

# The housing price boom of the late '90s: did inflation targeting matter<sup>1</sup>

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SUERF/Bank of Finland Conference - 4-5 June 2009

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<sup>1</sup>Preliminary version. Opinions expressed are those of the authors only and do not necessarily reflect the views of the Banque de France.

# Motivation 1

- A recent central banker's view (L. Bini-Smaghi, ECB, 27 May 2009):

*"Recent experience has shown that the approach followed by most central banks, based on inflation targeting (which involves forecasting inflation on the basis of an economic model and changing interest rates so as to ensure that inflation forecasts are in line with the target), does not sufficiently take into account financial developments, in particular with regard to asset prices, which may affect the stability of the markets and, in time, inflation."*

## Motivation 2

- Monetary stability may well be a necessary, but not a sufficient condition for financial stability
- A line of criticism of monetary policies focusing too narrowly on inflation stabilization developed notably by BIS economists in the early 2000s (e.g. Borio and White, Jackson Hole, 2003)
- "New environment hypothesis": globalization, deregulated goods and labour markets and financial liberalization
- Coexistence of economic booms, growing financial imbalances and muted inflation pressures is then possible

## Motivation 3

- Inflation targeting central banks may neglect the build-up of financial imbalances because they do not materialize rapidly into higher inflation
- Possible explanations for the disconnection between financial imbalances and inflation pressures:
  - falling import prices from and exchange rate pegging policy of China
  - structural changes in labour markets: dampened second-round effects of supply shocks
  - effects of financial innovation: easier access to credit and substitution between financial gains and higher wage claims by employees

# Motivation 4

- "Paradox of credibility" hypothesis (Borio and Lowe, 2002), building on arguments based on imperfect common knowledge and the exaggerated value of public information (Amato and Shin, 2006).
- The success of inflation targeting strategies may hamper a proper assesement of long run inflationary risks (by private agents as well as by the central bank).
- Policy rates then fail to rise promptly and early enough

# Objective of the paper

- Bring such claims to the data and propose an empirical test of whether monetary policies focusing mainly on inflation have had a sizeable impact on housing price growth over the last decade
- Focus on inflation targeting (IT) countries vs non-targeters: objective classification criterium
- Many papers on inflation / output growth performance of ITers, but no study on the consequences of IT for financial stability

# Overview and main results

- A comparative study on 17 OECD countries over 1980-2006
- An innovative methodology imported from the program evaluation literature (propensity score matching)
- Main findings: significantly higher levels of real housing price inflation in IT countries (by some 2% on average over various methods and models, whole sample), also higher house price to rent ratio (by some 10%)

# The recent housing price boom

- Several episodes of housing price B&B since 1970
- Latest episode unusual by its magnitude, length and geographical extension
- Monetary policy strategies largely absent from the list of usual suspects, including demographics, financial innovation and deregulation, loosening of credit standards, declining trends in real interest rates...
- Two simple metrics of imbalances: real housing price growth (RHOPG) and the house price to rent ratio (HOPCPIH).



# A possible selection bias on observables

- Pitfalls of regressing housing price growth on an IT dummy and control variables:

$$Y_{it} = \gamma D_{it} + \beta X_{it} + \varepsilon_{it} \quad (1)$$

- What if adopting IT depends on variables that also matter for explaining house price developments?
- For instance, economies with more developed/liberalized financial systems will be more likely to implement inflation targeting while more prone to credit and housing booms.
- We face a problem of selection on observables!

# Solution from program evaluation literature 1

- Microeconomic technique recently applied to macro issues (Persson, Ec Pol. 2001, Lin and Ye, JME 2007, Vega and Winkelried, JEEA 2005)
- Consider IT adoption as a natural experiment: a "treatment"
- Assess the average treatment effect on treated (ATT)

$$ATT = E [Y_{it}^1 | D_{it} = 1] - E [Y_{it}^0 | D_{it} = 1] \quad (2)$$

## Solution from program evaluation literature 2

- Problem:  $Y_{it}^0 | D_i = 1$  is not observable. How to get  $E [Y_{it}^0 | D_i = 1]$  ?
- $E [Y_{it}^0 | D_i = 0]$  (average on the control group) is not a good proxy since IT adoption is likely not to be random
- Let's randomize it:
  - Suppose that some determinants  $X_i$  of  $Y_{it}$  also matter a priori for IT adoption (e.g. prerequisites)
  - Then, conditionally on the  $X_i$ , the  $Y_{it}$  variable should be independent of the strategy variable:  $(Y_{it}^1, Y_{it}^0) \perp D_{it} | X_i$  (CIA). The ATT thus reads:

