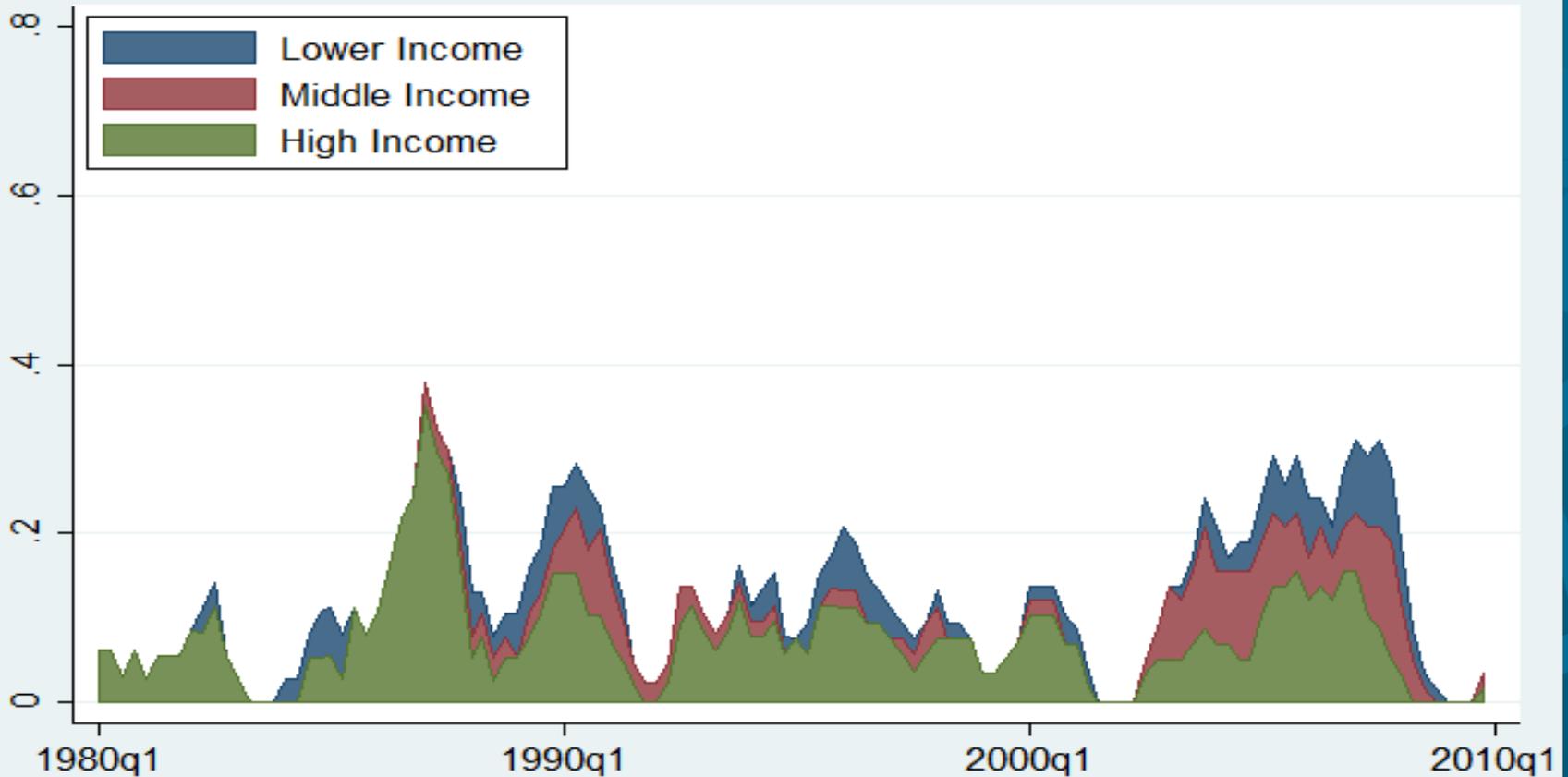
# The Episodes: Summary Statistics

168 surges, 220 stops, 194 flight & 211 retrenchment

		Surge	Stop	Flight	Retrench
		<b>Average length of time (in quarters)</b>			
<b>Full sample</b>		4.5	4.0	4.1	3.8
<b>By Income Group</b>	<b>High income</b>	4.5	4.1	4.1	4.1
	<b>Med income</b>	4.6	3.8	4.3	3.3
	<b>Low income</b>	4.3	3.8	3.8	3.5
<b>By Region</b>	<b>North America</b>	3.8	3.9	3.8	3.8
	<b>Western Europe</b>	4.5	4.2	4.2	4.1
	<b>Asia</b>	4.5	4.0	4.1	4.0
	<b>Eastern Europe</b>	4.8	3.7	4.2	3.5
	<b>Latin America</b>	4.4	4.0	3.7	3.2
	<b>Other</b>	4.3	3.7	4.4	3.7

