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Italy's firm and household investment: The role of credit constraints and other macro factors
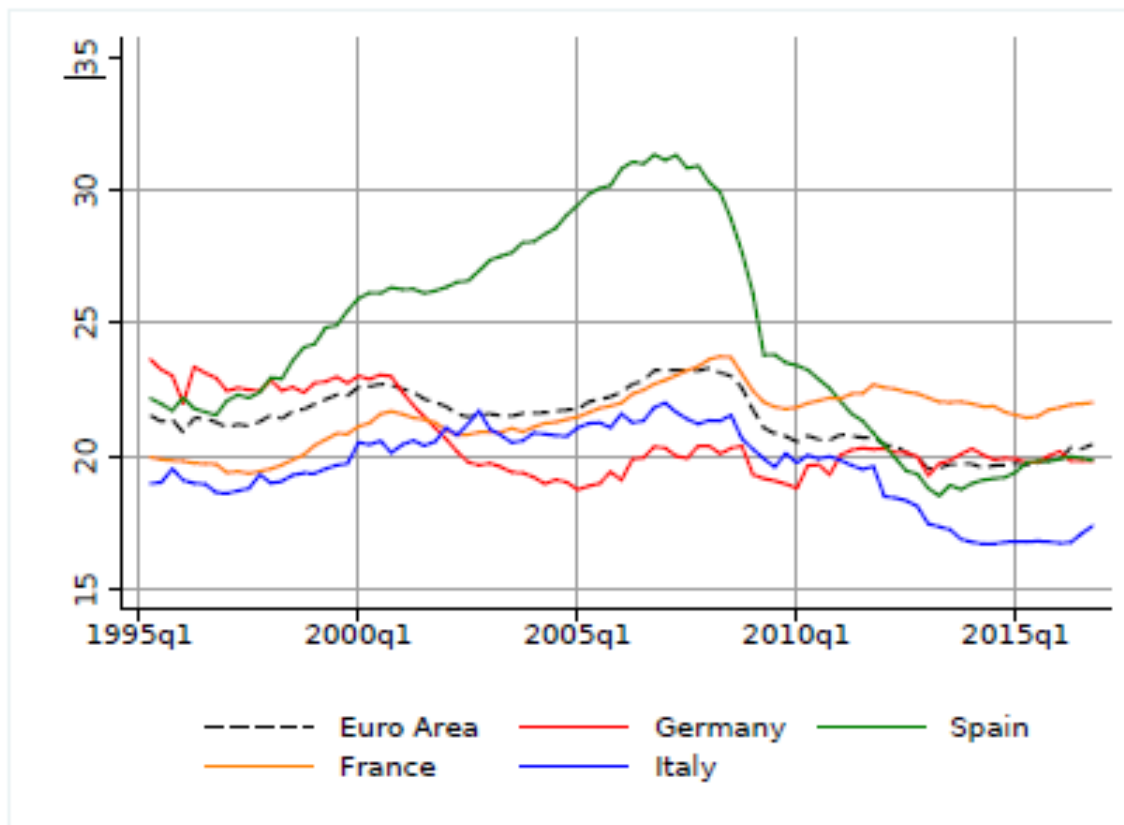
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(Banca d'Italia)

"How financial systems work: evidence from financial accounts",
Banca d'Italia Workshop, Rome
30th November 2017

Motivation

Investment rates in the euro area
(ratio of nominal total investment to GDP at market prices; percentage shares)

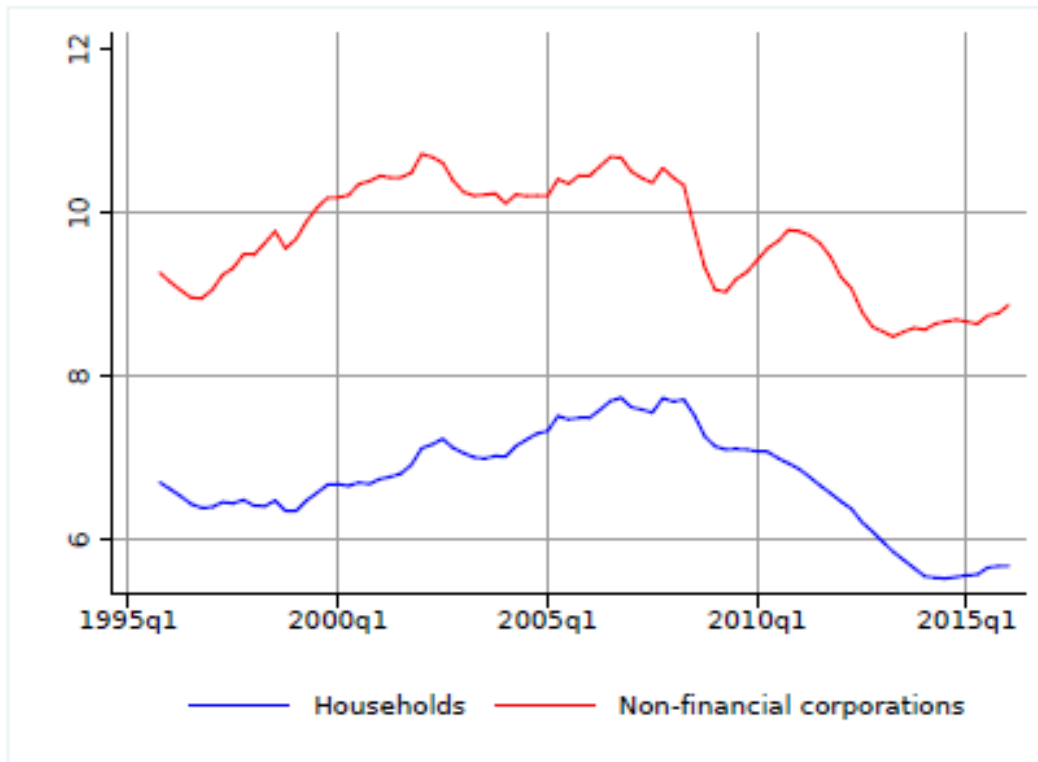

Source: Authors' calculations on Eurostat data.

o Until GFC, Italy's **investment rate comparable** to Germany and France's

o Subsequent **downturn** in Italy was the **largest** (excl. Spain) and the **most persistent**

o In 2016 "**investment gap**" w.r.t. pre-crisis average of over 3 points

o Lowest investment rate **since the 1950s**

Our contribution

o *What are the (macro) factors behind Italy's medium-term investment performance? And, in particular, did credit constraints play a role?*

o References: among others, Banerjee et al. (2015); Barkbu et al. (2015); Busetti, Giordano and Zevi (2016); Bacchini et al. (2017); 2017 ECB Report on Low Investment

o Originality of our contribution based on **3 aspects**:

(i) **Non-financial corporations'** (NFCs) **vs. households'** (HH) investment ⬄ institutional sector accounts

(ii) **Multivariate VECMs**: flexible neoclassical model vs. augmented model; long-run relationships vs. short-run dynamics

(iii) **Financial constraints**: indebtedness (financial accounts) vs. credit rationing (Bank of Italy's Survey of Industrial and Service Firms)

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The facts

Investment rates in Italy <u>by institutional sector</u>
(ratio of nominal investment to GDP at market prices; percentage shares)

Source: Authors' calculations on Istat data. Notes: The nominal investment series at the numerator is here smoothed by taking a 4-term moving average.

o **50% ca**. of total investment undertaken by NFCs and **35%** by (consumer and producer) HHs

o **Comparable pre-GFC** investment rate **dynamics**

o Larger drop in 2009 for **firms** but steeper first recovery

o In 2016 "**investment gap**" w.r.t pre-crisis average of over 1 point

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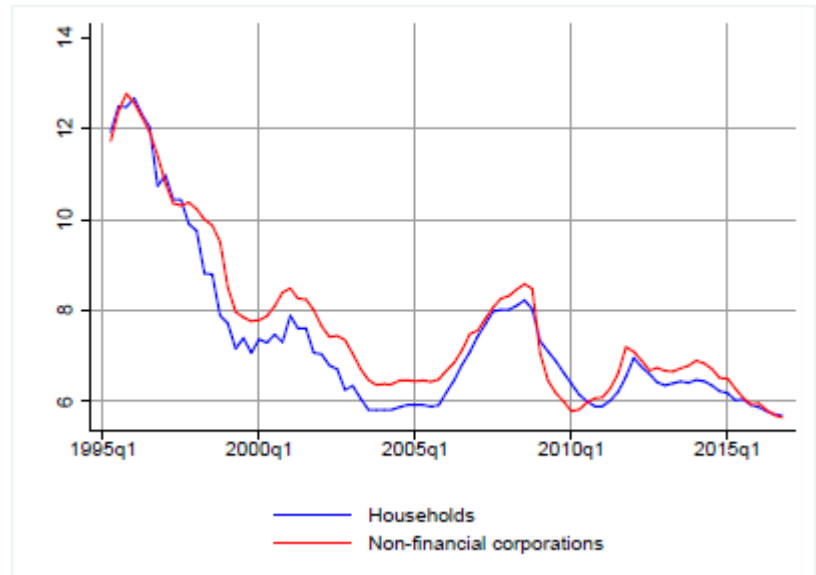EUROSISTEMA

<u>Other sectors</u>

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The "neoclassical" determinants

**Real value added of NFCs
and real disposable income of HHs**
(1996Q1=100; SA data)
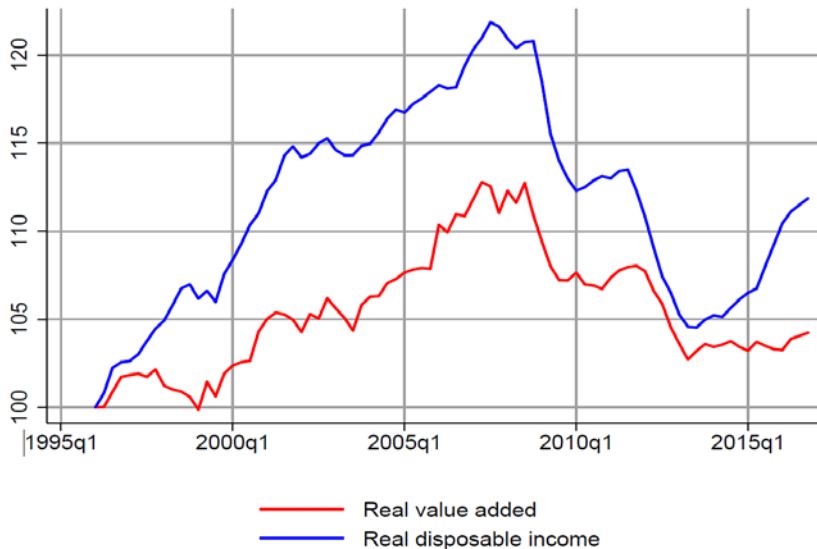
Source: Authors' calculations on Istat data.