$$ATT = E [Y_{it}^1 | D_i = 1, X_i] - E [Y_{it}^0 | D_i = 0, X_i] \quad (3)$$

# Propensity score

- If  $X_i$  is a vector of macro variables, difficult to match treated to counterfactual observations
- To solve the dimensionality problem, we may compute a propensity score using a probit regression of  $D_i$  on the  $X_i$  and compare observations according to this scalar.
- Indeed, under CIA, measuring the ATT is equivalent to measuring (see Rosenbaum and Rubin, 1983):

$$ATT = E [Y_{it}^1 | D_i = 1, p(X_{it})] - E [Y_{it}^0 | D_i = 0, p(X_{it})] \quad (4)$$

# Matching issues

- Numerous matching methods: does it make a difference?
  - Not much in large datasets with common support
  - In smaller datasets: trade-off between Bias and Variance of the ATT
- Small sample issue here. According to Frölich (2004), kernel matching is more robust to small sample bias.
- Common support: drop treated obs. outside the support of control units.
- Implementation of epanechnikov kernel matching (bw. 0.06) using PSMATCH2 (Leuven and Sianesi, 2003).

# Data issues

- 17 countries over 1980-2006, annual frequency
- Nine ITers, including Finland and Spain until EMU
- Two definitions of IT adoption timing: soft IT (merely announcement) vs fully fledged IT (full implementation)
- EMU countries from 1999 on are classified as non-ITers: stick to an objective criterion
- Variant for robustness: Euro area coded as IT over 1999-2006 ("quantitative objective"), unbalanced panel.

# Inflation targeting adoption timing

Countries	Starting year of IT strategy	
	soft (IT 1)	fully fledged (IT 2)
Australia	1994	1994
Canada	1991	1994
Finland	1993	1993
New Zealand	1990	1991
Norway	2001	2001
Spain	1994	1995
Sweden	1993	1995
Switzerland	2000	2000
United Kingdom	1992	1992

# Propensity score estimation

- Pooled probit model of the IT variable (IT1 or IT2)
- Objective:
  - we aim to correct for selection bias on "observables" = determinants of  $Y_{it}$
  - ... and not to propose a proper model of IT adoption
- Selected conditioning variables that:
  - should explain RHOPG (see standard determinants of housing prices)
  - should have an impact on the IT status (selectivity issue)
  - but should not be affected by the treatment (CIA)



# Choice of conditioning variables

- lagged short and long interest rates in real terms (RIRS and RIRL),
- lagged net household disposable income in real terms (NDIG)
- a fixed exchange rate regime dummy (FER) from Reinhart and Rogoff (2004)
- a dummy variable indicating the degree of sophistication of the national mortgage market (MS)
- a proxy for financial development: lagged ratio of the private credit to GDP (CREGDP) or net households' savings to income ratio (SAR)
- a lagged dummy for a banking crisis (source: World Bank).

# The role of mortgage market structures

- role of mortgage market structures for monetary policy transmission: Tsatsaronis and Zhu (2004), Gerlach and Assenmacher-Wesche (2008) and Calza et al. (2008).
- IT countries often have more sophisticated/deregulated mortgage markets (MEW, short term rate fixation etc.)
- Data limitations → Our solution: a 0-1 IMF-like index of mortgage market sophistication/development (MS)

# Classification based on the MS index

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"highly developed" (MS dummy=1)	"less developed" (MS dummy=0)
Australia	Belgium
Canada	Denmark
Finland	France
Ireland	Germany
Netherlands	Italy
Norway	New Zealand
Spain	Sweden
United Kingdom	Switzerland
United States	

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# Summary statistics and the case for a selection bias

