Capital Flow Waves

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In a Nutshell, What We Do

- Many papers have modeled the determinants of international capital flows using data of various frequencies from annual to daily.
  - Much of this is “push-pull” analysis.
- Others have examined sustained, extreme movements in net capital inflows
  - The sudden stops and capital flow bonanzas literatures
- We instead examine sustained, extreme movements in gross capital inflows and gross capital outflows.

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 inflows (cross-border trading in home assets) and gross capital outflows (cross-border trading in foreign assets)

2. Understand

   An understanding of these episodes will help guide policy and theory

   - Help 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. Describing the Episodes

3. Conclusions…as well as a bit on energy prices and capital flow surges

Measuring Capital Flow Episodes

Previous Work

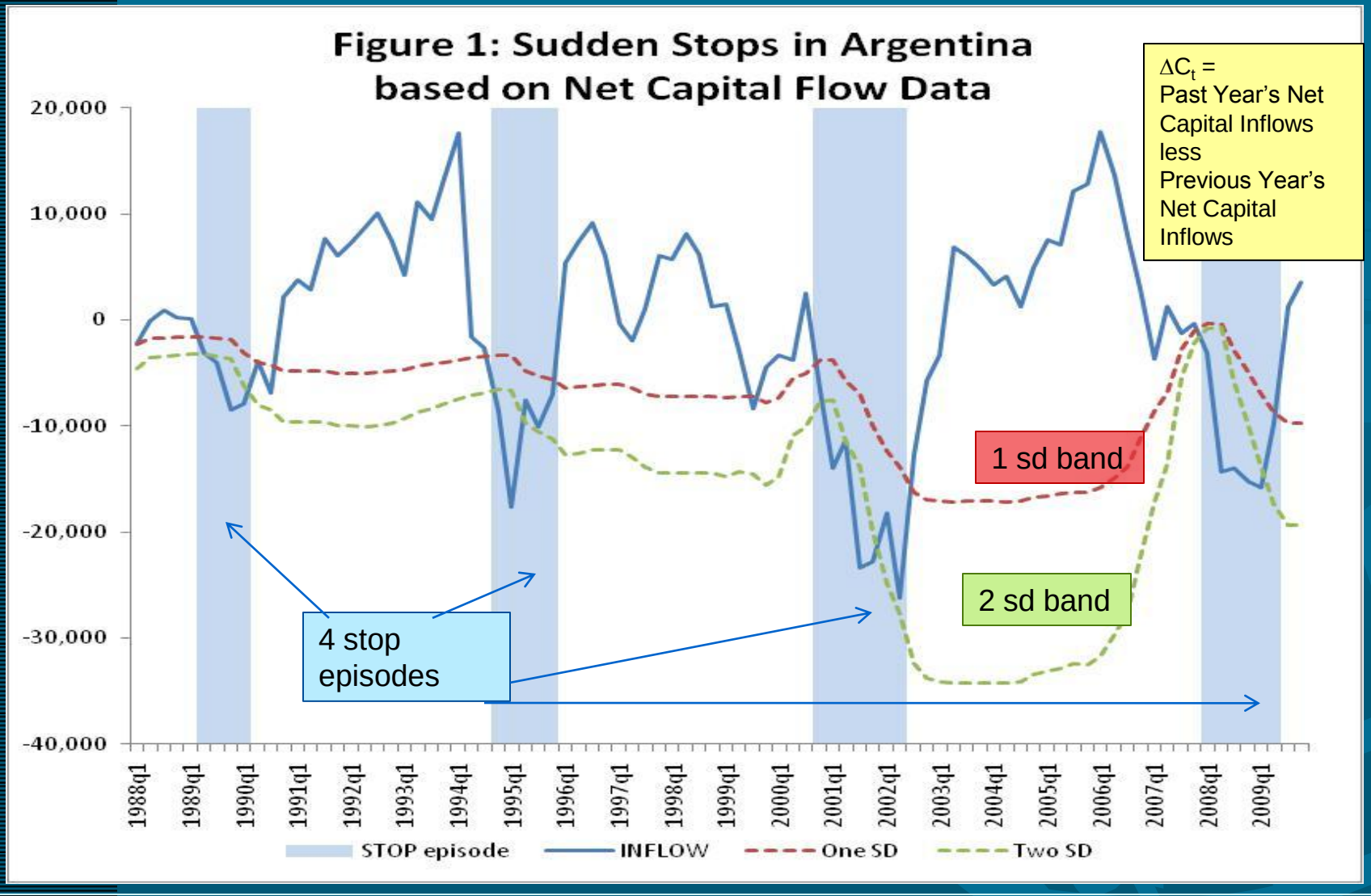
- Best known is the literature on "sudden stops"
  - Calvo (1998), Calvo et al. (2004)
- Compute year-to-year change in 12-month proxy for net private capital inflows

$$C_t = \sum_{i=1}^{12} P_{t-i}$$

$$\Delta C_t = C_t - C_{t-12}$$

  - With P_t defined as the current account balance less monthly changes in international reserves
- Stops are "significant slowdowns" relative to rolling average historic mean
  - Significant slowdown is when ΔC_t falls 1 standard deviation below its historical mean, provided it falls at least 2 sd at some point in episode