**Real user cost of capital**
(percentage points)

Source: Authors' calculations on Banca d'Italia, Consensus Economics and Istat data.

o Comparable **Y dynamics** for NFCs and HHs

o Definition of **real user cost of capital r**: real cost of borrowing + depreciation rate

o Steady decline in **r** linked to inception of EMU; spikes during crisis episodes

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The neoclassical model

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Additional factors: uncertainty

Firms' and consumers' <u>uncertainty</u>
(standardised dispersion measures; NSA data)
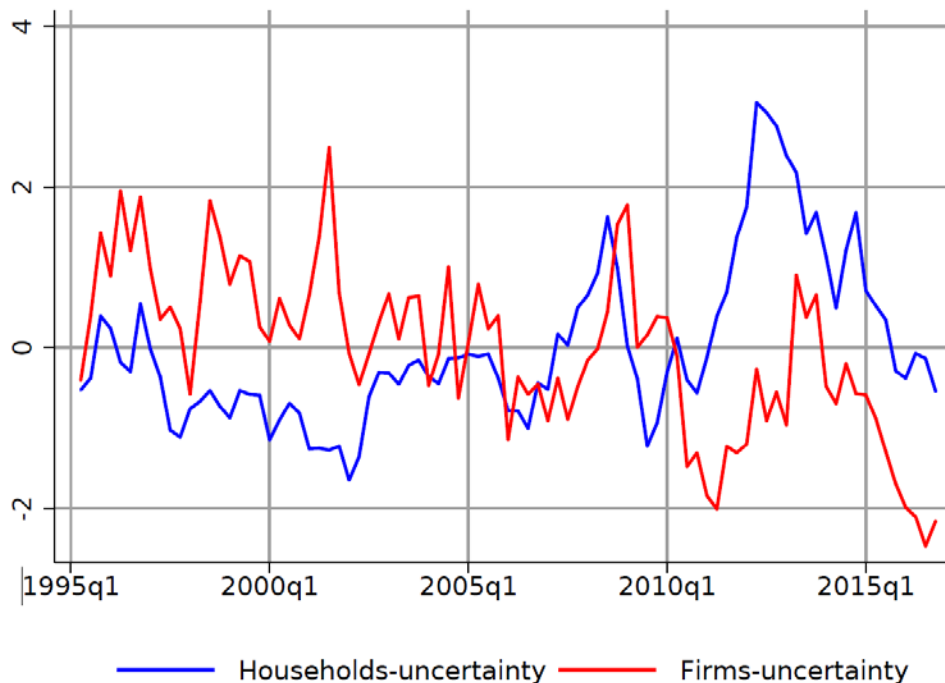
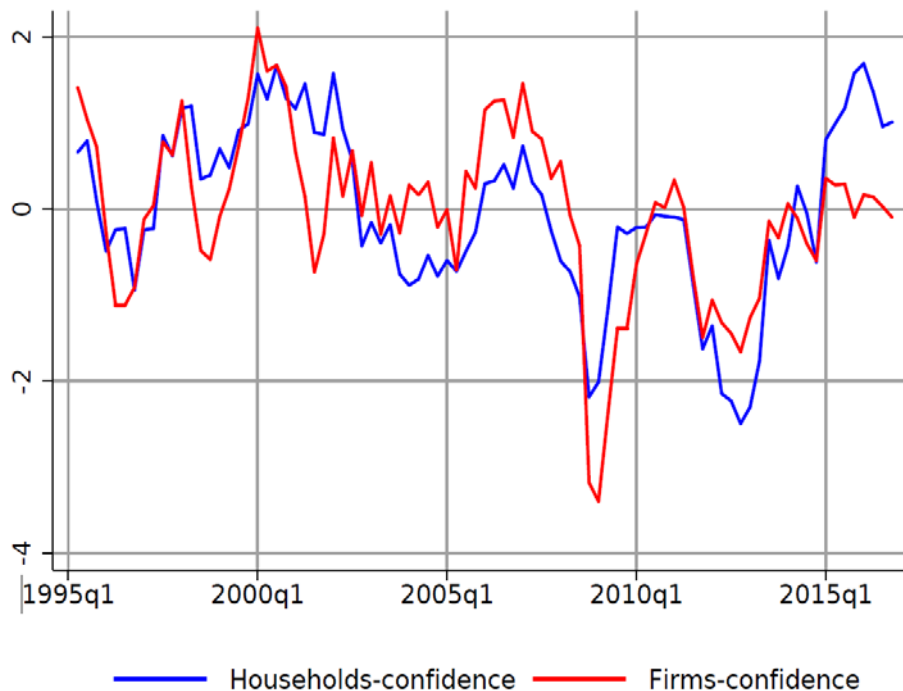Source: Authors' calculations on Istat Business and Consumer Survey data and on Istat NA data.

$$unc_t = \sqrt{frac_t^+ + frac_t^- - (frac_t^+ - frac_t^-)^2}$$

where frac is the share of firms with increase (+) or decrease (-) responses at time t

o **Theory**: Dixit & Pindyck (1994)

o **Empirics for Italy**: Guiso & Parigi (1999); Bontempi et al. (2010); Busetti, Giordano & Zevi (2016)

o **NFCs**: dispersion in expectations on production and orders of manuf. firms

o **HHs**: weighted average of the above and of dispersion in expectations on personal situation of consumers

o **Spikes** in early 2000s for NFCs and during GFC and SDC episodes for both NFCs and HHs

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Additional factors: confidence

**Firms' and consumers' confidence**
(standardised indices; NSA data)

Source: Authors' calculations on Istat Business and Consumer Survey data and on Istat NA data.

o **Business climate** (Parigi & Siviero 2001; Busetti, Giordano & Zevi 2016) **and consumer confidence** may also matter: "first moment" of NFCs' and HHs' outlook

o **NFCs**: business confidence index

o **HHs**: weighted average of business and consumer confidence indices

o Dramatic **drops** during GFC and SDC; **upward trend** since then

Additional factors: financing constraints [1]

Indebtedness by institutional sector
(percentage points)

Legend:
— Households' debt-to-income
— Firms' debt-to-GDP
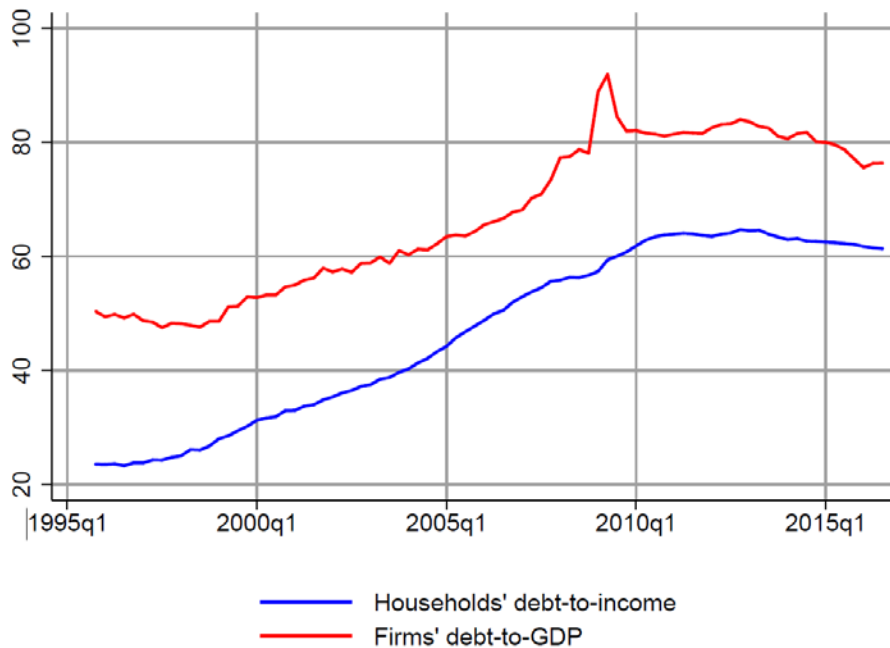
Source: Authors' calculations on Istat and Banca d'Italia data.

o **Theory:** Myers (1977); Stiglitz & Weiss (1981); Bernanke & Gertler (1989); Bernanke et al. (1999)

o **Empirics for Italy:** Gaiotti (2013); Bond et al. (2015); Cingano et al. (2016); Busetti et al. (2016)

o Measure #1 (indirect): **debt-to-GDP/income**

o Significant **increase** in indebtedness until SDC; **some deleveraging** since then

Measures of leverage

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Additional factors: financing constraints [2]

NFCs' debt-to-GDP and credit constraints
(percentage points)

Debt-to-GDP (left-hand side)
Credit constraints (right-hand side)

Source: Authors' calculations on Istat and Banca d'Italia data.
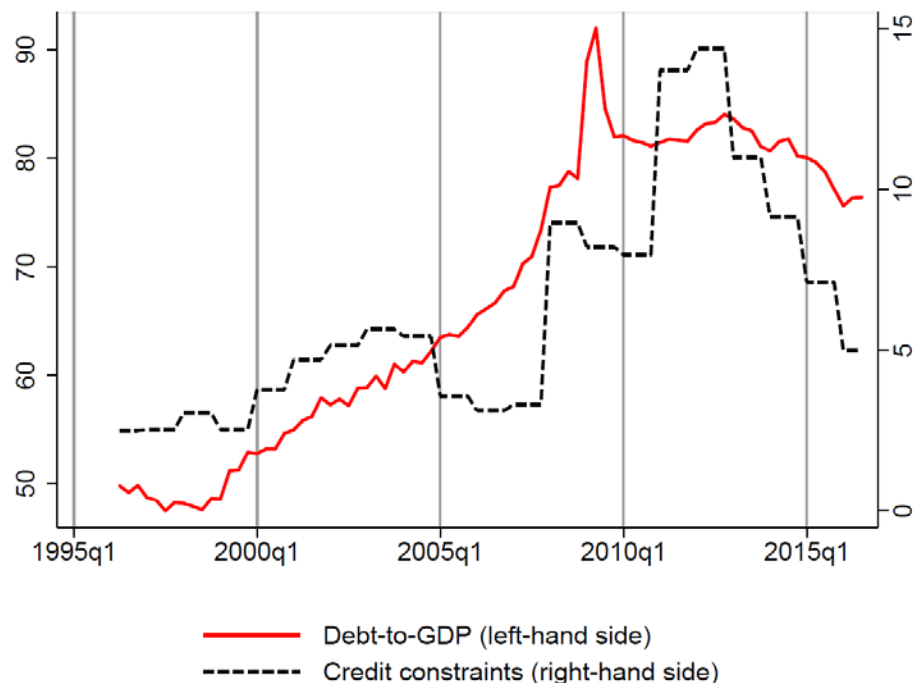
o Measure #2 (direct): **share of credit-rationed firms** out of surveyed firms in Banca d'Italia's SISF

o **Peak** during SDC; **attenuation** of credit constraints since then

The econometric framework

o   We begin with a **multivariate VAR(p)** model: $A(L)y_t = CD_t + \varepsilon_t$

where y_t is a vector of n I(1) endogenous variables, $\mathbf{D_t}$ is a matrix of deterministic terms, **A**(L) is a matrix polynomial of order p in the lag operator L and t=1,…,T.

o   It can be represented as a **VECM** (Johansen 1995):

$$\Delta y_t = CD_t + \Pi y_{t-1} + \sum_{i=1}^{p-1} \Gamma_i \Delta y_{t-i} + \varepsilon_t$$

o   If Π has reduced rank ρ with 0<ρ<n, it is possible to decompose $\Pi = \alpha\beta'$, where α and β are both n x ρ matrices (with full column rank ρ) such that:

$$\Delta y_t = CD_t + \alpha\beta' y_{t-1} + \sum_{i=1}^{p-1} \Gamma_i \Delta y_{t-i} + \varepsilon_t$$

where **β´ y_{t-1}** is the vector of **long-run cointegrating relationships**, **α** is a matrix of **loading factors** and **Γ_i** are parameter matrices accounting for **short-run dynamics**

o   If α_i=0, the variable *i* is "**weakly exogenous**" w.r.t the LR parameters (Engle, Hendry & Richard 1983; Johansen 1992)

Preliminary testing

o Multivariate VAR(2)/**VECM(1)** model with **6 variables** (investment, output, user cost of capital, uncertainty, confidence, financing constraints) separately for NFCs and HHs; quarterly data; 1995-2016

o **Weak exogeneity tests** (Johansen 1992):

NFCs

	$\alpha_{1,1}=0$	$\alpha_{2,1}=0$	$\alpha_{3,1}=0$	$\alpha_{4,1}=0$	$\alpha_{5,1}=0$	$\alpha_{6,1}=0$
Chi-square(1)	4.3977	16.3545	15.9951	0.1315	0.3561	2.3685
P-value	0.0360	0.0001	0.0001	0.7169	0.5507	0.1238

The asymptotic distribution is Chi-square(1), for which the 95% percentile is 3.8415.