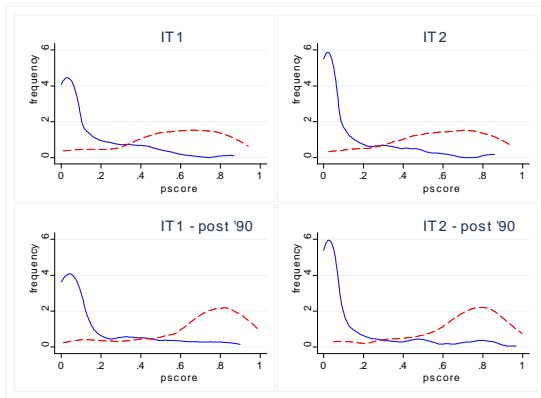
Variables	IT1=0, 1980-2006			IT1=1, 1980-2006		
	Obs	Mean	Std.Dev.	Obs	Mean	Std.Dev.
RHOPG	343	2.13	7.71	99	3.99	5.87
RIRS	343	4.15	3.18	99	3.25	1.83
RIRL	343	4.56	2.66	99	4.24	1.75
NDIG	323	2.27	2.40	99	2.68	2.41
CREGDP	343	0.70	0.43	99	1.01	0.35
MS1	343	0.51	0.50	99	0.62	0.49
SAR	343	11.50	9.74	99	5.85	5.21
BKCR	343	0.10	0.30	99	0.05	0.22

Table: Descriptive statistics

## Results of Probit estimation (2)

- Real short and long term interest rate, fixed FX rate dummy, mortgage structures and financial development and banking crises are significant
- Expected signs
- Densities of propensity scores have a "good shape": sufficiently accurate models of IT adoption, but still some common support

# Propensity score densities



**Figure:** Propensity scores densities: non-targeters (solid) vs targeters (dashed)

# Results of matching

- Positive and significant impact on RHOPG and HOPCPIH of IT adoption
- Larger if controls are restricted to the post 1990 period and strict targeting is considered
- Robustness checks: alternative measure of financial development, exclusion of outliers, EMU as one IT country, other matching methods.
- Quality checks: the results of our matching procedures correctly pass standard balancing tests.

# Matching estimates of treatment effect on housing price inflation (1980-2006)

		RHOPG	RHOPG	RHOPG	HOPG	HOPCPIH
		baseline	no out.	SAR		
IT1	ATT	2.78	2.73	0.63	3.28	0.09
	SD	(1.20)	(1.18)	(0.92)	(1.51)	(0.04)
	Treated /Control units	99/326	99/323	98/322	99/326	99/315
IT2	ATT	2.64	2.58	1.28	2.32	0.08
	SD	(0.99)	(0.96)	(0.95)	(1.07)	(0.04)
	Treated /Control units	92/333	92/330	91/329	92/333	92/322

Note: bootstrapped standard errors for ATT are reported in parenthesis (1000 reps)



# Matching estimates of treatment effect on on housing price inflation : EMU as one IT country (1980-2006)

		RHOPG baseline	RHOPG no out.	RHOPG SAR	HOPG	HOPCPIH
IT1	ATT	3.07	2.81	0.86	2.84	0.08
	SD	(1.32)	(1.26)	(0.93)	(1.41)	(0.04)
	Treated /Control units	105/262	105/260	104/258	105/262	105/251
IT2	ATT	2.72	2.60	1.32	2.18	0.10
	SD	(1.16)	(1.10)	(0.92)	(1.09)	(0.04)
	Treated /Control units	98/269	98/267	97/265	98/269	98/258

Note: bootstrapped standard errors for ATT are reported in parenthesis (1000 reps)

# Conclusion

- We find evidence that inflation targeting was associated with higher housing price growth in the late 1990s-early 2000s.
- Our exercise can be viewed as an empirical test underlying recent non-formalized criticism against monetary policies too exclusively focused on stabilizing inflation in the short run
- Caveats: some data limitations regarding available housing price series, no access to comparable series of mortgage credit...
- Impetus for more formal research on the consequences of the inflation targeting paradigm for financial stability.

# Conclusion

- Thank you for your attention !

# Choice of the matching method: a trade-off between bias and variance

Methods	Bias	Variance	Problem/Choice
One nearest neighbour	- ( good match)	+ (less info)	ordering of matches
Multiple neighbours	+ (poorer matches)	- (more controls)	number + weights
Matching with replacement	- ( better matches)	+ (less distinct controls)	-
Radius matching	- ( bad match avoided)	+ (fewer matches)	radius choice
Kernel Matching	+ (poorer matches)	- ( more info)	bandwidth choice
Local Linear Matching	+ (poorer matches)	- ( more info)	-

(+)/(-): increase/decrease

# Construction of the MS index and MS dummy

- Let's consider four features: MEW, the loan-to-value ratio (LTV), securitization, the share of owner-occupied homes, the type of interest rate adjustment (F or V)
- For each feature: values between 0 and 1 are assigned depending on the degree of development
- MS index value = average of 4 features : higher values indicating easier access to mortgage finance
- MS dummy: compared with median value: “highly developed” mortgage market (MS = 1) or “less developed” (MS = 0)