Removing the Punch Bowl:
Moderating Vulnerabilities from Global Economic Booms*

Kristin Forbes: MIT-Sloan School and NBER
Michael Klein: Tufts-Fletcher School and NBER

*The views in this paper do not represent the views or policies of any institutions with which the authors are affiliated

NBER-Central Bank of Turkey Conference
"Monetary Policy and Financial Stability in Emerging Markets"
June 13-14, 2014 in Istanbul, Turkey

Motivation

- **Are there any policies which can moderate economic booms and their economic consequences?**
  - Key question from Global Financial Crisis
  - Relates to age-old question: William McChesney Martin's removing the "punch bowl"
  - Links to recent research led by many conference participants
- This paper: examines impact of 6 policies adopted during 2002-2007 aimed at moderating booms
  1. Increasing interest rates
  2. Tightening fiscal policy
  3. Allowing exchange rate appreciation
  4. Accumulating reserves
  5. Increasing controls on capital inflows
  6. Strengthening macroprudential regulations
- Uses propensity-score matching to address selection bias
  - Compliments analysis in "Pick Your Poison: The Choices and Consequences of Policy Responses to Crises" by Forbes and Klein (2013)

Key Results

- Many policies have large and meaningful effects on some outcomes:
  - Bank credit booms
  - Equity booms
  - Bank crises
  - Non-performing loans
- Policies which moderate certain aspects of booms simultaneously generate other risks
- Many results are not significant: unclear if reflects ineffectiveness of policies or limits to estimation technique
- Other caveats: timing, limited outcome measures, country-specific differences (including in policy formulation)