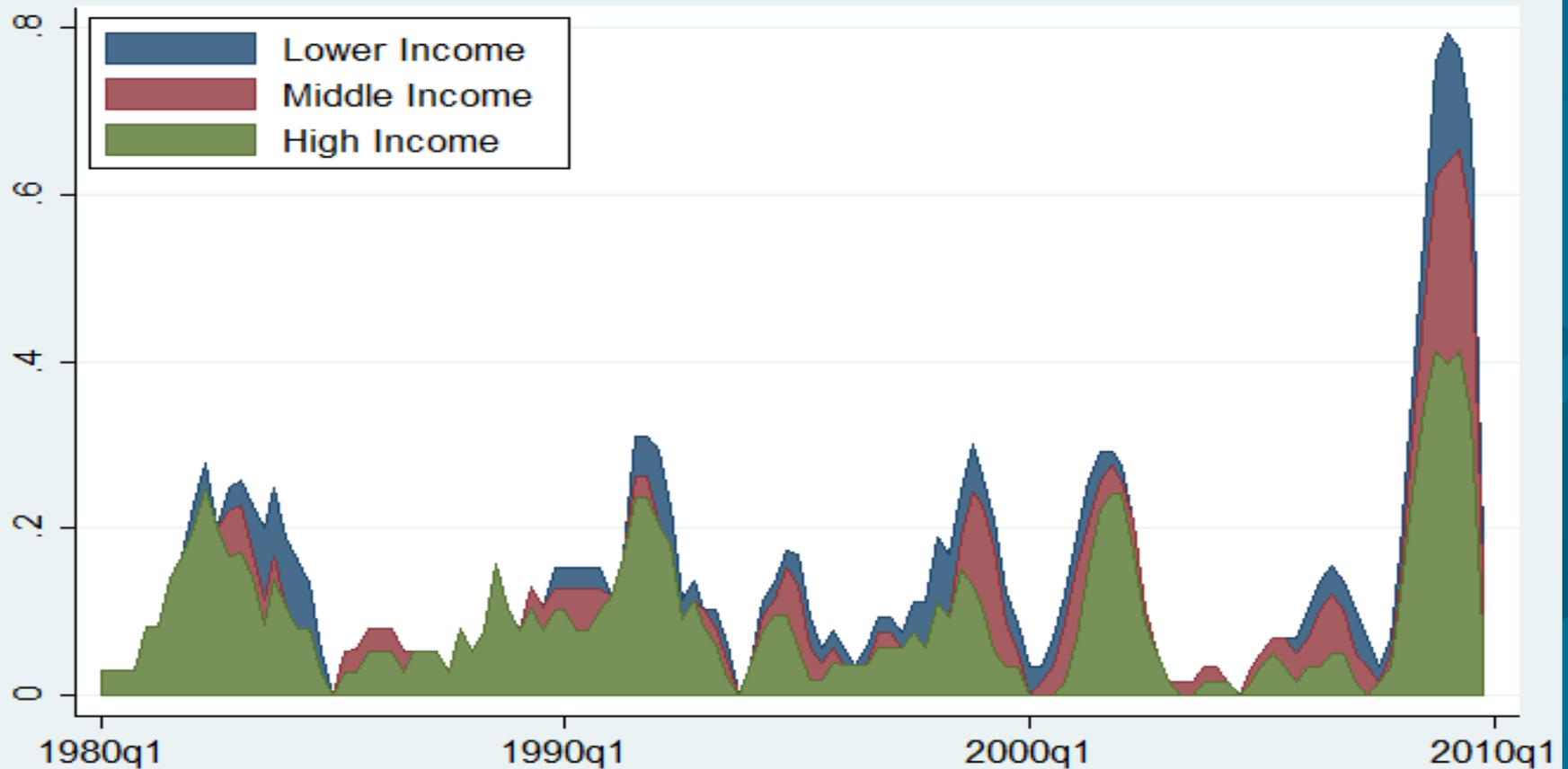
# Share of Countries with a Surge

Share of countries experiencing a sudden surge episode (for TO capital flows)



