Modeling private and public Intangible investments in a macro-econometric framework

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Outline

- Aim
- MeMo-It: the macro-econometric model for the Italian economy
- Modeling intangible capital in a macro-econometric framework
- Policy issues

Motivation

- Existing macro econometric models rarely include investment by asset and hardly explicitly incorporate intangible investments.
- Some work has been done to evaluate the best framework to model R&D transmission mechanisms for policy purposes (IPTS WP (2015)):
  - Dynamic Stochastic General Equilibrium (DSGE) model-QUEST;
  - Spatial Computable General Equilibrium (SCGE) model- RHOMOLO;
  - Computable General Equilibrium (CGE) model-GEM-E3;
  - Macro-econometric model-NEMESIS.

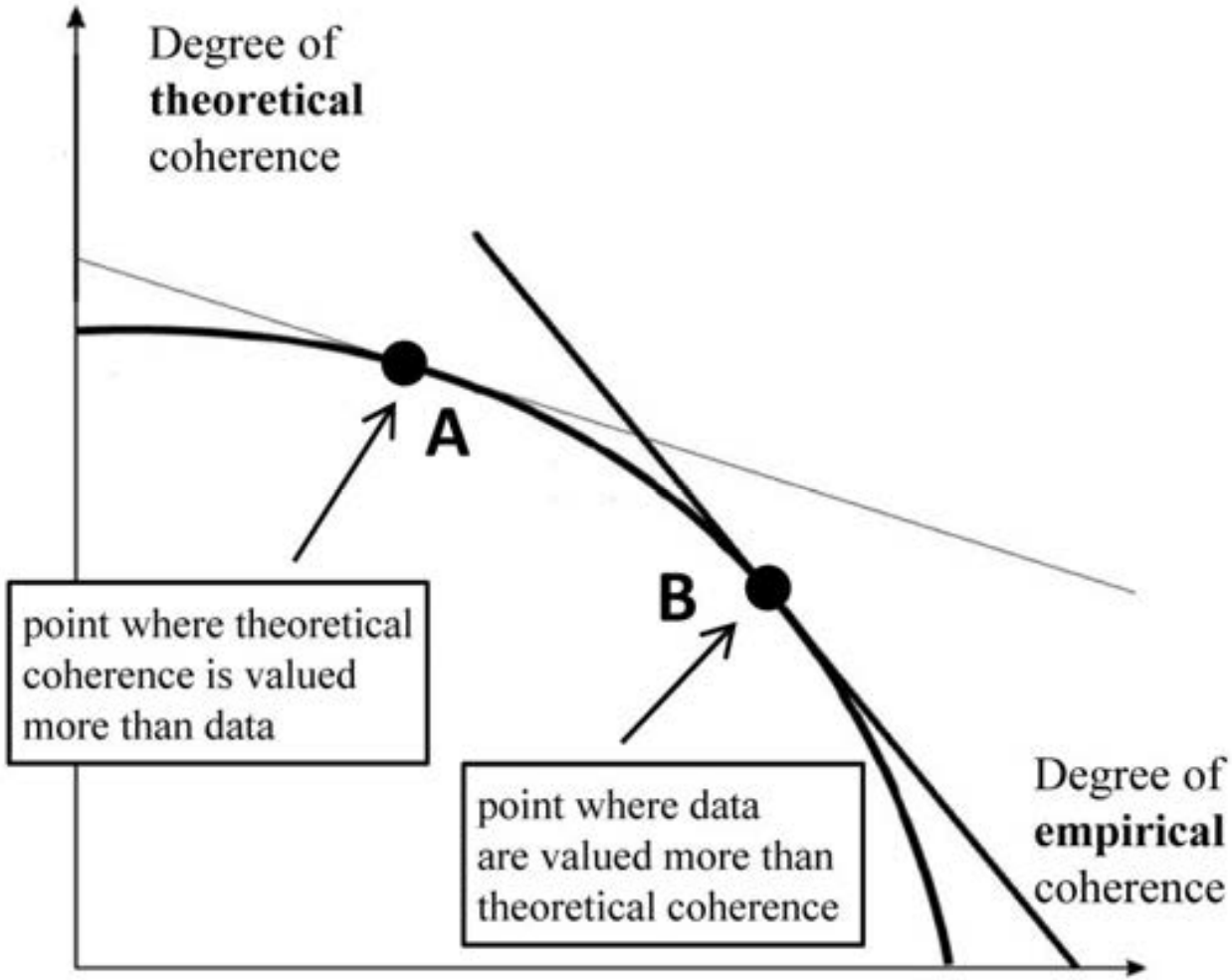
Aim

We investigate:

- the determinants of market and nonmarket investment in intellectual property products
- the mechanisms trough which their interaction affects the growth performance of the Italian economy

We do that including market and nonmarket investment in intellectual property products in the macro-econometric model, **MeMo.It** developed by the Italian Statistical Institute for the medium term forecasts

Frontier that reflects different optimal composition between economic theory and data (Pagan, 2003)