HHs

	$\alpha_{1,1}=0$	$\alpha_{2,1}=0$	$\alpha_{3,1}=0$	$\alpha_{4,1}=0$	$\alpha_{5,1}=0$	$\alpha_{6,1}=0$
Chi-square(1)	4.3367	3.3405	10.7442	2.1687	1.0671	2.6762
P-value	0.0373	0.0676	0.0010	0.1408	0.3016	0.1019

The asymptotic distribution is Chi-square(1), for which the 95% percentile is 3.8415.

o Null of weak exogeneity: **rejected** for (1) real investment, (2) output and (3) user cost of capital; **not rejected** for (4) uncertainty, (5) confidence and (6) financing constraints

o Final specification: trivariate model with **3 I(1) endogenous variables** separately for NFCs and HHs

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Tests

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Results for NFCs' investment

	Coint. Equation		
$\ln(I_{t-1})$	1.0000		
$\ln(Y_{t-1})$	-1.2349***		
	[-4.3259]		
r_{t-1}	0.1557***		
	[3.1542]		
Trend	0.0034***		
	[4.4485]		
Const.	2.8436		
Error Correction:	$\Delta(\ln(I_t))$	$\Delta(\ln(Y_t))$	$\Delta(r_t)$
Speed of adj.	-0.0861***	-0.0350***	0.1744
	[-4.0242]	[-3.0798]	[1.2901]
$\Delta(\ln(I_{t-1}))$	0.4376***	0.0658	-0.0872
	[3.3984]	[0.9617]	[-0.1072]
$\Delta(\ln(Y_{t-1}))$	0.2586	0.3627**	2.6717
	[0.7752]	[2.0472]	[1.2673]
$\Delta(r_{t-1})$	0.0557**	0.0318***	0.3970***
	[2.5692]	[2.7650]	[2.9005]
$\Delta(Uncertainty)_{t-1}$	-0.1079*	-0.0490	-0.4261
	[-1.7914]	[-1.5324]	[-1.1195]
$\Delta(Climate)_{t-1}$	0.0327*	0.0241**	0.4074***
	[1.7888]	[2.4787]	[3.5383]
$Creditconstraints_t$	-0.1079***	-0.0426**	0.2847
	[-3.3870]	[-2.5189]	[1.4139]
Const.	0.0079***	0.0038***	-0.0305*
	[3.1142]	[2.8058]	[-1.9123]
Adj. R-squared	0.7659	0.6920	0.4227
Log likelihood		747.9253	
Schwarz criterion		-17.6136	

Notes: t-statistics are in [ ]. ***, ** and * denote statistical significance at 1, 5 and 10%, respectively.

- o **LR positive relationship** (around unity) **with Y** and **negative** relationship **with r**

- o **Speed of adjustment** significant and **negative**

- o Rise in **uncertainty**, deterioration in **business climate** and tighter **credit constraints** have dampened NFCs' investment dynamics

- o Satisfactory model **fit,** slightly better than with debt measure

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Results for HHs' investment

	Coint. Equation		
$\ln(I_{t-1})$	1.0000		
$\ln(Y_{t-1})$	-2.5365*** [-14.1030]		
r_{t-1}	0.0895*** [3.7001]		
$Trend$	0.0032** [2.3118]		
$Const.$	14.2944		
Error Correction:	$\Delta(\ln(I_t))$	$\Delta(\ln(Y_t))$	$\Delta(r_t)$
Speed of adj.	-0.1276*** [-3.9792]	-0.0090 [-0.4088]	0.6382*** [2.9390]
$\Delta(\ln(I_{t-1}))$	0.7639*** [9.0467]	0.1691*** [2.9314]	0.3890 [0.6802]
$\Delta(\ln(Y_{t-1}))$	-0.4216** [-2.3128]	0.1344 [1.0789]	6.5951*** [5.3420]
$\Delta(r_{t-1})$	0.0349** [2.3164]	0.0314*** [3.0499]	-0.1397 [-1.3696]
$\Delta(Uncertainty)_{t-1}$	0.0096 [0.2672]	-0.0234 [-0.9476]	0.1667 [0.6817]
$\Delta(Confidence)_{t-1}$	0.0407* [1.6570]	0.0327 [1.4758]	0.0372 [0.1692]
$MA(Debt\_to\_income_t)$	-0.0200*** [-2.7164]	-0.0056 [-1.1119]	0.2245*** [4.5033]
$Const.$	0.0098*** [2.7059]	0.0036 [1.4706]	-0.1263*** [-5.1369]
Adj. R-squared	0.7327	0.3891	0.3905
Log likelihood		714.4894	
Schwarz criterion		-16.7563	

Notes: t-statistics are in [ ]. ***, ** and * denote statistical significance at 1, 5 and 10%, respectively. $MA(Debt\_to\_income_t)$ is a 4-term moving average of the debt-to-income ratio.

o **LR positive relationship** (above unity) **with Y** and **negative** relationship **with r**

o **Speed of adjustment** significant and **negative**

o Deterioration in **confidence** and higher **debt** have dampened HHs' investment dynamics

o **Uncertainty** is not significant BUT evidence of significance with a larger number of lags

o Satisfactory model **fit**

The "investment growth gap" (2009-2012)

NFCs (percentage points)
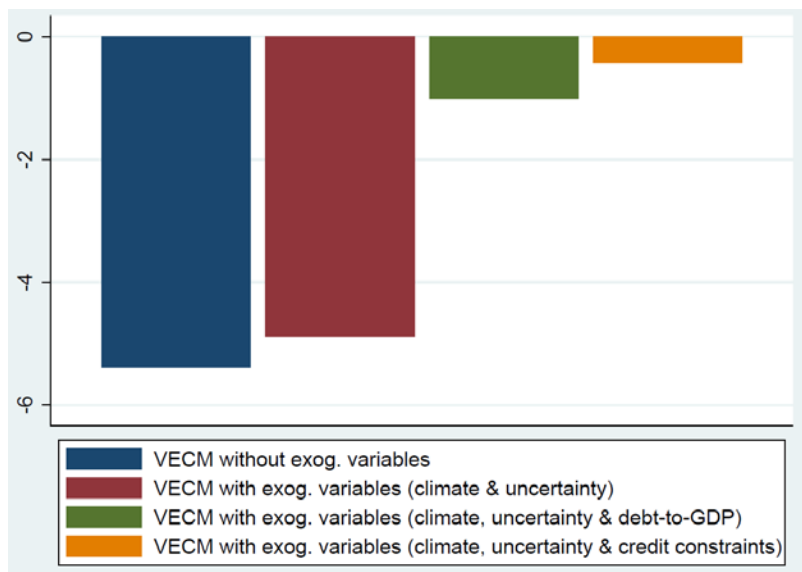
HHs (percentage points)
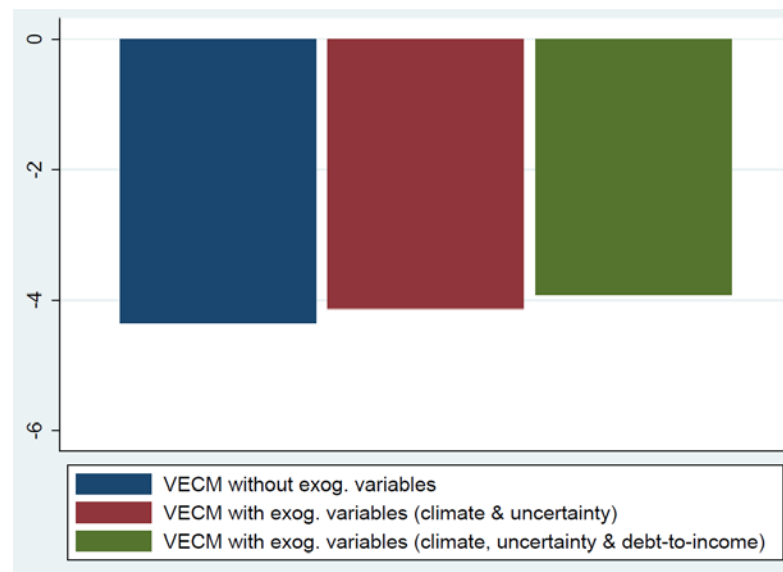
- o **Cumulative sum of residuals** in the double recessionary phase across alternative model specifications

- o Systematically **negative** unexplained investment **shortfall**

- o <u>YET</u> for **NFCs** when financial factors included in model the **gap is remarkably reduced**, in particular when using credit constraints

- o **Smaller "gain"** of augmented model in reducing shortfall for **HHs**

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Conclusions

o Assessment of the **determinants of investment in Italy** since 1995…

o …disaggregating by **institutional sector** (NFCs vs. HHs)

o …disentangling **LR and SR** dynamics…

o ….and with a focus on **financing constraints** using both macro and micro data

o The **neoclassical model** holds in the long-run for Italy…

o …**BUT** short-run dynamics are explained also by **business climate/confidence, uncertainty** and – especially for firms and during the recent double recession – by **credit constraints**

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Future research agenda [1]

o The role of **taxation** (Hall & Jorgenson 1967): corporate taxes/subsidies vs. property taxes

o The role of **regulation**:

  o PMR: **theoretical effect** on investment **ambiguous BUT empirical** evidence has generally found a **negative relationship** (Alesina et al. 2005; Égert 2017)

  o EPL: theoretical and empirical **effect ambiguous**; **negative** in Calcagnini et al. (2009); Cingano et al. (2010) **BUT positive** in Saltari & Travaglini (2009); Cingano et al. (2015) for Italy

    o inverse U-shaped link (Janiak & Wasmer 2012) and differences across asset types

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Future research agenda [2]

o **Non-linearities/time-varying effects**:

  o **threshold for** private sector **indebtedness**/leverage (Ferrando et al. 2010; Lombardi et al. 2017)

  o interactions btw. **cycle and credit constraints** (Bordo & Haubrich 2010; Bernanke et al. 2016; Gaiotti 2013 for Italy): premium on external finance ↑ during downturns

  o interactions btw. **uncertainty and credit constraints** (Barrero et al. 2017)

o **Cross-country comparisons**:

  o **heterogeneous contribution** of financial variables to real fluctuations across countries (Chirinko et al. 2008; Hubrich et al. 2013)

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RESERVE SLIDES

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Italy's investment rate in a historical perspective