Example: Argentina



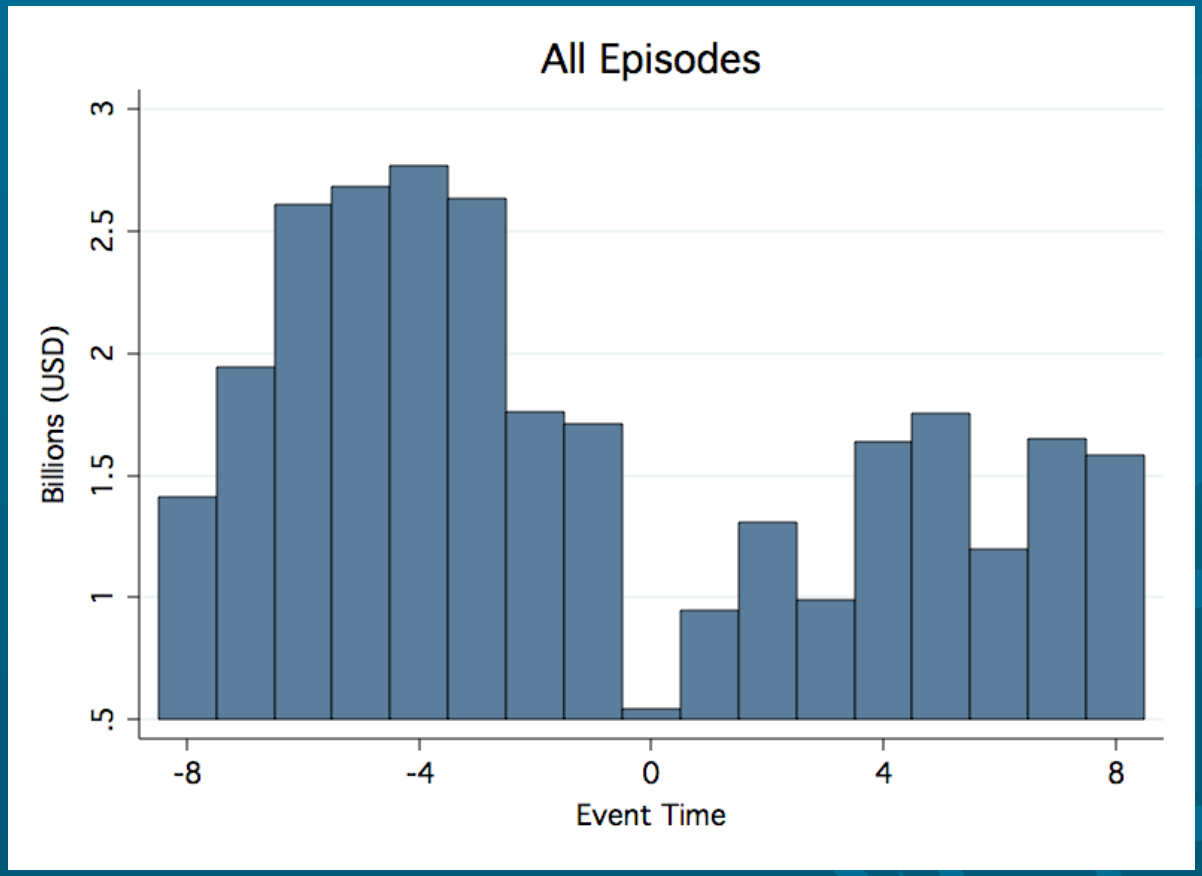
A Disconnect between Language and Methodology

- "A sudden stop episode [i]s an abrupt and major reduction in capital inflows to a country that up to that time had been receiving large volumes of foreign capital." (Edwards 2007)

- But ΔC_t is the year-to-year change in a 12-month proxy for *net capital inflows*
  - In a traditionally defined sudden stop, do we know that the decline is due to a sharp decrease in the amount of foreign capital entering the country?

In traditionally defined sudden stops, gross inflows pause and then resume rather quickly.

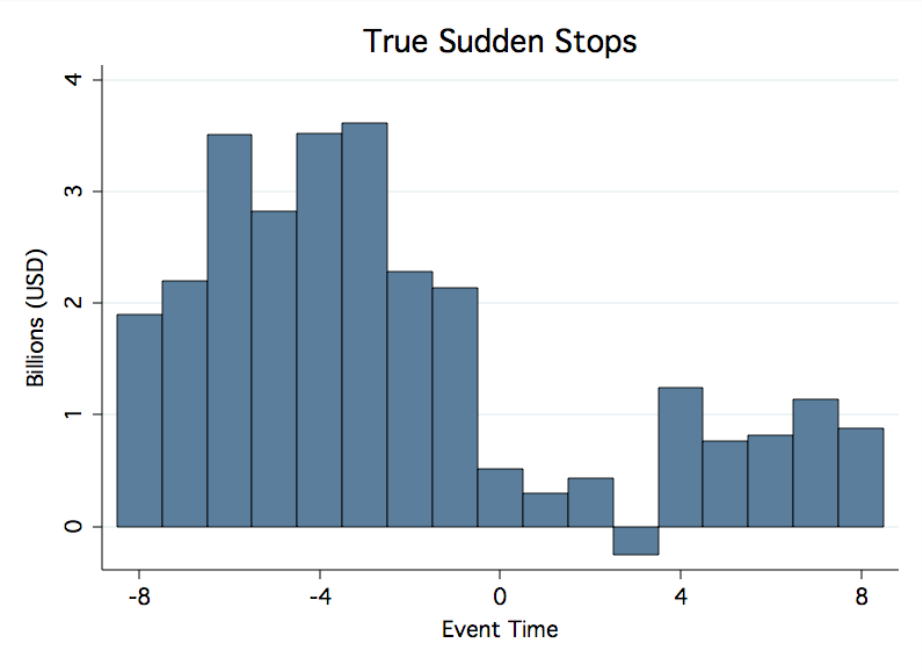
Gross Inflows in 47 traditionally defined sudden stop episodes