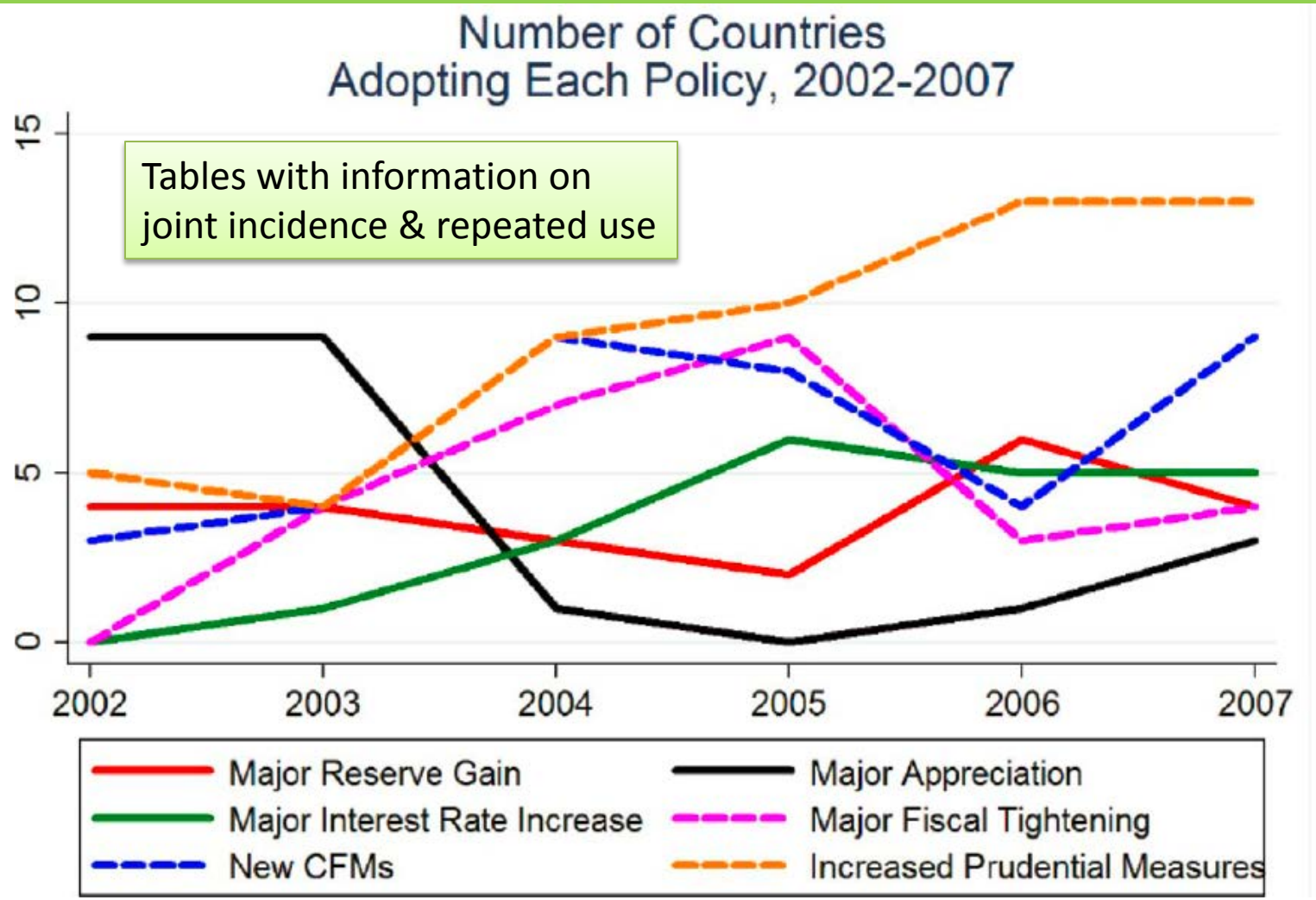
Comments Today

- Major policy responses during boom: definitions & incidence
- Propensity-score methodology
- Key Results

Defining "Major" Policy Responses

- Focus on major policy responses to moderate booms
  - Large and infrequent actions
  - Define thresholds so occur in 10% of country-year observations (except controls and macropru)
- 0/1 dummy measuring major policy responses (all relative to previous year):
  - Increase in interest rates: 244 bp ↑ in policy interest rate
    - Inflation <10%
  - Fiscal policy tightening: 1.4% ↑ in structural budget balance (to GDP)
  - Reserve accumulation: 4.4% ↑ in international reserves (to GDP)
  - Exchange rate appreciation: 16% appreciation in US$ ER
  - Controls on capital inflows: any increased controls, regulations on forex or intl exposure in financial sector
    - From Klein (2013), Beirne & Friedrich (2014), Ostry et al. (20132)
  - Macroprudential regulations: any increase in housing related or banking regulations
    - From Kuttner and Shim (2013)
- Additional requirements: data availability, euro zone, recession
- Final data set: 50 countries, annual data, 2002-2007

Time Series of Boom Responses



Propensity-Score Methodology (PSM) and OLS

- Concern with OLS: sample selection
  - Policies (treatments) undertaken by countries that themselves differ
  - Generates bias if differences correlated with likelihood of treatment, differences themselves affect outcomes
- Propensity-scores can be used to match treated observations to those "close" to them (Rosenbaum & Rubin, 1985)
  - Ability to control for differences even if not unidimensional
  - Common in labor & medical literatures, newer to intl/macro
- Both PSM & OLS estimate partial correlation of treatment with outcome variables conditional on covariates
- Both weight treated – untreated in estimation "across cells"
  - OLS: greatest weights on cells with equal likelihood of being treated or untreated
  - PSM: greatest weights on cells with highest likelihood of being treated, e.g. "nearest neighbors"

PSM vs. OLS

- Several advantages of PSM over OLS:
  - Puts more weight on comparison observations that are more "similar"
  - Greater emphasis on explaining policy choices (treatments) instead of outcomes
    - Allows large set of variables to determine propensity scores
  - Avoids specifying joint process governing outcomes, policy choices & covariates
    - Does not require linearity between treatments and outcomes since just comparing within "cells".
- Potential challenges of PSM relative to OLS:
  - Requires sufficient "similar" observations across countries and time
    - Particularly challenging in cross-country macro literature
  - Sensitivity of results to matching methods & control variables
  - **Must pass critical tests ("on support" & balancing/independence)**

Implementing PSM

- Define observations:
  - "Treatments": country-years when adopts major policy response
  - "Controls": country-years with no major policy responses
- 1st stage: Estimate logit model of probability that each country adopts each of major policy responses as a function of observables:
  - **Changes in global environment**: global risk, Δ U.S. interest rates, commodity prices
  - **Fairly stable domestic characteristics**: income per capita, institutional quality, pegged ER dummy, capital account openness, euro zone dummy
  - **Time-varying domestic variables**: current account balance/GDP, reserves/GDP, CPI inflation, Δ private credit, Δ stock market index, Δ real GDP growth, Δ gross capital inflows/GDP, commodity exporter interaction
  - **Recent changes in six major policy responses aimed at moderating boom in previous period**
- Base case: stepped regression focusing on variables significant at 20% level