Italy's investment rate, 1861-2016
(ratio of nominal total investment to GDP at market prices; percentage shares)
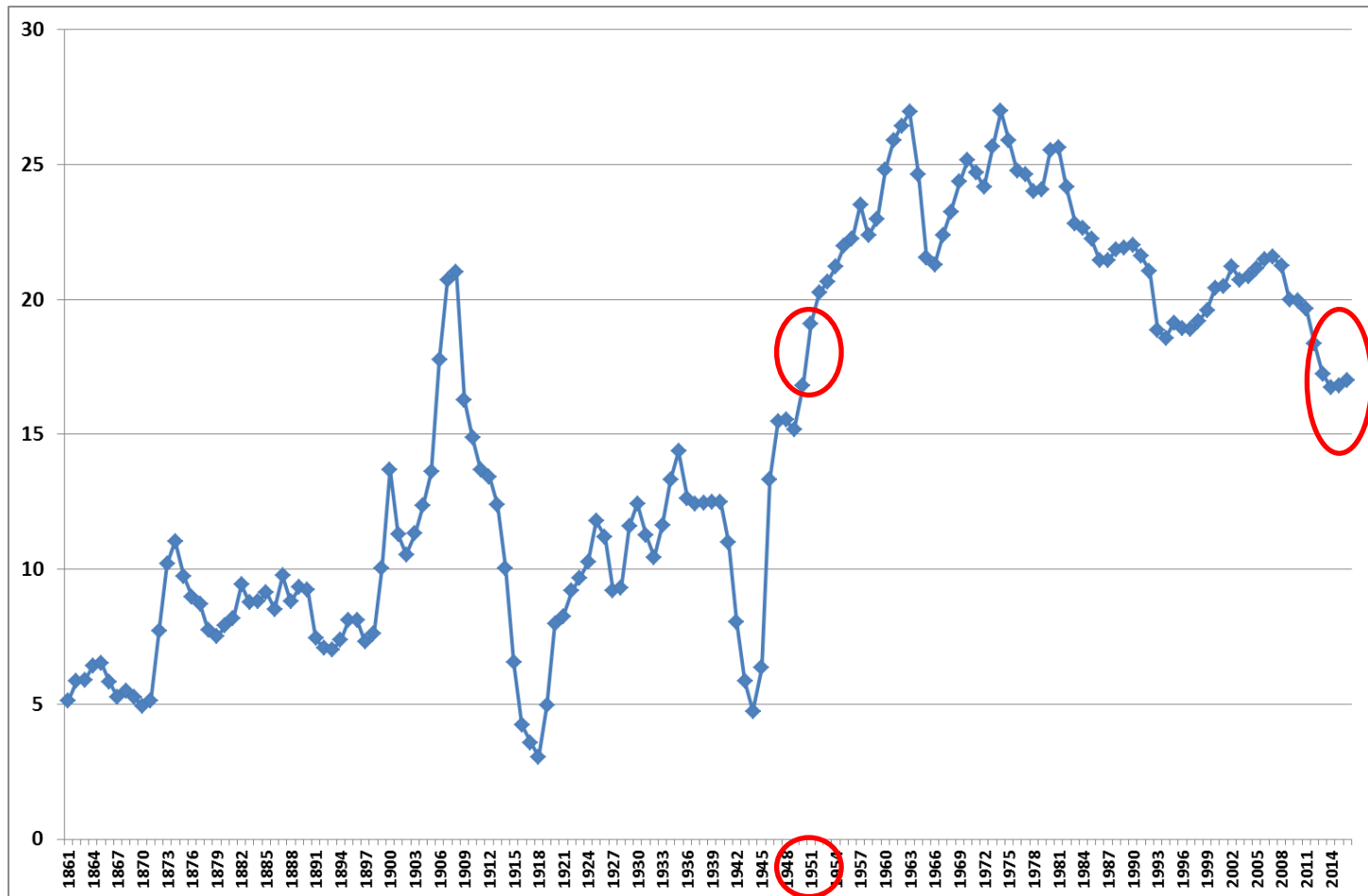
Source: Authors' calculations on Baffigi (2015) and Istat data.

Italy's investment by institutional sector: shares

(percentage shares computed on annual current-price series)

	Non-financial corporations (1)	Households (2)	General government (3)	Financial corporations (4)
1995–1999	49.5	34.6	14.4	1.6
2000–2007	50.2	34.7	13.7	1.6
2008–2016	49.7	34.9	14.1	1.5

Source: Authors' calculations on Istat data. Notes:

(1) Non-financial corporations include all private and public corporate enterprises that produce goods or provide non-financial services to the market.

(2) Households include "consumer" households, as well as "producer" households (i.e. household firms with up to five employees) and non-profit institutions serving households.

(3) General government includes central, regional and local government and social security funds.

(4) Financial corporations include both financial and insurance firms.

Italy's investment by institutional sector: dynamics

(seasonally unadjusted quarterly current-price series; 2000Q1=100; 4-term moving averages)
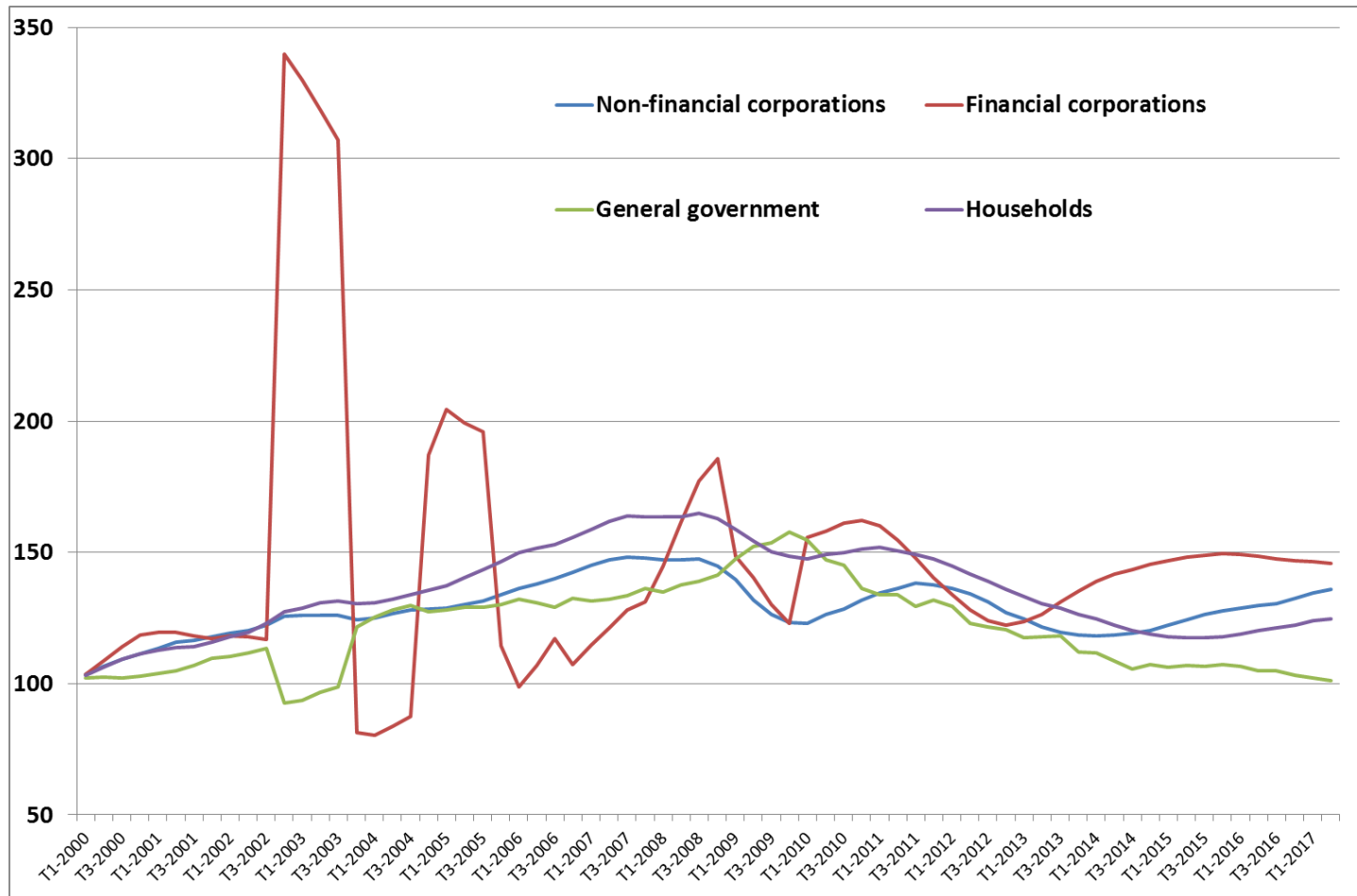
Source: Authors' calculations on Istat data.

The flexible neoclassical model

o The **desired level of capital** K* depends on real output and the real user cost of capital:

$$K^* = \alpha \frac{Y}{r},$$

o **Gross investment** is the sum of a weighted average of past changes in K* and replacement investment, which is proportional to existing capital stock:

$$I_t = \sum_{s=0}^{\infty} \mu_s (K_{t-s}^* - K_{t-s-1}^*) + \delta K_t$$

o **Net investment** is an infinite weighted average of past changes in K*:

$$I_t - \delta K_t = N_t = \sum_{s=0}^{\infty} \mu_s \Delta K_{t-s}^*,$$

o Hall and Jorgenson (1967) place **restrictions on** the infinite sequence of **weights**: the first two weights are estimated as separate parameters, while successive weights decline geometrically (Koyck 1954):

$$N_t = \gamma_0 \Delta K_t^* + \gamma_1 \Delta K_{t-1}^* - \omega N_{t-1} + \varepsilon_t \Rightarrow$$

$$(1 - \omega L) N_t = \alpha \gamma_0 \Delta \left(\frac{Y_t}{r_t} \right) + \alpha \gamma_1 \Delta \left(\frac{Y_{t-1}}{r_{t-1}} \right) + \varepsilon_t,$$