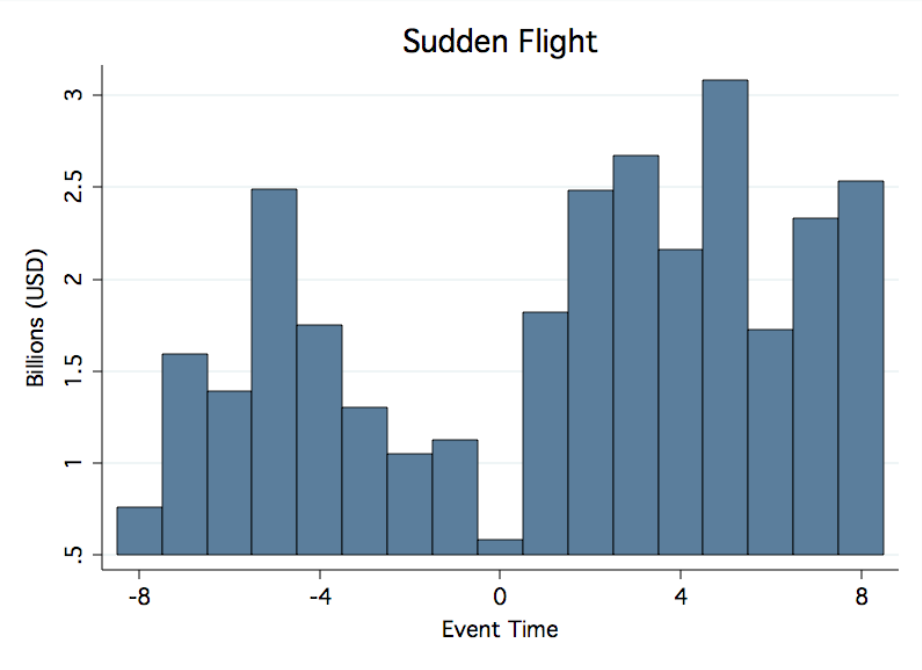
Rothenberg and Warnock (2011 *Review of International Economics*)

Traditionally defined sudden stops mix two very different types of episodes.

Gross Inflows in True Sudden Stops

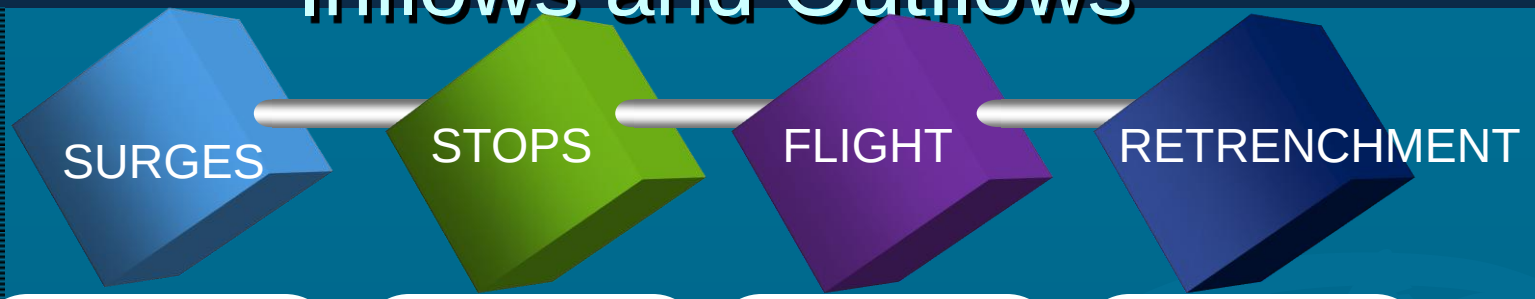


Gross Inflows in Sudden Flight



20 of the 47 traditionally defined sudden stops studied in Rothenberg and Warnock (2011) were actually episodes of flight.

Our Approach: Study Extreme Capital Inflows and Outflows



SURGES	STOPS	FLIGHT	RETRENCHMENT
Sharp increase in gross capital **inflows**	Sharp decrease in gross capital **inflows**	Sharp increase in gross capital **outflows**	Sharp decrease in gross capital **outflows**

We build on the literatures on “sudden stops” “bonanzas” of Calvo (1998), Calvo et al. (2004), Reinhart and Reinhart (2009), Caballero (2010), and others.