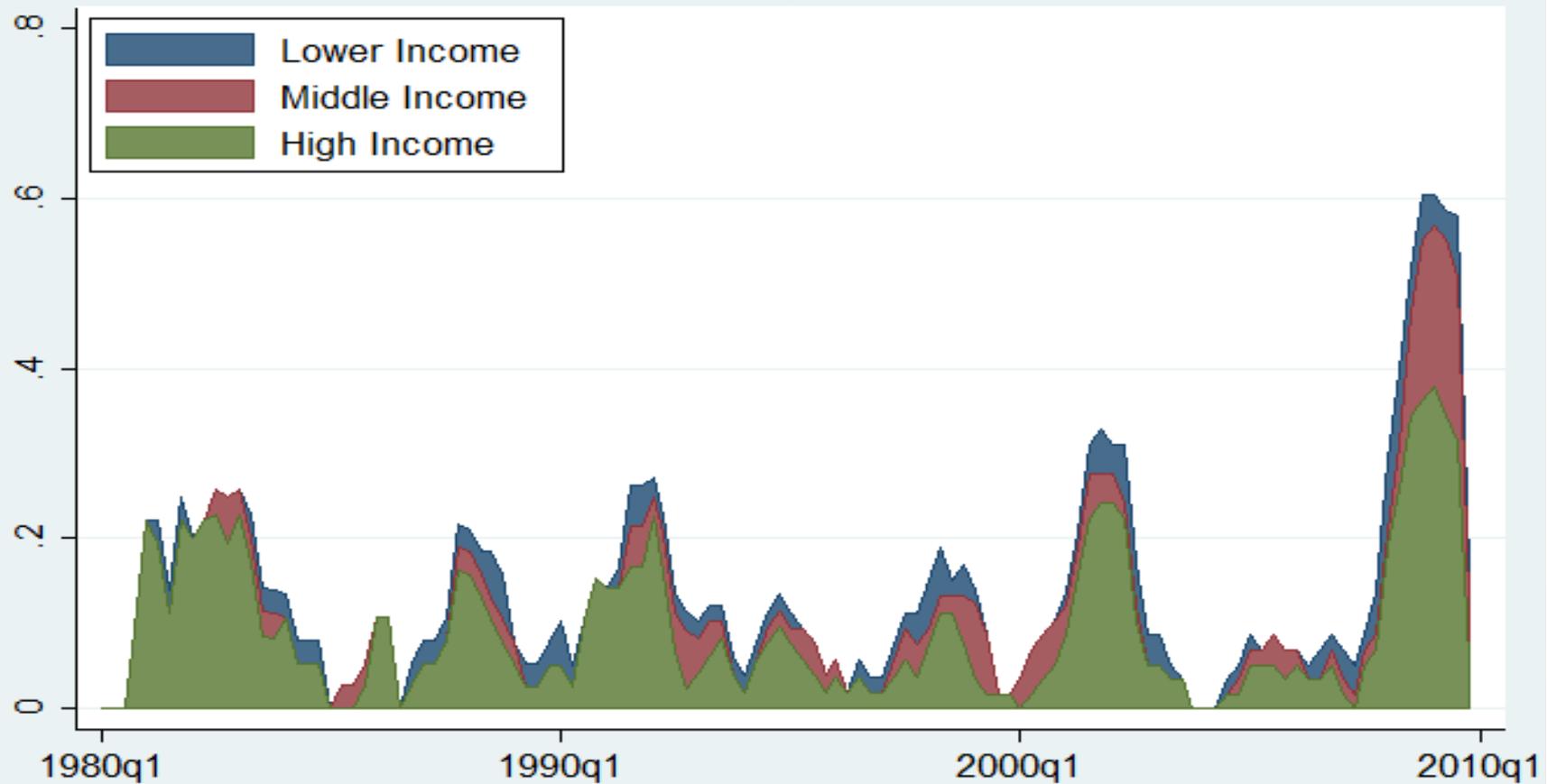
# Share of Countries with a Stop

Share of countries experiencing a sudden stop episode  
(for TO capital flows)