	Reserves	Apprec.	Int Rate	Fiscal	Controls	MacroPru	
VXO		0.22*** (0.07)			-0.04 (0.03)	-0.07** (0.03)	**Lagged Global**
ln(Commodity)		8.17** (3.34)					
Δ(US Interest Rate)		-0.009*** (0.003)	0.006** (0.002)	0.003** (0.001)			
ln(RealGDP/Cap.)	-0.60*** (0.17)		0.82** (0.39)				**(Lagged) Country Charac-teristics**
Commodity × Exporter	0.81 (0.56)						
Cap.Acc't Openness			-0.81** (0.35)	-0.41** (0.17)	-0.41*** (0.12)	-0.61*** (0.13)	
Exchange Rate Peg				-1.26** (0.62)			
Δ(Real GDP Growth)		0.25** (0.12)		0.26** (0.10)	0.16** (0.07)		**Lagged Time-Varying Country Specific**
CA / GDP			-12.84** (5.70)			-11.23*** (3.65)	
Reserves / GDP	5.63*** (1.11)	-2.39* (1.26)	4.23** (1.73)	2.71*** (1.02)		3.07** (1.20)	
Δ(Inflows / GDP)		-4.63** (1.45)	5.34*** (1.90)				
CPI Inflation		0.14** (0.06)				0.01*** (0.04)	
Δ(Priv. Credit)	0.13*** (0.04)						
Appreciation Dummy		1.36** (0.61)					**Lagged Large Policy Changes**
Interest Rate Dummy			-1.31 (0.91)	1.38* (0.78)		-1.68 (1.20)	
Fiscal Dummy		1.88 (1.19)	-1.19 (0.73)				
Control Dummy			1.55** (0.61)	-1.53 (0.92)			
MacroPru Dummy	0.92* (0.51)		-3.04*** (1.16)			1.33*** (0.41)	
Pseudo R²	***0.20***	***0.25***	***0.27***	***0.21***	***0.08***	***0.27***	

Logit Results: Predicting Major Policy Changes

Propensity-Score Methodology

- Use coefficients estimated in logit model to calculate propensity scores
- Use propensity scores to match each treatment with a control group based on 5 matching algorithms:
  1. **Nearest neighbor without replacement**
  2. **5 nearest neighbors**
  3. **Radius** (with caliper = 0.05)
  4. **Kernel**
  5. **Local-linear**

- **<u>Tests of methodology</u>**
  - Preferred method (bias/efficiency tradeoff)
  - All treatments meet "common support condition"
  - Meets "independence" assumption/"balancing assumption"

Balancing Tests for Fiscal Tightening

MEANS FOR TREATMENTS AND CONTROLS

	Treated, All & On-Support		Untreated		5 Nearest Neighbors		Local Linear	
	$\mu_{T,\,All}$	$\mu_{T,\,ON}$	$\mu_{C,UM}$	t-stat	$\mu_{C,M}$	t-stat	$\mu_{C,M}$	t-stat
Δ(US Int. Rate)	64.8	67.0	-25.7	2.05**	74.4	0.23	49.0	0.45
Cap.Acc't Open	0.76	0.77	1.42	2.42**	0.45	0.78	0.24	1.25
Exch. Rate Peg	0.15	0.16	0.40	2.55**	0.19	0.29	0.36	1.62
Δ(RGDP Growth)	1.69	1.17	-0.06	3.53**	0.97	0.27	0.86	0.53
Reserves / GDP	0.26	0.23	0.15	3.32**	0.19	0.70	0.23	0.03
Int. Rate Dummy	0.15	0.16	0.04	2.43**	0.14	0.15	0.20	0.36
CFM Dummy	0.07	0.08	0.10	0.39	0.06	0.33	0.00	1.44

Impact of Policy Responses on Outcomes

- Calculate **average treatment effect on the treated (ATT)** for each policy response on each outcome variable
  - Compare average values for treated observations with average for matched controls
  - Estimate ATT for year of policy change and subsequent 2 years
  - Bootstrapped standard errors
- Test for impact on 4 outcome variables (for now):
  - **Incidence of bank credit boom** (Del-Ariccia, Igan, Laeven & Tone, 2012)
  - **Incidence of equity boom** (World Bank, GFDD)
  - **Incidence of bank crisis** (Laeven and Valencia, 2012)
  - **Share of NPLs/Gross loans** (World Bank, GFDD)

ATTs: Typical Results

Bank Credit Boom Dummy

Reserve accumulation	
ER appreciation	
Interest rate increases	
Fiscal tightening	**
Capital controls	*
Macroprudential regulations	

Equity Boom Dummy

Reserve accumulation	
ER appreciation	
Interest rate increases	**
Fiscal tightening	
Capital controls	
Macroprudential regulations	**

--Green indicates that policy listed moderated the boom;
--Red indicates a deterioration
--Blank indicates effect is small and below cutoff
--* Is significant at 5% level and ** at 10%