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

Recall the Previous Methodology

- "Sudden stops" of Calvo (1998), Calvo et al. (2004), and others
- Compute year-to-year change in 12-month proxy for net private capital inflows

$$C_t = \sum_{i=1}^{12} P_{t-i}$$

$$\Delta C_t = C_t - C_{t-12}$$

  - With P_t defined as the current account balance less monthly changes in international reserves
- Stops are "significant slowdowns" relative to rolling average historic mean
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Our Approach for Gross Inflows

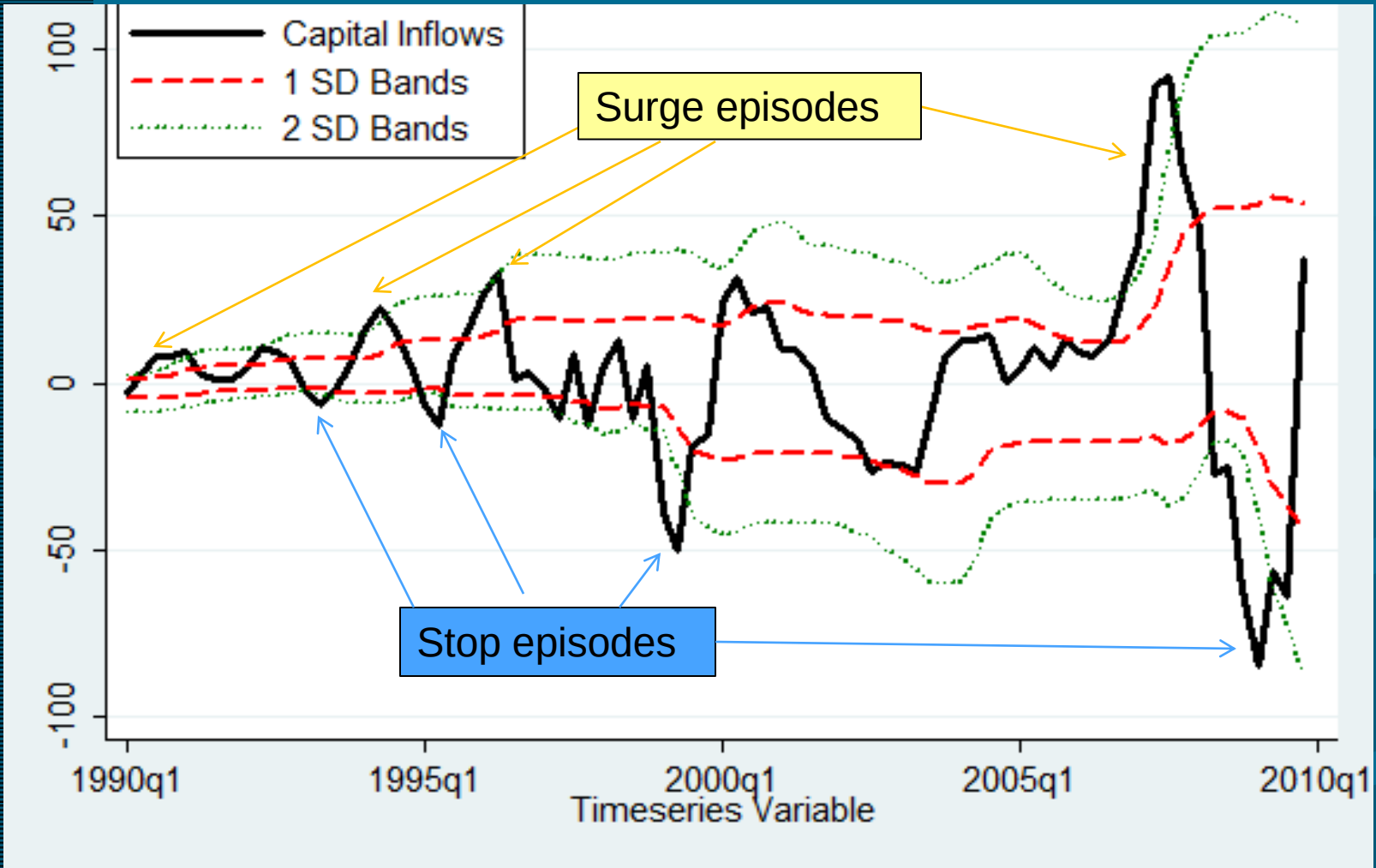
- To calculate a surge or stop of gross inflows:
  - Let C_t be a 4-quarter moving sum of gross capital inflows from foreigners (GINFLOW):

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

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

  - A surge is when ΔC_t increases more than 1 standard deviation above its rolling historical mean, provided:
    - ΔC_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 (as a sharp decline in gross inflows.
  - Using gross outflow data, flight and retrenchment are defined analogously.