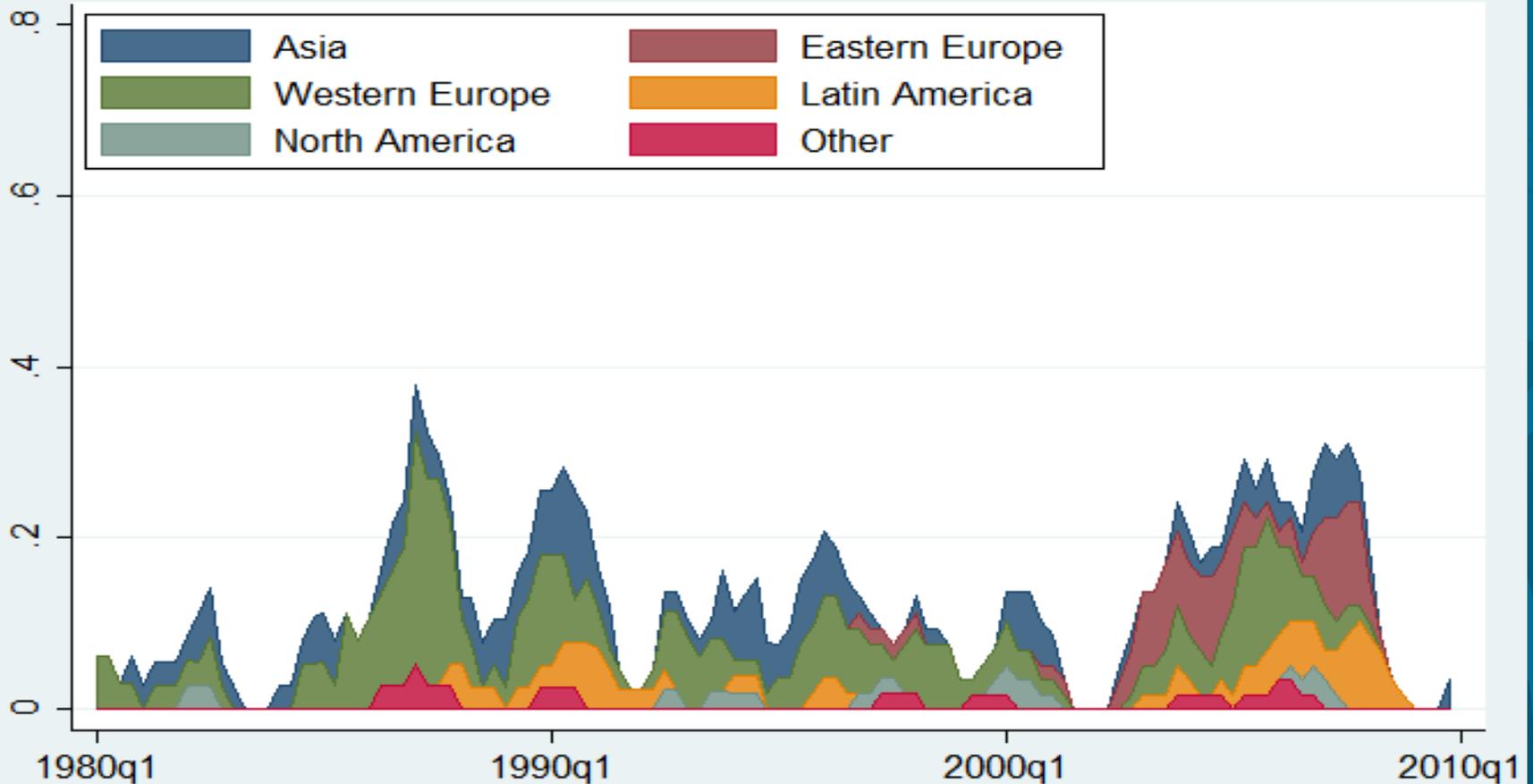
# Share of Countries with Retrenchment

Share of countries experiencing a sudden retrench episode  
(for TO capital flows)