ATTs: Typical Results

Banking Crisis Dummy

Reserve accumulation	
ER appreciation	**
Interest rate increases	**
Fiscal tightening	
Capital controls	
Macroprudential regulations	

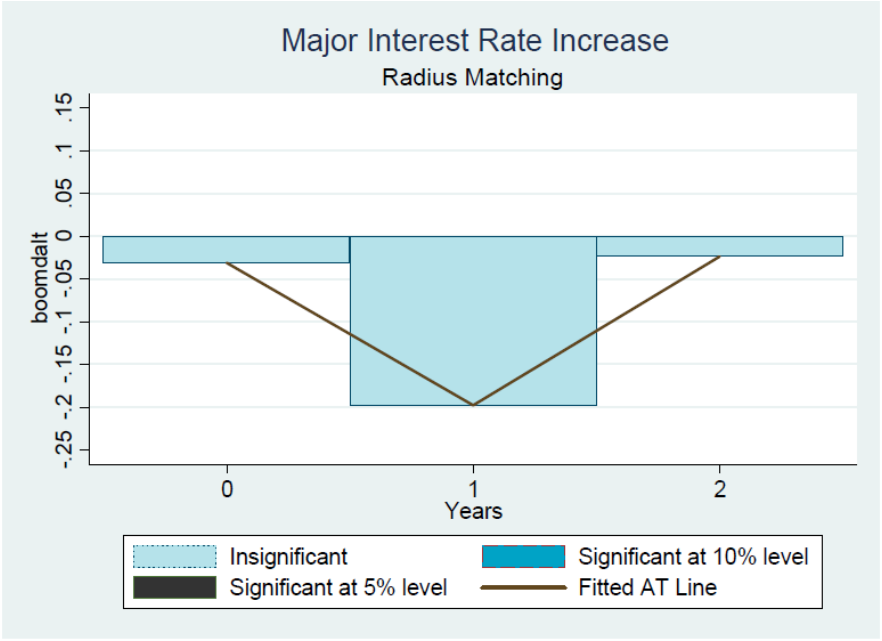
Increased Non-Performing Loans

Reserve accumulation	
ER appreciation	
Interest rate increases	
Fiscal tightening	
Capital controls	
Macroprudential regulations	

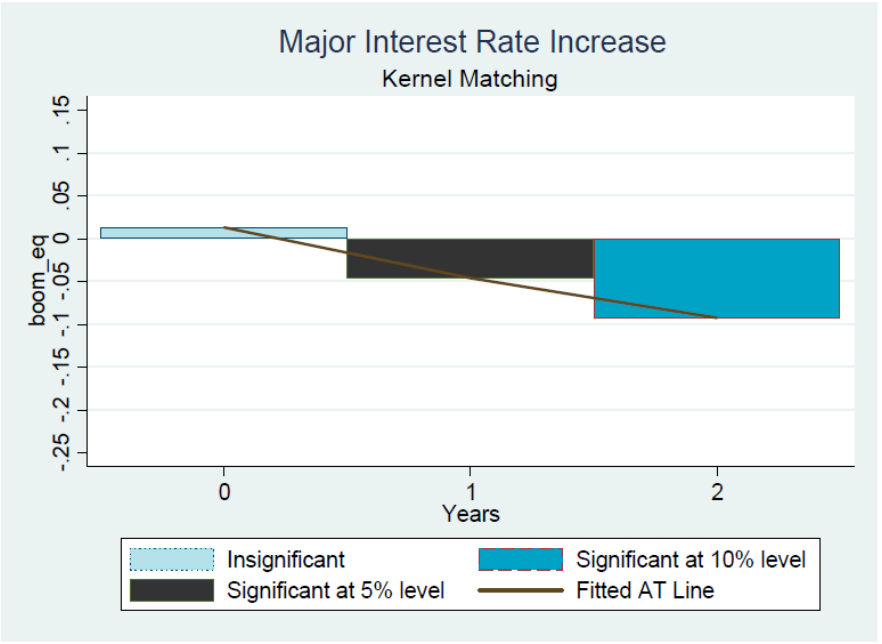
--Green indicates that policy listed moderated the boom;
--Red indicates a deterioration
--Blank indicates effect is small and below cutoff
--* Is significant at 5% level and ** at 10%