Surges & Stops for Brazil



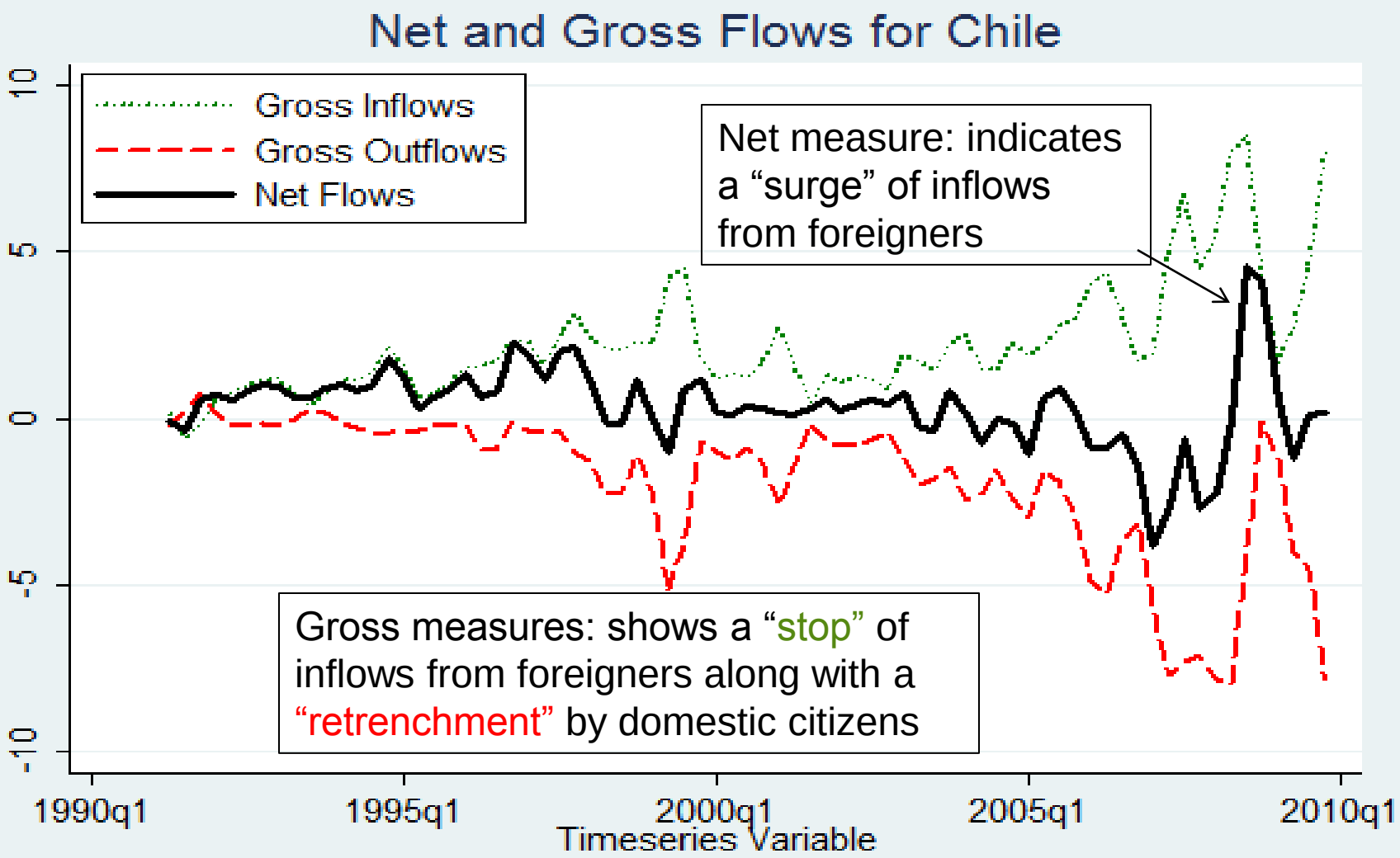
Comparison to Earlier Methodology

- 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
    - Recent movement toward the use of gross flow data (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 differentiate between these effects.