# Share of Countries with a Surge

Share of countries experiencing a sudden surge episode  
(for TO capital flows)



***Explaining the  
Episodes***



# Regression Analysis

- Estimate conditional probability of having a surge, stop, flight or retrenchment in a quarter

$$Prob(e_{it}=1)=F(\phi_t, \gamma_{it}, \alpha_{it})$$

- $e_{it}$  is dummy=1 for each episode (surge, stop, flight, retrenchment)
- $\phi_t$ : global factors
- $\gamma_{it}$ : contagion variables
- $\alpha_{it}$ : domestic variables
- Use complimentary logarithmic estimator (cloglog) that assumes the cdf of  $F(\cdot)$  is the extreme value distribution
$$F(z) = 1 - \exp [-\exp(z)]$$
- Seemingly unrelated regression estimation to allow for cross-episode correlation in errors
- Robust standard errors, clustered by country

# Theory

- Extensive literature on cross-country allocation of investment, contagion & capital flow cycles
  - “Push” or external factors
    - Includes global effects & contagion
  - “Pull” or domestic factors
- Global Factors—outside a country’s control, affects world
  - Risk/risk appetite/probability of disaster:
    - Gourio, Siemer and Verdelhan (2010), Bacchetta and Van Wincoop (2010), Dedola and Lombardo (2010),
    - Recent emphasis of theoretical work on Great Recession, motivated by Rose and Spiegel (2009)
  - Liquidity/leverage/bank run models
    - Devereux and Yetman (2010), Calvo (2009), Giannetti (2007), Brunnermeier (2009)
  - Interest rates
    - Calvo, Leiderman and Reinhart (1993, 1996)
  - Growth
    - Albuquerque, Loayza, and Servén (2005)

# Theory

- Contagion Effects –outside of country's control, resulting from circumstances in another country or group of countries (but not world); Claessens and Forbes, 2001, Dungey et al, 2011
  - Regional effects
  - Trade channels
    - Glick and Rose (1999), Forbes (2002)
  - Financial channels
    - Peek and Rosengreen (1997), Kaminsky, Lyons and Schmukler (2001)
- Domestic Factors—country-specific characteristics
  - Financial system size, depth and fragility
    - Caballero, Farhi and Gourinchas (2008), Mendoza, Quadrini, and Rios-Rull (2009), Bacchetta and Benhima (2010), Forbes (2010), Ju and Wei (2011), Dekle and Kletzer (2001), Mendoza and Terrones (2008)
    - Recent focus of work on global imbalances
  - Capital controls, integration with global financial markets
    - Ostry et al. (2010, 2011), Milesi-Ferretti and Tille (2010), Aghion, Bacchetta and Banerjee (2004)
  - Fiscal position/solvency
  - Technological shocks/TOT shocks/growth
    - Aguiar and Gopinath (2007)

# The Components

- Global factors
  - Global risk: VXO, VIX, quality spread, CSFB Risk Appetite index, Variance Risk Premium (VRP)
  - Global liquidity: growth in money supply in largest economies, private credit growth by financial institutions./GDP
  - Global interest rates: Avg long-term rate in US, euro & Japan, just US
  - Global productivity: global GDP growth
- Contagion factors
  - Geographic proximity; episode in country in same region
  - Trade linkages: based on bilateral trade flows
  - Financial linkages: based on bilateral bank exposure
- Domestic factors
  - Financial market depth: stock market cap/GDP, stock & bond mkt cap/GDP, ROE of banking system
  - Capital controls: general controls, intl assets & liabilities/GDP, specific controls, FX regulation, financial regulation
  - Fiscal position: public debt to GDP
  - Growth shocks: country GDP growth relative to trend or WEO forecast
  - GDP per capita