Large Interest Rate Increases: Effects on Booms

Bank Credit Booms

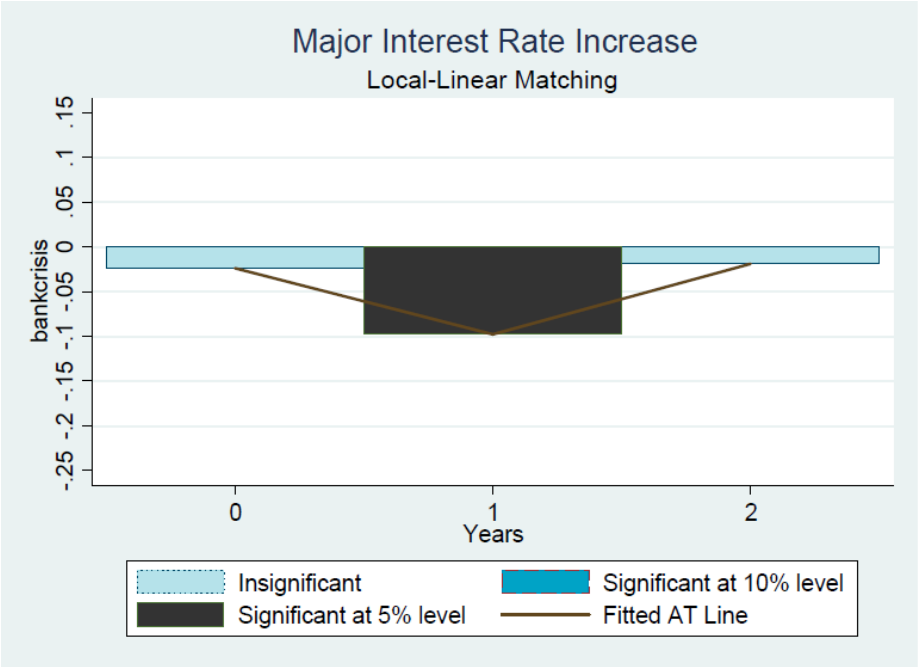


Equity Booms

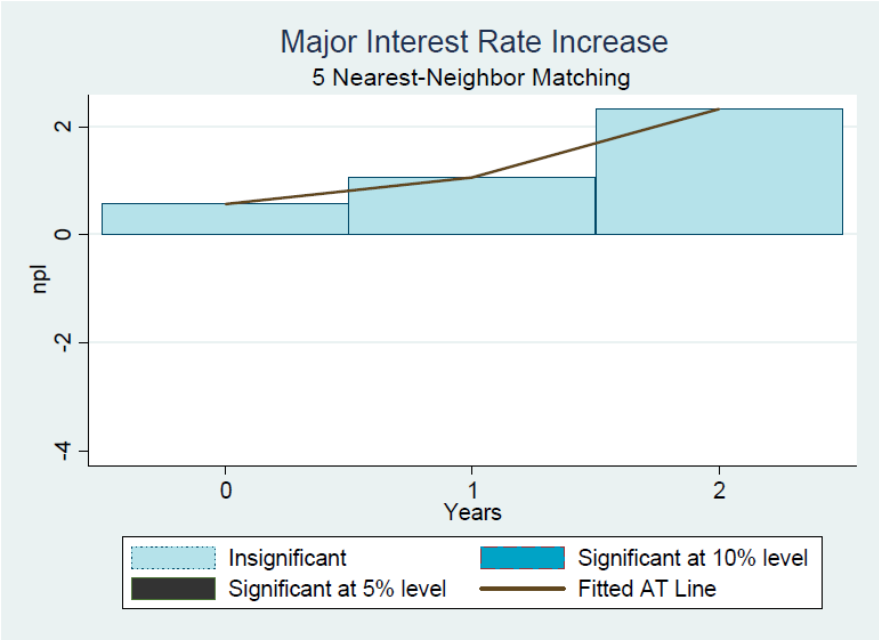


Large Interest Rate Increases: Effects on Bank Crises & NPLs

Bank Crises



NPLs



Extensions/Next Steps Tests

- Additional outcome variables (housing prices, leverage, data suggestions appreciated!)
- Different thresholds to qualify as a “major” policy change
- Finer gradations of policy changes (different macroprudential instruments)
- Different control variables in first stages
- Sample splits for EMs & developed countries

Conclusions

- What policies can effectively moderate economic booms?
  - To answer, need to take selection bias seriously
- Several policies have large and meaningful effects, but policies which moderate certain aspects of booms simultaneously generate other risks:
- Key caveats
  - Many results are not significant: unclear if reflects ineffectiveness of policies or limits to estimation technique
  - Unable to measure long term effects
  - Other costs and benefits not incorporated in analysis
  - Broad measures of policy variables may miss important distinctions