Example: Chile

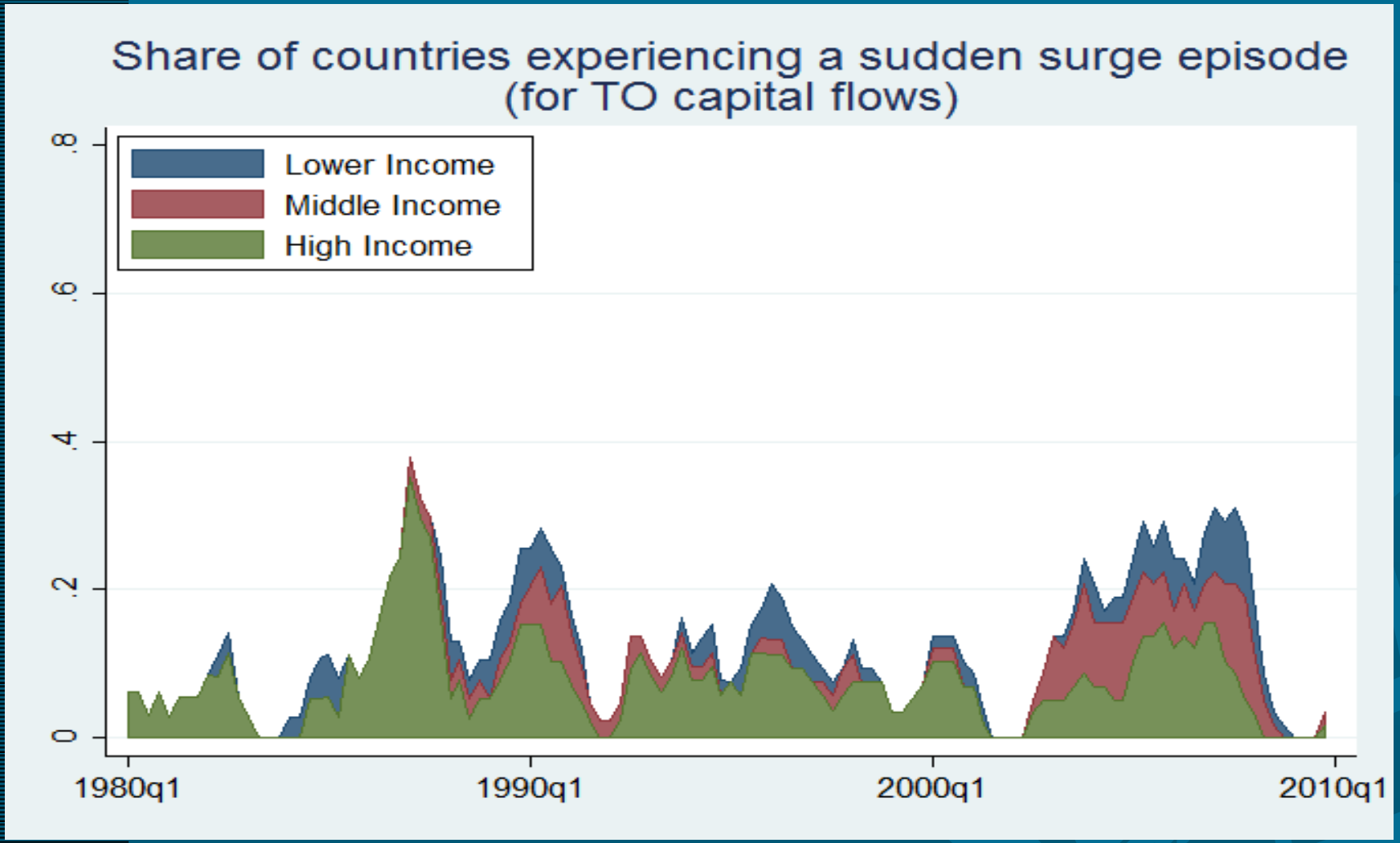


The Episodes: Summary Statistics

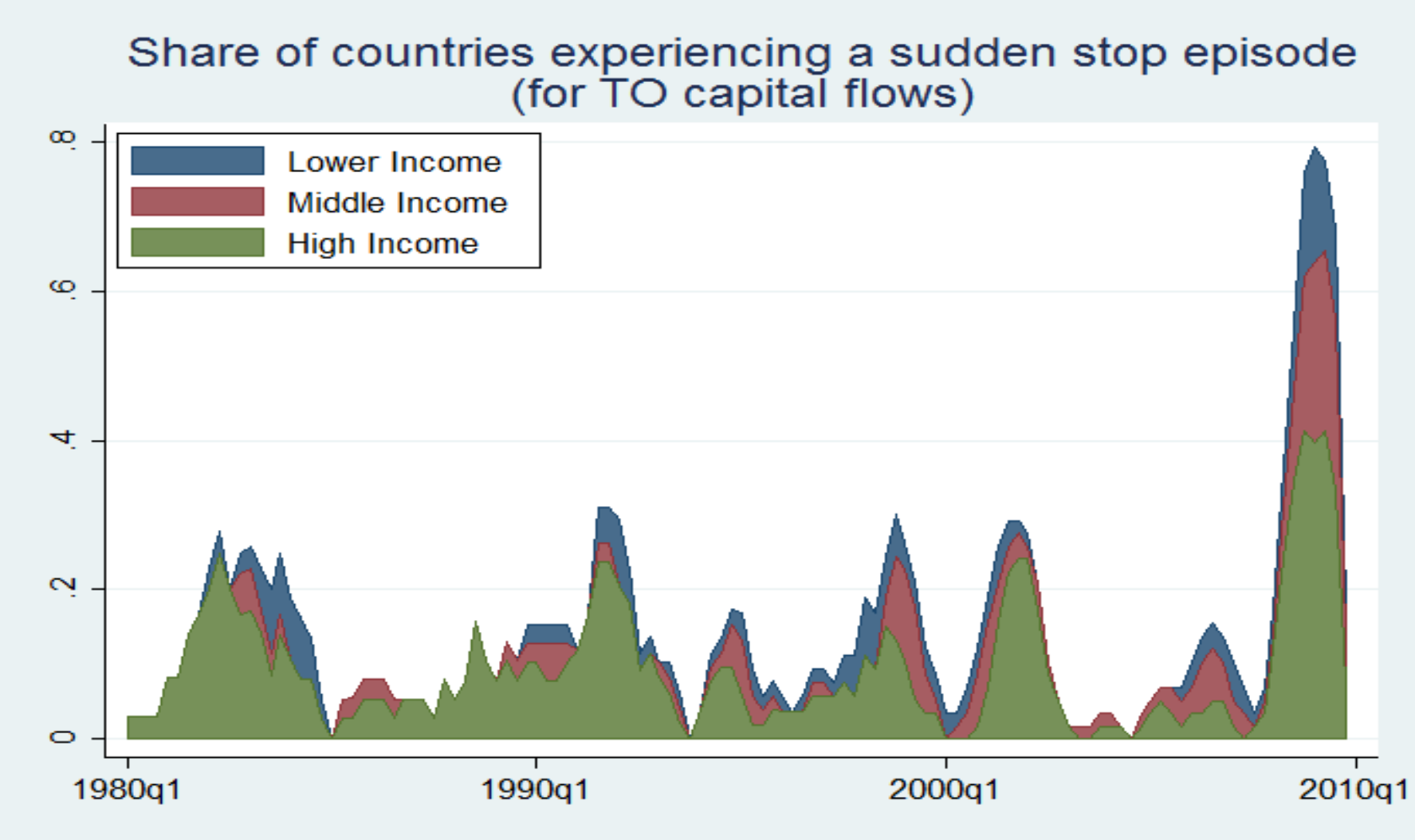
168 surges, 220 stops, 194 flight & 211 retrenchment