Real investment dynamics by institutional sector

(1996Q4=100)
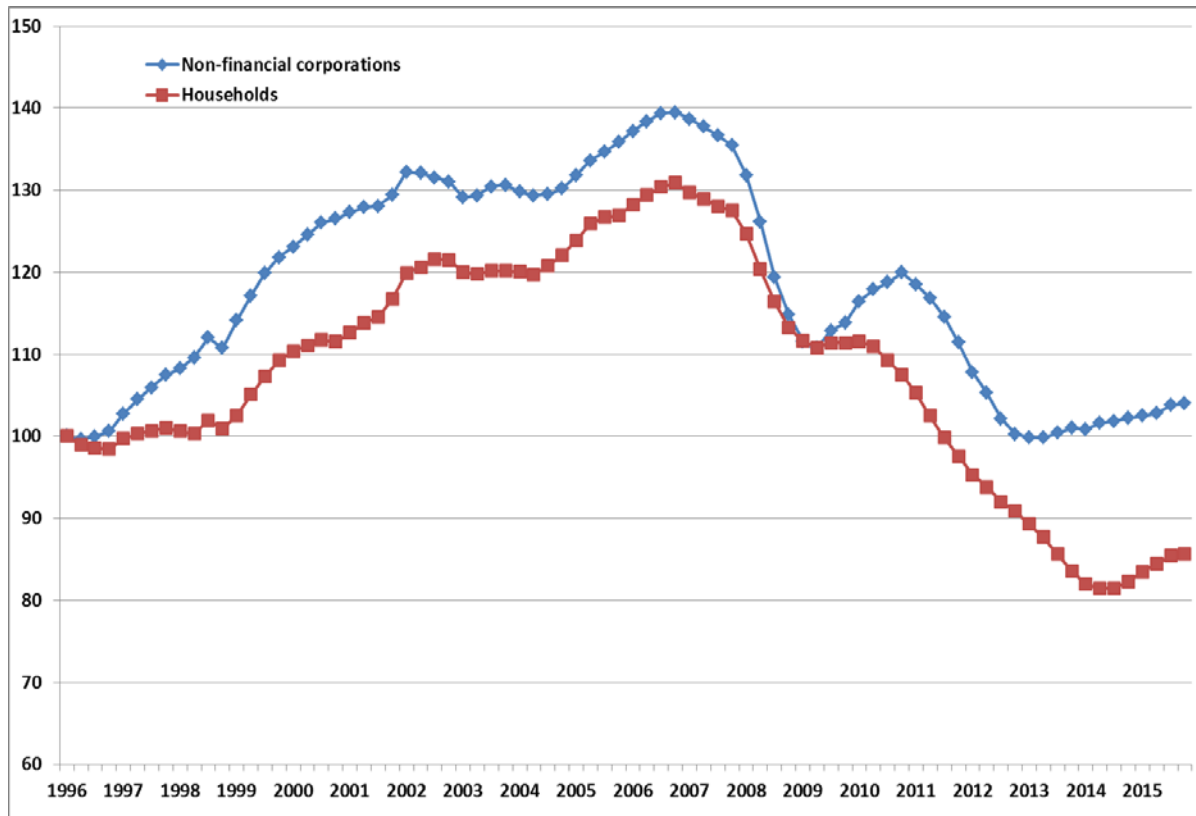
Source: Authors' calculations on Istat data.
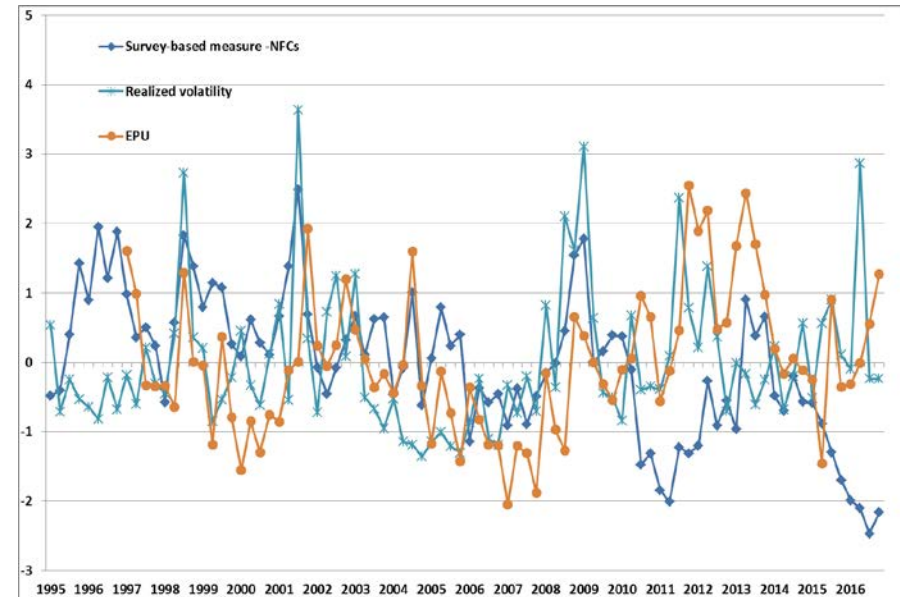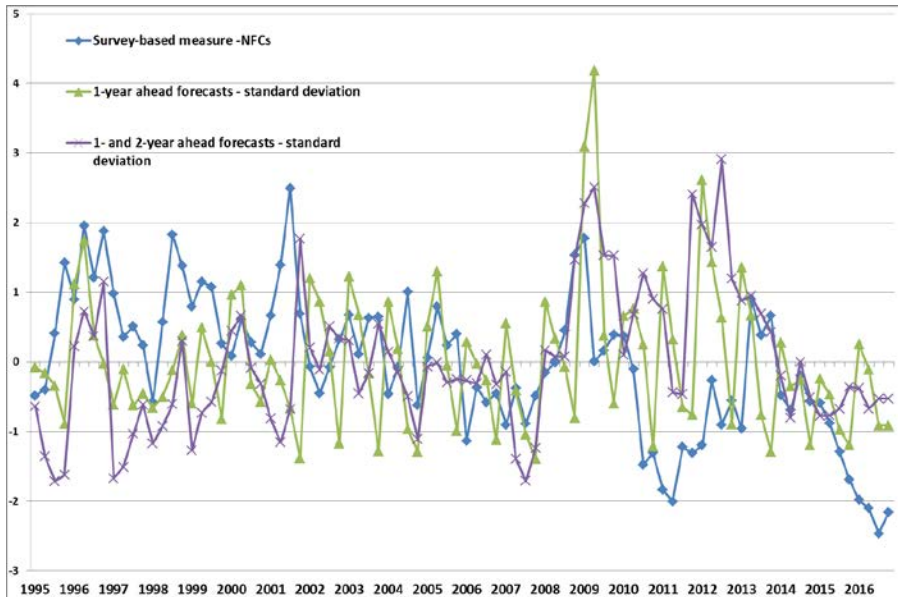Notes: The series are smoothed by a 4-term moving average.

Depreciation rates

(percentage points)
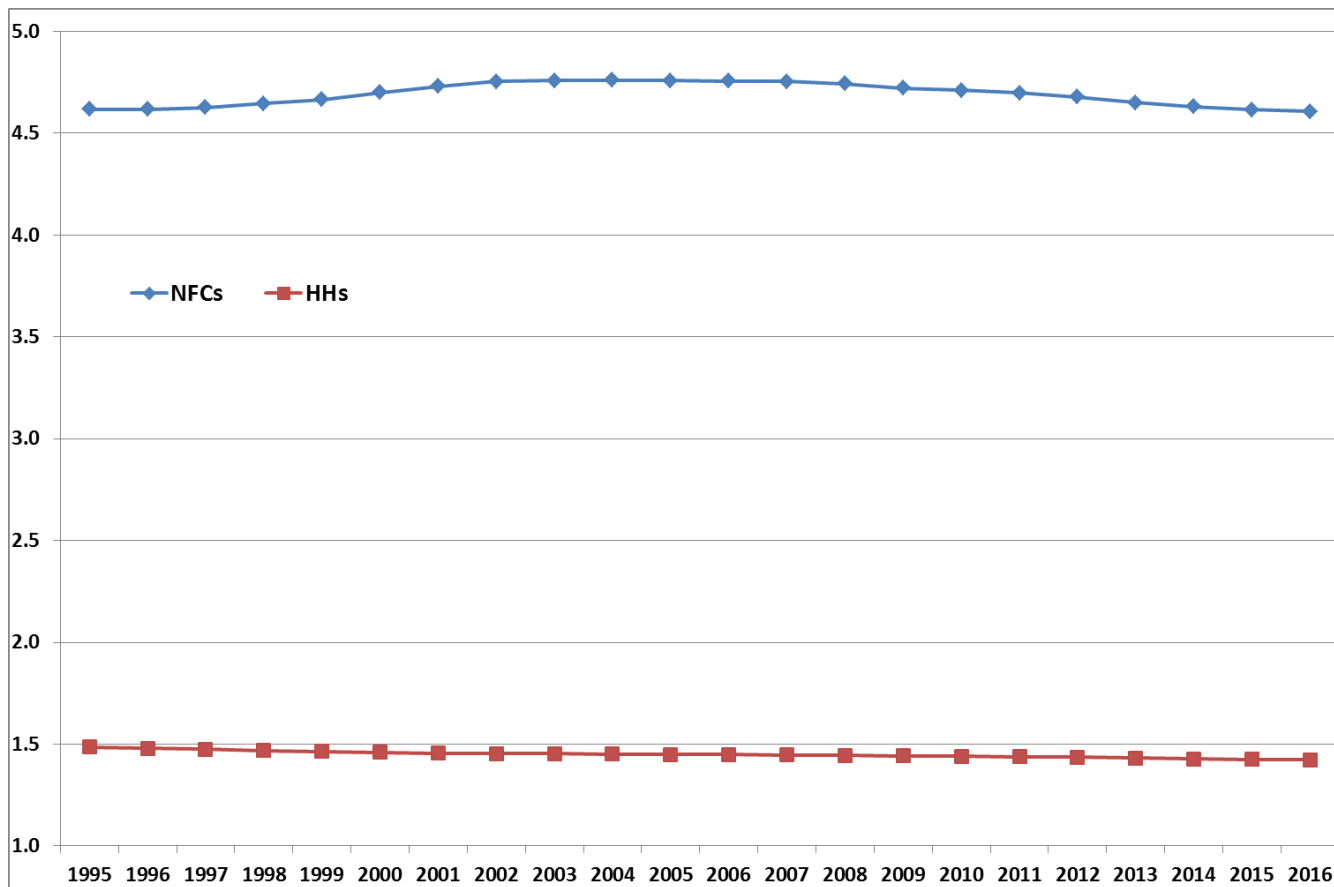
Source: Authors' calculations on Istat data.

# Alternative measures of uncertainty

(standardised measures)

Source: Authors' calculations on Istat, Consensus Economics, Baker et al. (2016) data.

- o Our survey-based measure of NFCs' uncertainty is most correlated with the **dispersion of GDP forecasts** by professional analysts
- o Lower correlation with **realised volatility**
- o Least correlated with **economic policy uncertainty**
- o NOTE: ours is the only **sector-specific** measure

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Uncertainty and confidence

(standardised measures)

NFCs

HHs
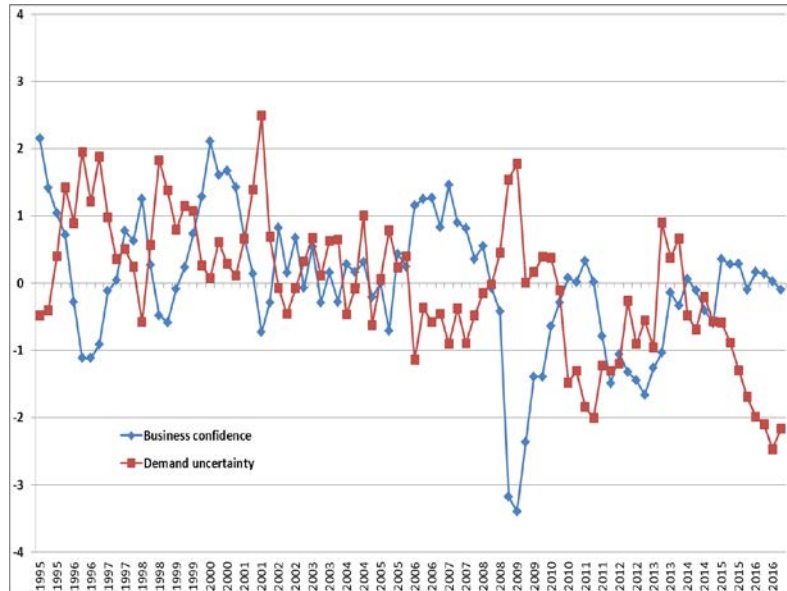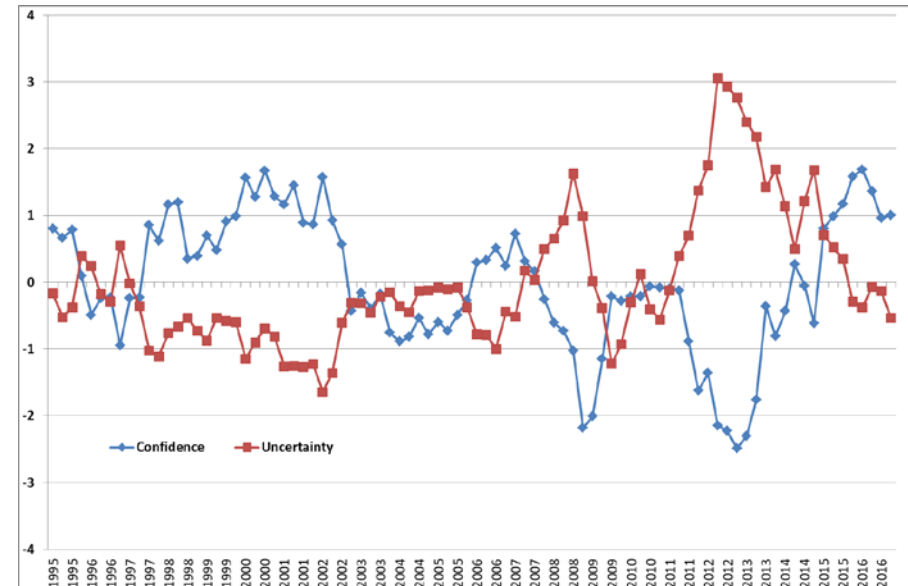
Source: Authors' calculations on Istat survey and NA data.