# Baseline Results

	Surge	Stop	Flight	Retrench
<b>Global Factors</b>				
Risk	-0.049** (0.019)	0.021** (0.005)	-0.028 (0.021)	0.012** (0.006)
Liquidity	4.060 (4.837)	-0.060 (4.816)	-6.338 (4.634)	2.403 (4.673)
Interest Rates	-0.001 (0.055)	0.054 (0.039)	-0.045 (0.077)	0.115** (0.043)
Growth	22.350** (9.349)	-7.351** (2.409)	2.521 (6.332)	-4.841* (2.699)
<b>Linkages</b>				
Regional	0.306 (0.250)	0.351** (0.153)	0.351* (0.201)	-0.167 (0.159)
Trade	5.459 (4.660)	4.545** (2.092)	2.856 (6.875)	6.895** (2.385)
Financial	-1.164 (1.426)	3.798** (0.831)	1.289 (2.502)	4.334** (0.910)
<b>Local Factors</b>				
Fin'l System	-0.055 (0.196)	0.325** (0.145)	0.081 (0.201)	0.121 (0.168)
Capital Controls	-0.001 (0.074)	0.020 (0.058)	0.171** (0.067)	0.075 (0.056)
Debt-to-GDP	-0.004 (0.004)	-0.001 (0.003)	-0.006** (0.002)	-0.003 (0.003)
Growth	1.190* (0.645)	-3.104** (1.067)	-0.148 (0.724)	-0.163 (0.983)
Income	-0.002 (0.008)	-0.003 (0.005)	0.003 (0.010)	0.013** (0.005)
Observations	3,479	3,479	3,479	3,479

# Baseline Results: Global Factors

Fewer surges, more stops and retrenchments when risk aversion is high or global economic growth is slow.

No evidence that global liquidity or the level of global interest rates impact the probability of surges or stops.

	Surge	Stop	Flight	Retrench
<b>Global Factors</b>				
Risk	<b>-0.049**</b> (0.019)	<b>0.021**</b> (0.005)	-0.028 (0.021)	<b>0.012**</b> (0.006)
Liquidity	4.060 (4.837)	-0.060 (4.816)	-6.338 (4.634)	2.403 (4.673)
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Growth	<b>22.350**</b> (9.349)	<b>-7.351**</b> (2.409)	2.521 (6.332)	<b>-4.841*</b> (2.699)

# Baseline Results: Linkages

Stops and retrenchment have a linkage/contagion component.

	Surge	Stop	Flight	Retrench
<b>Linkages</b>				
Regional	0.306	<b>0.351**</b>	0.351*	-0.167
	(0.250)	<b>(0.153)</b>	(0.201)	(0.159)
Trade	5.459	<b>4.545**</b>	2.856	<b>6.895**</b>
	(4.660)	<b>(2.092)</b>	(6.875)	<b>(2.385)</b>
Financial	-1.164	<b>3.798**</b>	1.289	<b>4.334**</b>
	(1.426)	<b>(0.831)</b>	(2.502)	<b>(0.910)</b>

# Baseline Results: Domestic Factors

When local growth is strong, surge more likely and stop less likely. Other than that, domestic factors, including capital controls, rarely matter.

	Surge	Stop	Flight	Retrench
<b>Local Factors</b>				
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Income	-0.002 (0.008)	-0.003 (0.005)	0.003 (0.010)	0.013** (0.005)

# Baseline Results

- Global Factors:
  - Fewer surges, more stops and retrenchments when risk aversion is high or global economic growth is slow.
  - No evidence that global liquidity or the level of global interest rates impact the probability of surges or stops.
- Linkages:
  - Stops and retrenchment have a linkage/contagion component
    - For example, more likely to have a stop episode when neighbors, trading partners, banking partners are having one.
- Domestic Factors:
  - Most domestic factors are insignificant.
    - Exception: When domestic growth is strong, more likely to have surge, less likely to have stop.
- Takeaways from baseline regressions:
  - Most episodes of extreme capital flows are driven by global factors (especially swings in risk appetite, but also global growth) or linkages, not by domestic factors.
  - No evidence that capital controls impact probability of having an episode.
  - Flight episodes seem mostly idiosyncratic.