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

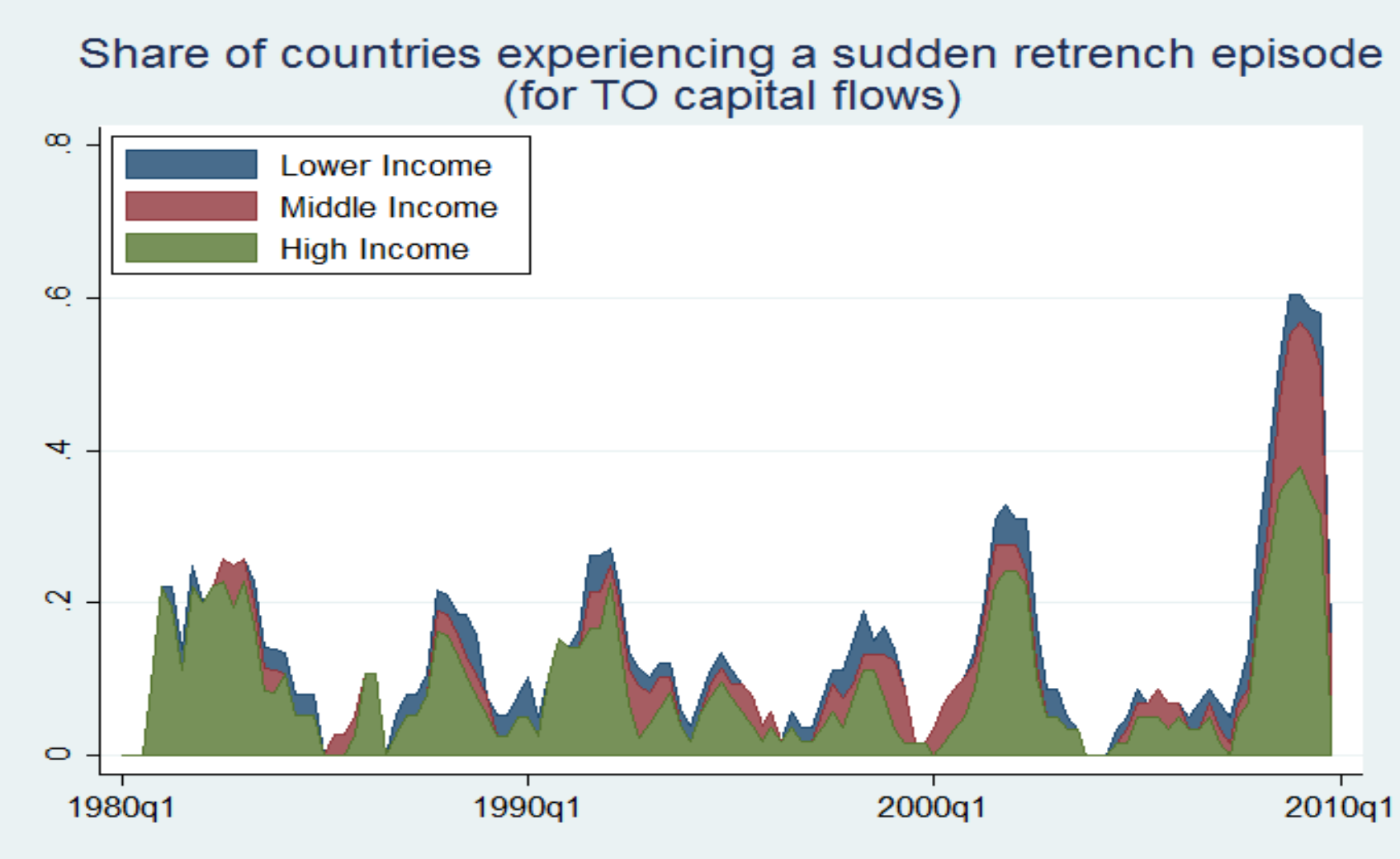
An elevated number of countries had surge episodes 2003-2007.