o **High uncertainty** not necessarily associated with **low confidence**

o <u>BUT</u> significant **negative correlation** found for **HHs**…

o …with a possible **impact on our results** when the two variables are included contemporaneously

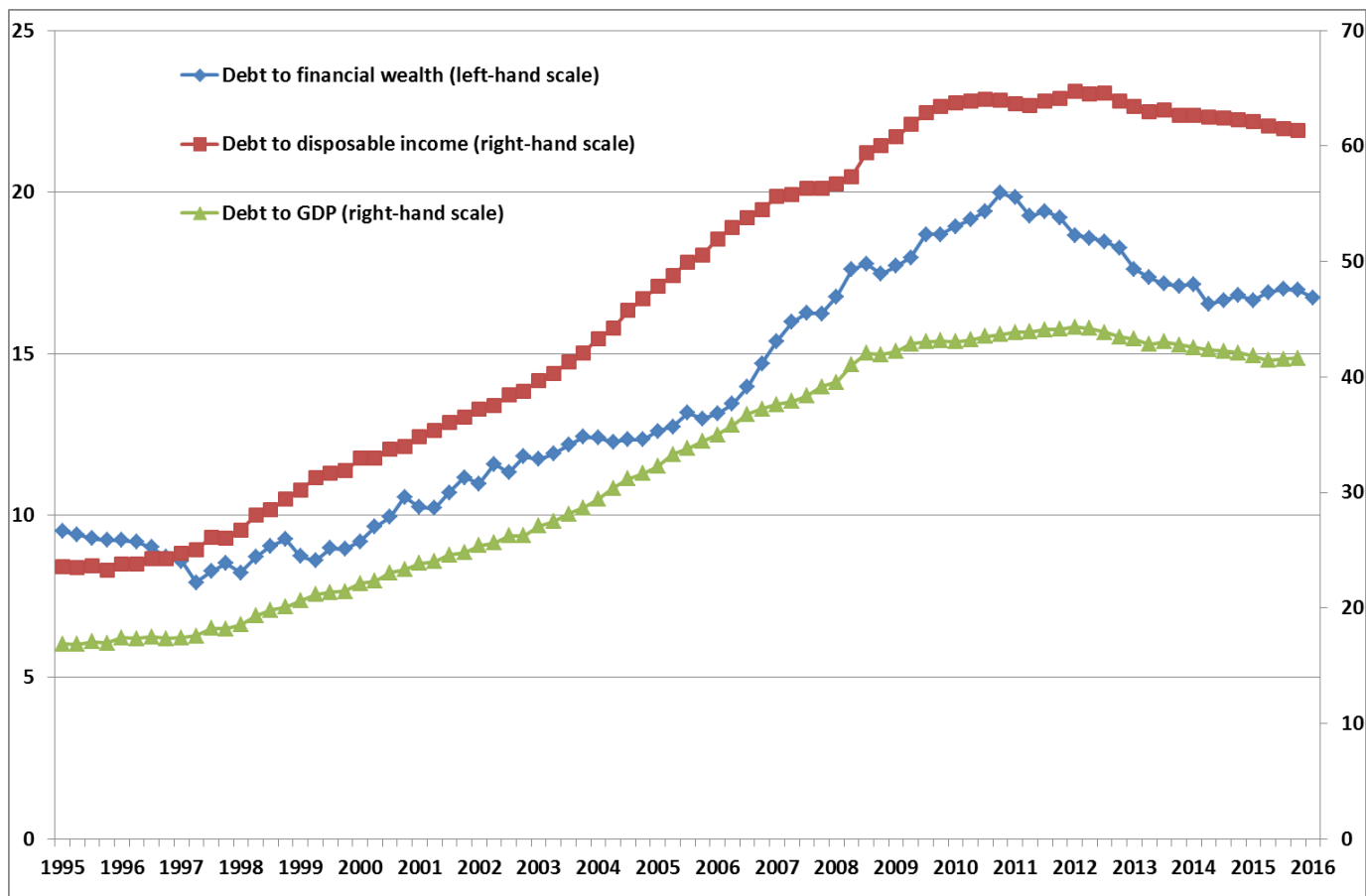# Alternative measures of NFCs' leverage

(percentage points)
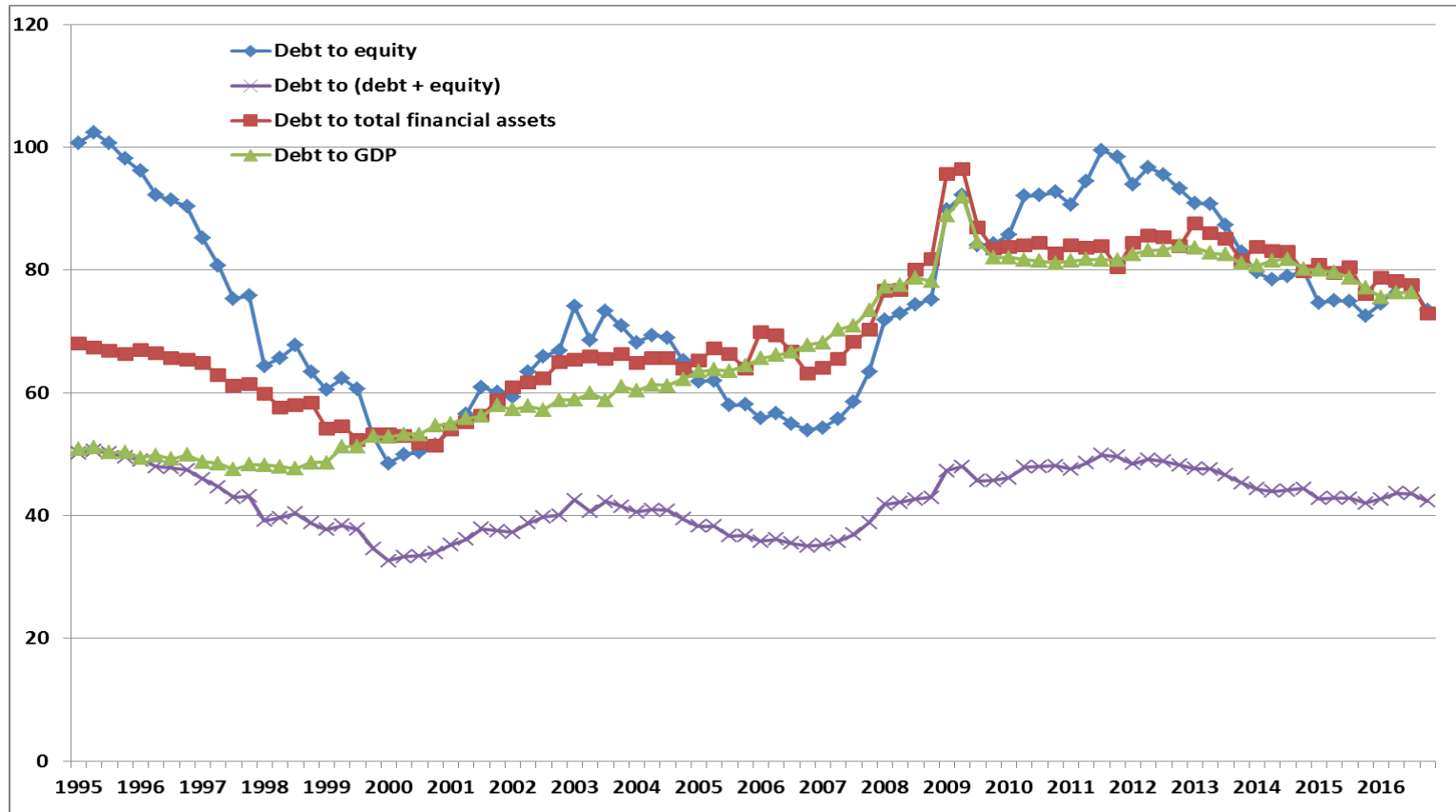
Source: Authors' calculations on Banca d'Italia and Istat data.
Notes: The correlation between debt to GDP and debt to total financial assets is 0.91 in levels (**0.74** in first differences); the correlation between debt to GDP and debt to equity is 0.39.in levels (**0.48** in first differences); the correlation between debt to GDP and debt to (debt + equity) is in 0.40 levels (**0.44** in first differences).

Alternative measures of HHs' leverage

(percentage points)

Source: Authors' calculations on Banca d'Italia and Istat data.
Notes: The correlation between debt-to-income and debt-to-GDP (debt-to-financial-wealth) is 1.00 (**0.97**) and 0.78 (**0.28**) in first differences.

Financial liabilities by institutional sector: composition

(percentage shares)

NFCs

Period	Shares and other equities	Short-term loans	Long-term loans	Bonds	Trade Debts and Other Liabilities
1995-1999	42.5	17.4	12.8	1.1	26.1
2000-2007	49.5	13.1	15.4	1.7	20.3
2008-2015	43.7	11.3	21.8	3.3	20.0

HHs

Period	Short-term loans	Long-term loans	Trade Debts and Other Liabilities
1995-1999	15.8	47.4	36.8
2000-2007	9.2	59.8	31.0
2008-2016	6.3	69.3	24.4

Notes: Authors' calculations on Banca d'Italia data.