# Closer Look at Risk

<i>Risk Variable Measured by.</i>	<b>Surge</b>	<b>Stop</b>	<b>Flight</b>	<b>Retrench</b>
VXO	-0.043** -0.017	0.022** -0.005	-0.033* -0.019	0.013** -0.006
VIX	-0.057** -0.024	0.029** -0.005	-0.035 -0.028	0.013** -0.007
Quality Spread	-0.750** -0.348	0.571** -0.126	-0.42 -0.325	0.364** -0.143
CSFB Risk Appetite Index (RAI)	-0.049 -0.033	0.105** -0.023	-0.028 -0.037	0.100** -0.022
Volatility Risk Premium (VRP)	-0.020* -0.011	0.010** -0.002	-0.011 -0.01	0.001 -0.003

# Closer Look at Capital Controls

<i>Capital Control Variable Measured by:</i>	<b>Surge</b>	<b>Stop</b>	<b>Flight</b>	<b>Retrench</b>	<b># Obs</b>
Capital controls Chinn-Ito (2008)	0.024 (0.069)	-0.029 (0.057)	-0.130* (0.071)	-0.034 (0.061)	3,459
Financial integration Lane-Milesi-Ferretti (2007)	-0.031 (0.135)	-0.186** (0.072)	-0.216 (0.156)	-0.115* (0.061)	3,459
Overall capital act restrictions Schindler (2009)	0.028 (0.460)	-0.061 (0.431)	0.698 (0.457)	0.467 (0.398)	1,763
Specific capital act restrictions Schindler (2009)	-0.440 (0.325)	0.124 (0.239)	0.297 (0.297)	0.556* (0.288)	1,763
Financial controls Ostry et al. (2011)	-0.414 (0.438)	-0.244 (0.447)	-0.379 (0.467)	0.605 (0.476)	1,183
Forex regulations Ostry et al. (2011)	-0.910 (0.646)	0.013 (0.508)	0.085 (0.561)	0.225 (0.481)	1,213

# Sensitivity Tests

- Too many to list, but...
  - Drop recent crisis
  - Add variables: demographics; exchange rate regime; credit rating; reserves/GDP
  - Alternate estimation techniques: fixed effects, logit, probit
  - Different measures for controls
  - Different definitions of episodes: hp filter instead of trend; exclude swaps; include reserves in outflows; distribute E&O into the gross flows; flows as share of GDP

# Results: Sensitivity Tests

- Robust results:
  - Global risk: most consistently significant for all episodes (except flight)
  - Global & domestic growth shocks: significant predicting foreign capital flows (surges & stops)
  - Linkages: through financial flows (and either geographic location or trade) significant in predicting stops and retrenchment
- Robust non-results:
  - Little evidence that global liquidity or global interest rates significantly affect probability of episodes
    - Mixed evidence higher rates affecting stops and retrenchment
  - Little evidence that global financial integration or capital controls affect episodes
  - Harder to explain flight episodes

# Implications for Theory & Policy

- Supports recent trend in theoretical literature
  - Importance of global shocks and especially risk/risk aversion in explaining capital flows and crises
- Mixed Evidence
  - Primacy of domestic productivity shocks (some RBC models) in driving capital flows—domestic growth significant for foreign flows but not domestic flows
- Does NOT support other theoretical approaches
  - Renewed emphasis on capital controls to reduce capital flow volatility
  - Importance of global liquidity & leverage in driving capital flows (independent of risk)

# Conclusions

- New methodology to understand capital flow waves
  - Important to examine gross flows
  - Very different results than traditional approach using net flows
- Global & linkages factors most important determinants of surges, stops, flight & retrenchment episodes
  - Supports recent focus in theoretical literature on global risk
  - Little evidence supporting role of global liquidity & capital controls
- For policymakers seeking to reduce capital flow volatility, there is an important role for global institutions and cross-country cooperation
  - Domestic policies may be better aimed at managing the volatility in capital flows (prudential regulations, etc) rather than directly reducing the volatility