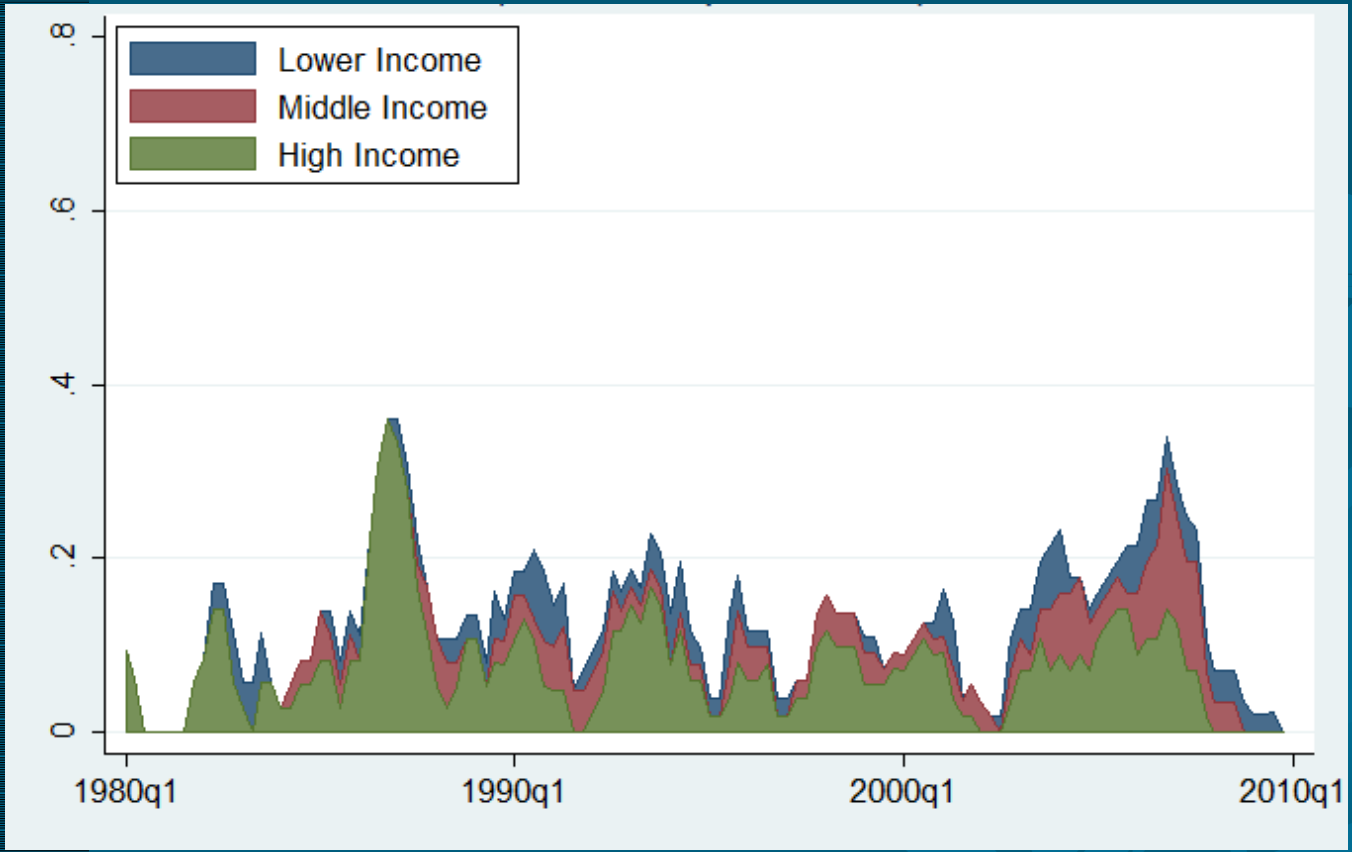
An unprecedented number of countries had stops in 2008/09.



During the GFC, investors from many countries were retrenching.



Share of Countries with Flight



Describing the Episodes:

Under What Conditions is a Country Likely to Experience Episode Type i?

- 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)
  - ϕ_t : global factors
  - γ_{it} : contagion variables
  - α_{it} : domestic variables

Various Factors: The Specifics

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

Baseline Results: Linkages

Stops and retrenchment have a linkages component.

	Surge		Stop		Flight		Retrench
Linkages							
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Financial	-1.164		**3.798****		1.289		**4.334****
	(1.426)		**(0.831)**		(2.502)		**(0.910)**

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
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Income	-0.002	-0.003	0.003	0.013**
	(0.008)	(0.005)	(0.010)	(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

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

Closer Look at Capital Controls

Capital Control Variable Measured by:	Surge	Stop	Flight	Retrench	# Obs
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
  - In general, more difficult to explain flight episodes

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, & 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

Energy Prices and Capital Flow Waves

- Relationship between energy prices and episodes of extreme capital flows.
  - Weak over the full sample of 1980 – 2010.
  - Stronger in the 2000s.
    - The pattern of oil prices in the 2000s – low to start the decade, surging by the middle of the decade, plummeting with the GFC and then rebounding – is matched by the pattern of surges (+) and stops and retrenchments (-).
    - Common factors?
- More generally, when a country's terms of trade have improved, it is more likely to experience <u>surge</u> and <u>flight</u> episodes.