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Financial liabilities by institutional sector: trends

NFCs
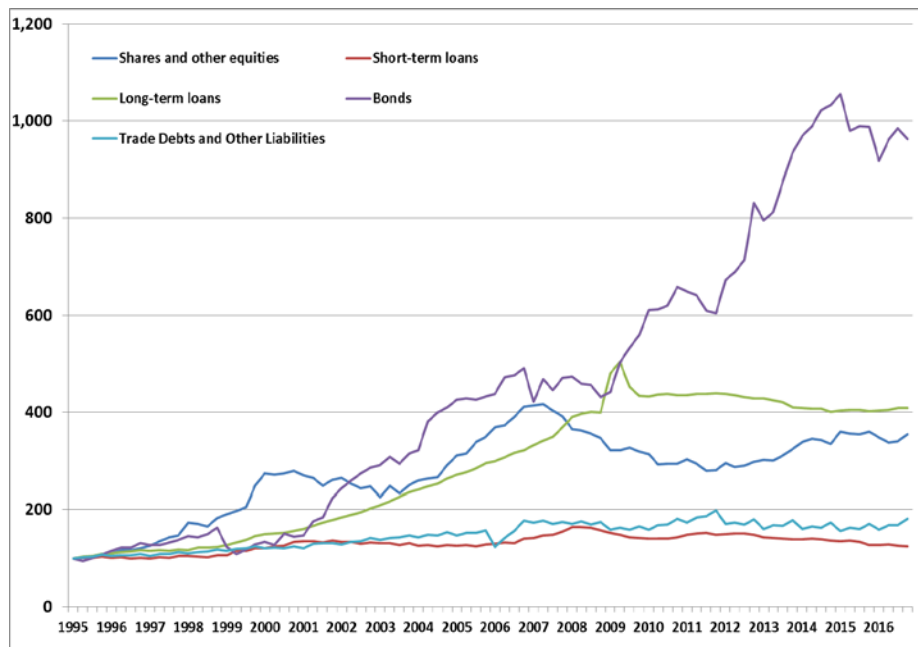
HHs
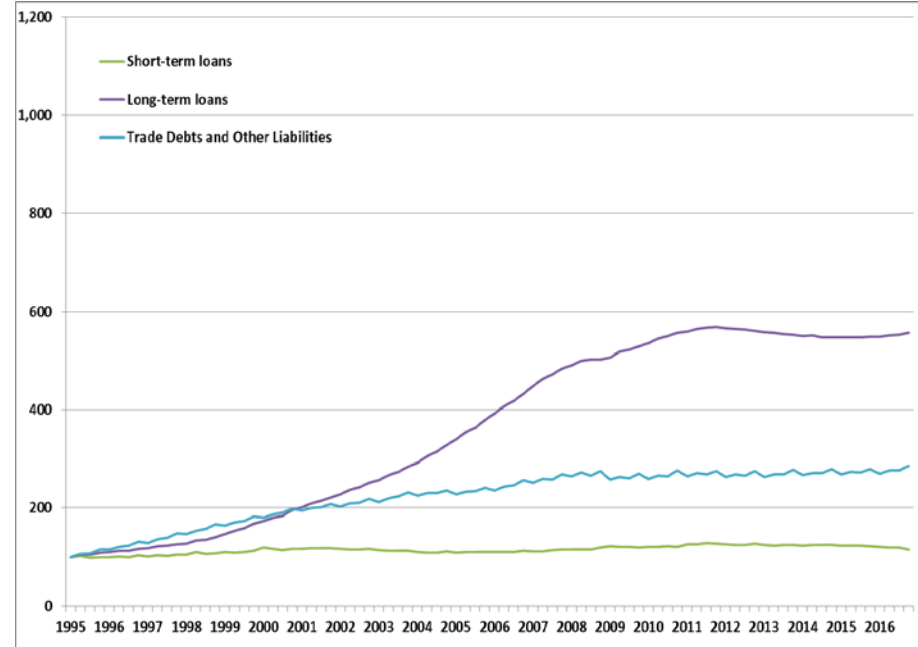
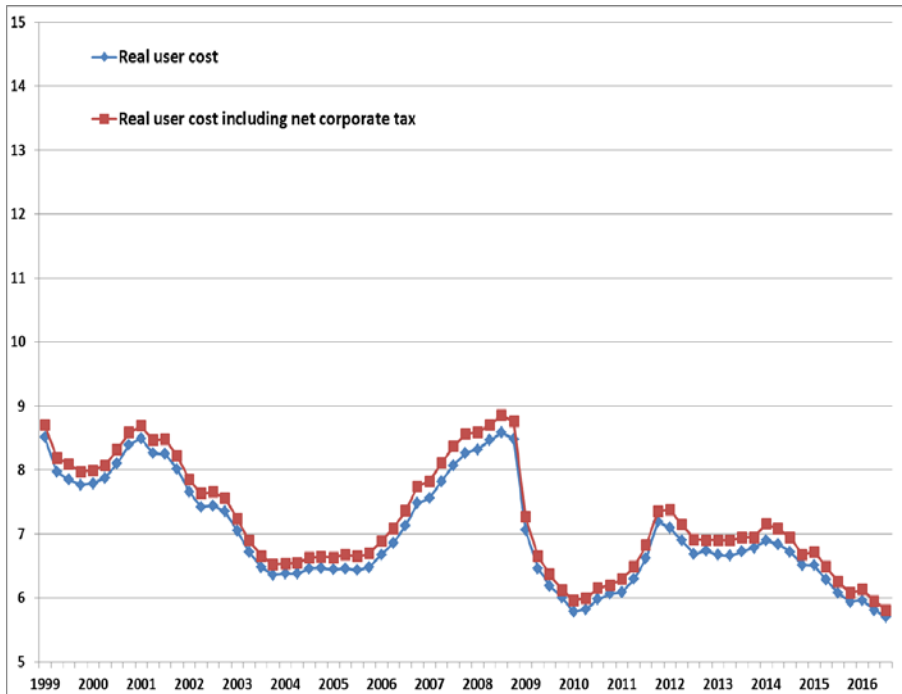Notes: Authors' calculations on Banca d'Italia data.

Preliminary testing

o Multivariate model with **6 variables** (investment, output, user cost of capital, uncertainty, sentiment, financing constraints) separately for NFCs and HHs; quarterly data; 1995-2016

o Sequential modified likelihood ratio test; final prediction error; information criteria: **VAR**(**p=2)** => **VECM(1)**

o Trace and max eigenvalue tests: **1 cointegrating relationship**

o **Linear trend** in the level data (constant) and in the cointegrating relationship
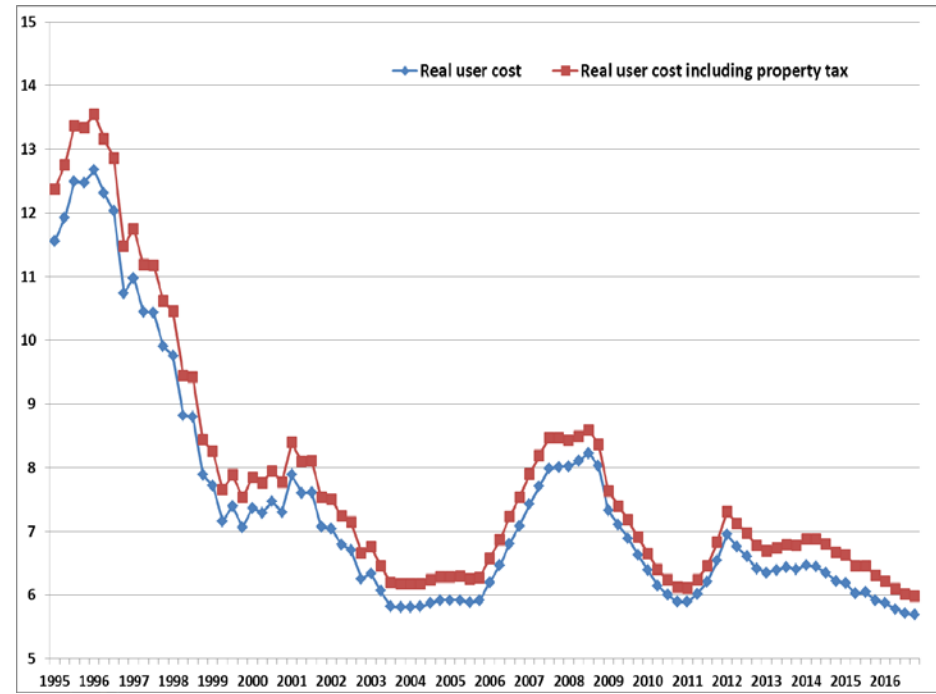
o **Maximum likelihood** estimation

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Real user costs with taxation
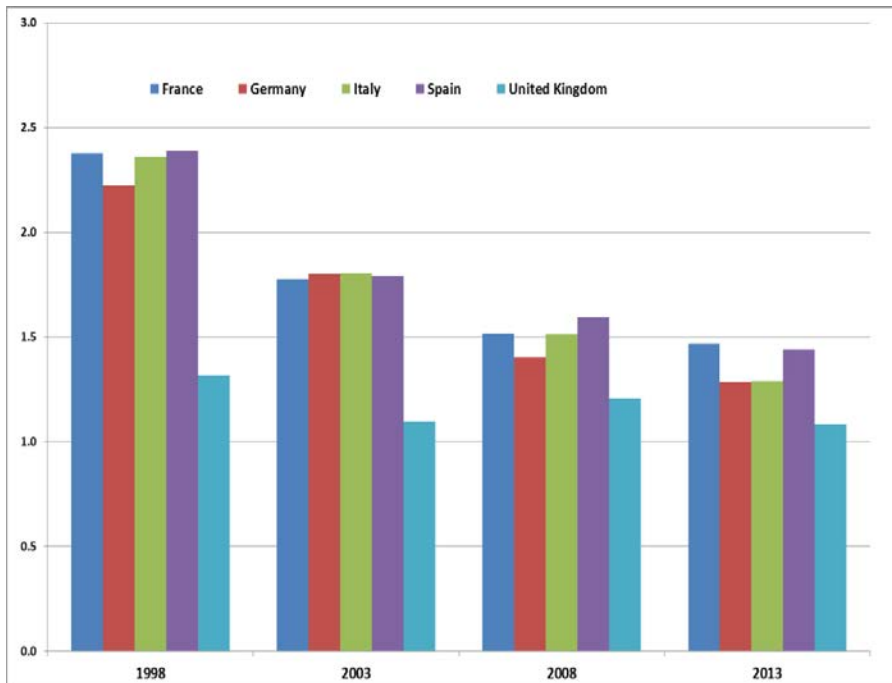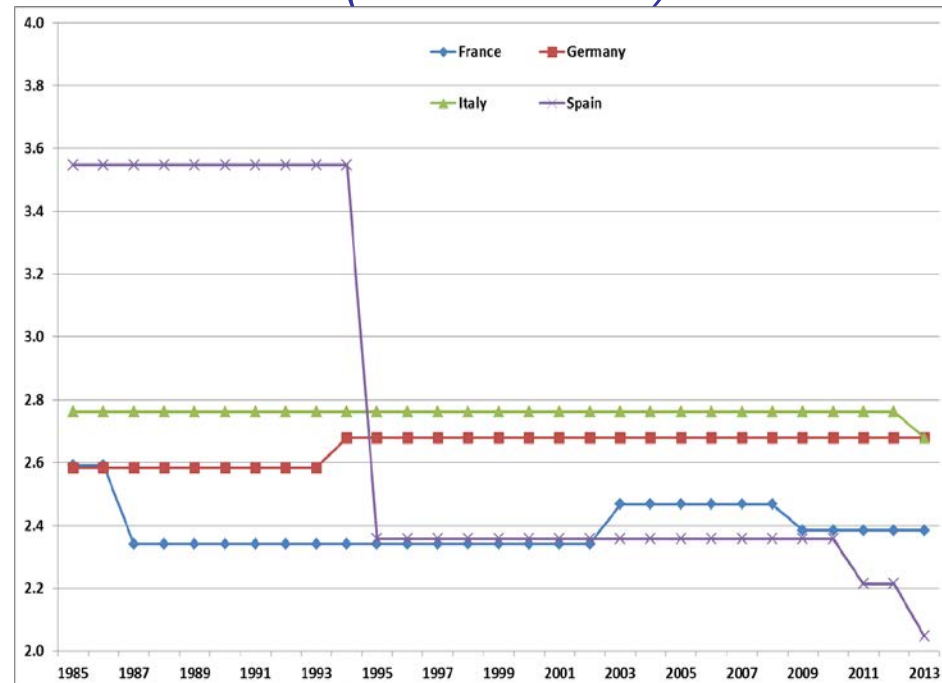
(percentage points)

NFCs

HHs

Source: Authors' calculations on Banca d'Italia, Consensus Economics and Istat data.

Regulation

PMR in selected countries
(0-6 indicator)

## EPL in selected countries
(0-6 indicator)

Source: Authors' calculations on OECD data.

Notes: A rise in PMR and in EPL signals tighter regulation. EPL refers to the strictness of employment protection referring to individual dismissals (regular contracts).

o **Loosening of PMR** in Italy **BUT** still tight relative to US and in some key sectors

o **EPL loosened in 2013** in Italy (and in following years)

o **Issue**: slow-moving and not timely indicators => **macro** analysis only possible **across countries**

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Determinants of investment dynamics in the private sector excluding construction

(changes on corresponding period and contribution)

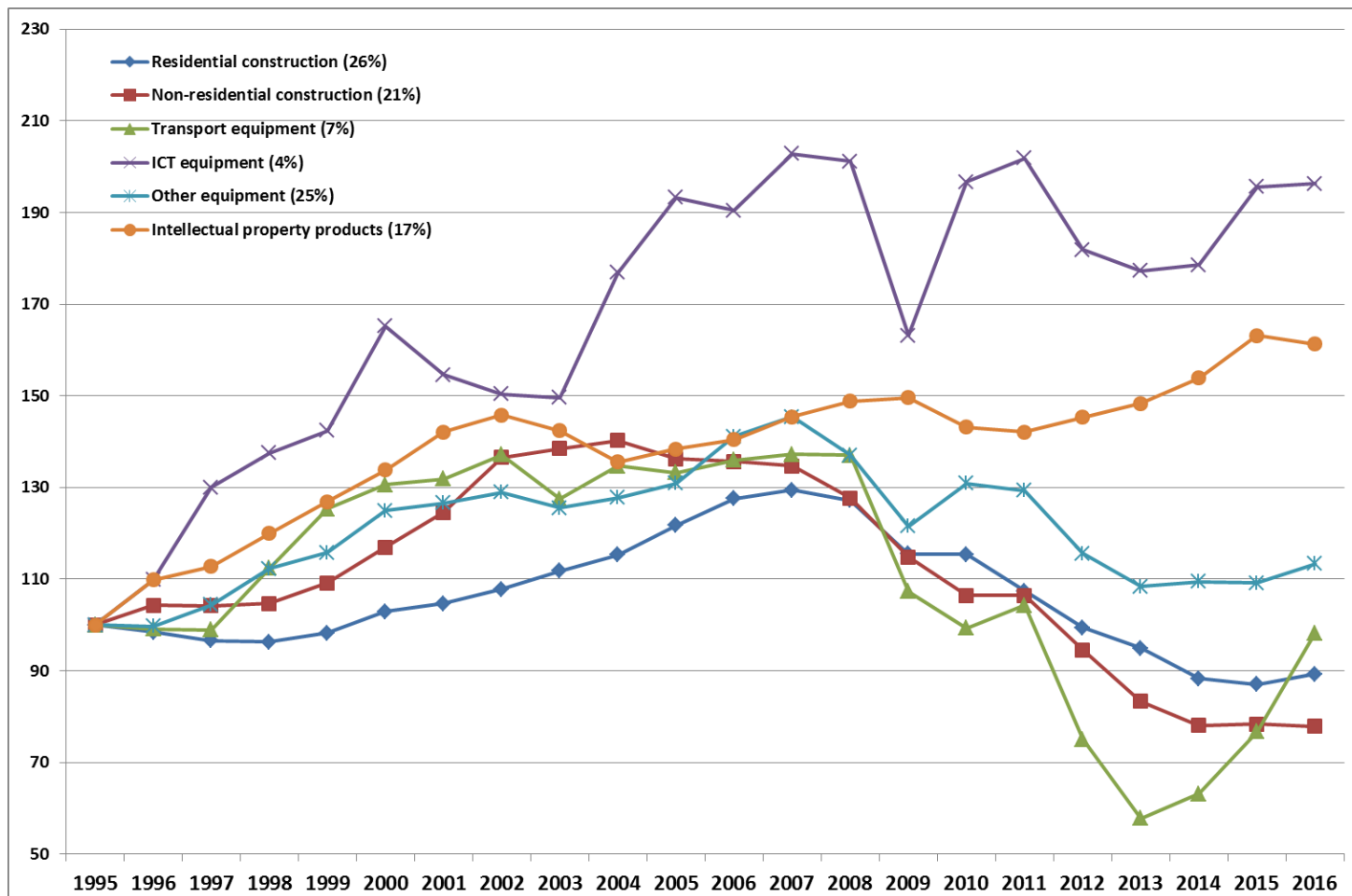Source: Banca d'Italia, Annual Report. 2016.
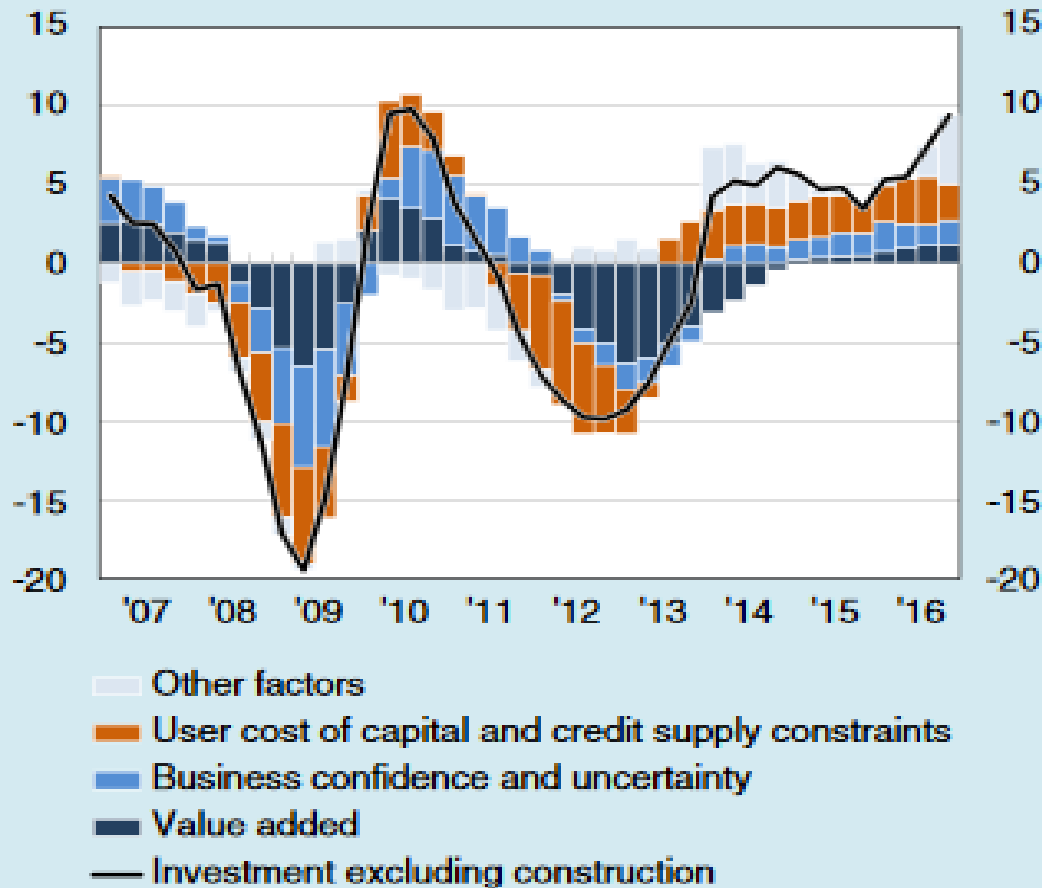
o **Since the end of 2014** investment buoyed mainly by the **reduction in the user cost of capital** (reduction in interest rates and a progressive easing of credit supply conditions)

o The contribution of **value added**, albeit moderate, is **improving steadily**

o The improvement in **business confidence** and the gradual drop in **uncertainty** have **also fostered the recovery**

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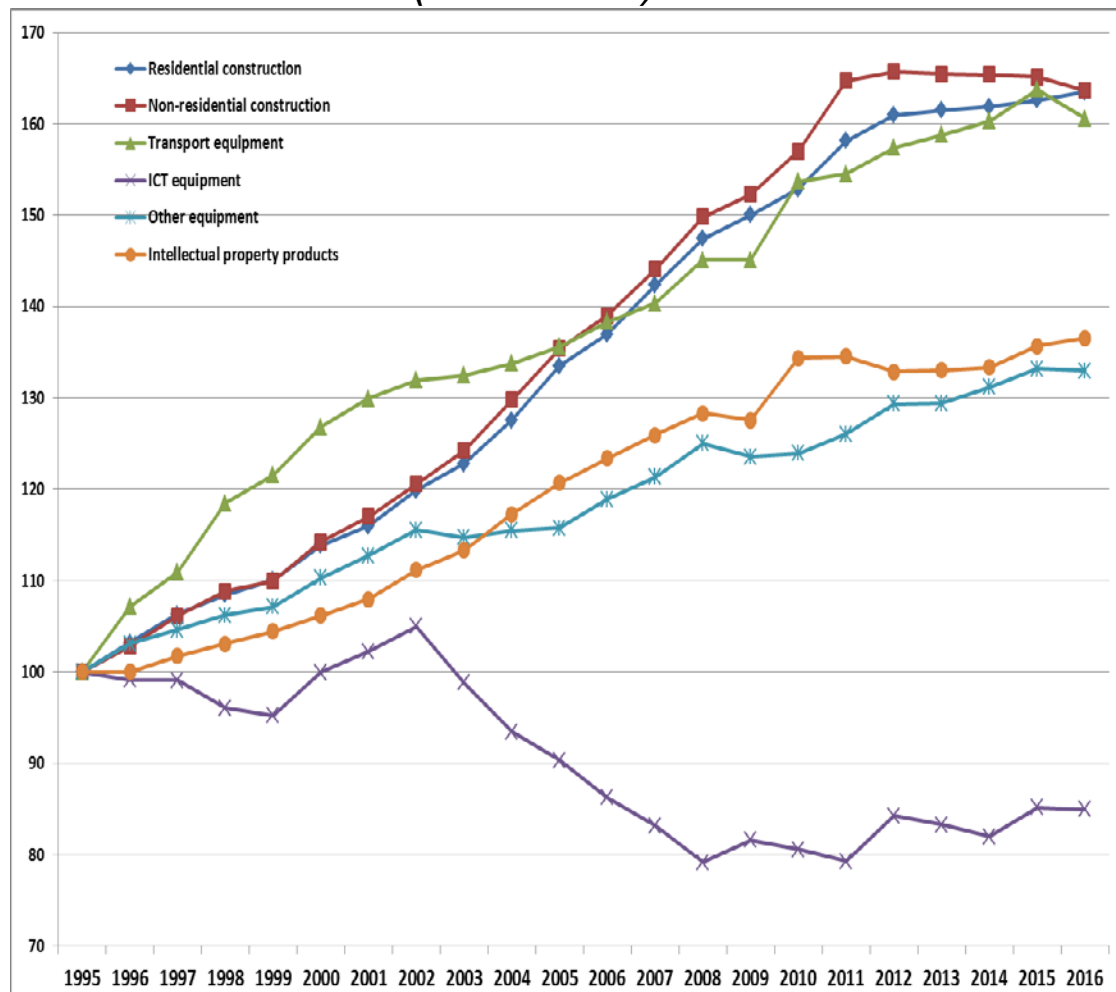EUROSISTEMA

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Real investment dynamics by asset type

(1995=100; chain-linked values; percentage shares in 2016 in brackets)

Source: Istat.

Investment deflators by asset type

(1995=100)

Legend:
- Residential construction
- Non-residential construction
- Transport equipment
- ICT equipment
- Other equipment
- Intellectual property products

Source: Istat.

○ In the medium term, current-price investment series may be **biased by price movements**…

○ …which may differ across **assets**

○ **Construction and transport equipment** prices nearly doubled since 1995….

○ …whereas **ICT equipment** prices dropped by nearly 25% since 2002

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