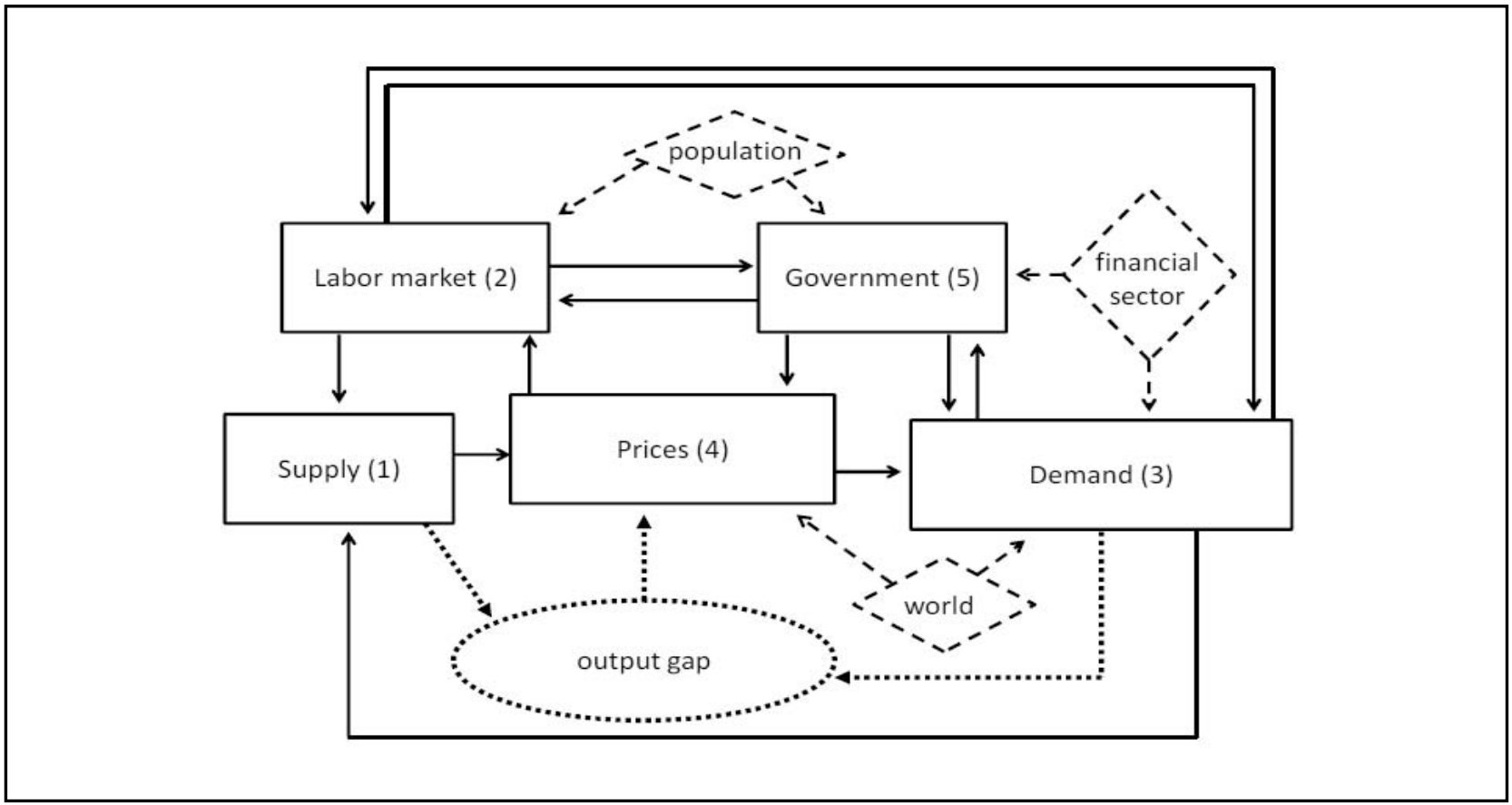


Optimal composition

- At the top there are models (such as RBCs and DSGEs) that aim to interpret the data
- At the bottom there are models (such as VARs) that aim to summarize the data
- Data coherence pays more than theory coherence in terms of the model' forecasting ability

- MeMo-It modeling is a mixture of both LSE and Fair-updated Cowles Commission approaches and techniques: in order to merge theory and data at point B, MeMo-It uses cointegration methods on dynamic sub-systems to estimate theory-interpretable and identified steady state relationships, imposed in the form of equilibrium-correction models.
- MeMo.it is a New Keynesian model where in the short run the activity is mainly driven by the demand side, while in the long run the economic system converges to the potential output determined by the supply side of the economy.

MeMo is structured into 5 main interacting blocks including 60 equations and 82 identities.



We model business and public investment accounting for asset specific characteristics potentially affecting the reactivity of capital accumulation over the business cycle.

- Framework consistent with both traditional and micro investment models (Clark, (1944); Hall and Jorgenson, (1967); Bloom et al 2007).
- Investigate short and long run investment determinants.
- Aggregate vs investment by asset (intangible vs physical assets)

To explore all these options in a comprehensive framework we adopt a Vector Error Correction Model (VECM) (Johansen, 1995).

- The vector of variables for the aggregate representation is

$$Z^{agg} = (k^{agg}, y, uc^{agg}, liq, unc)$$

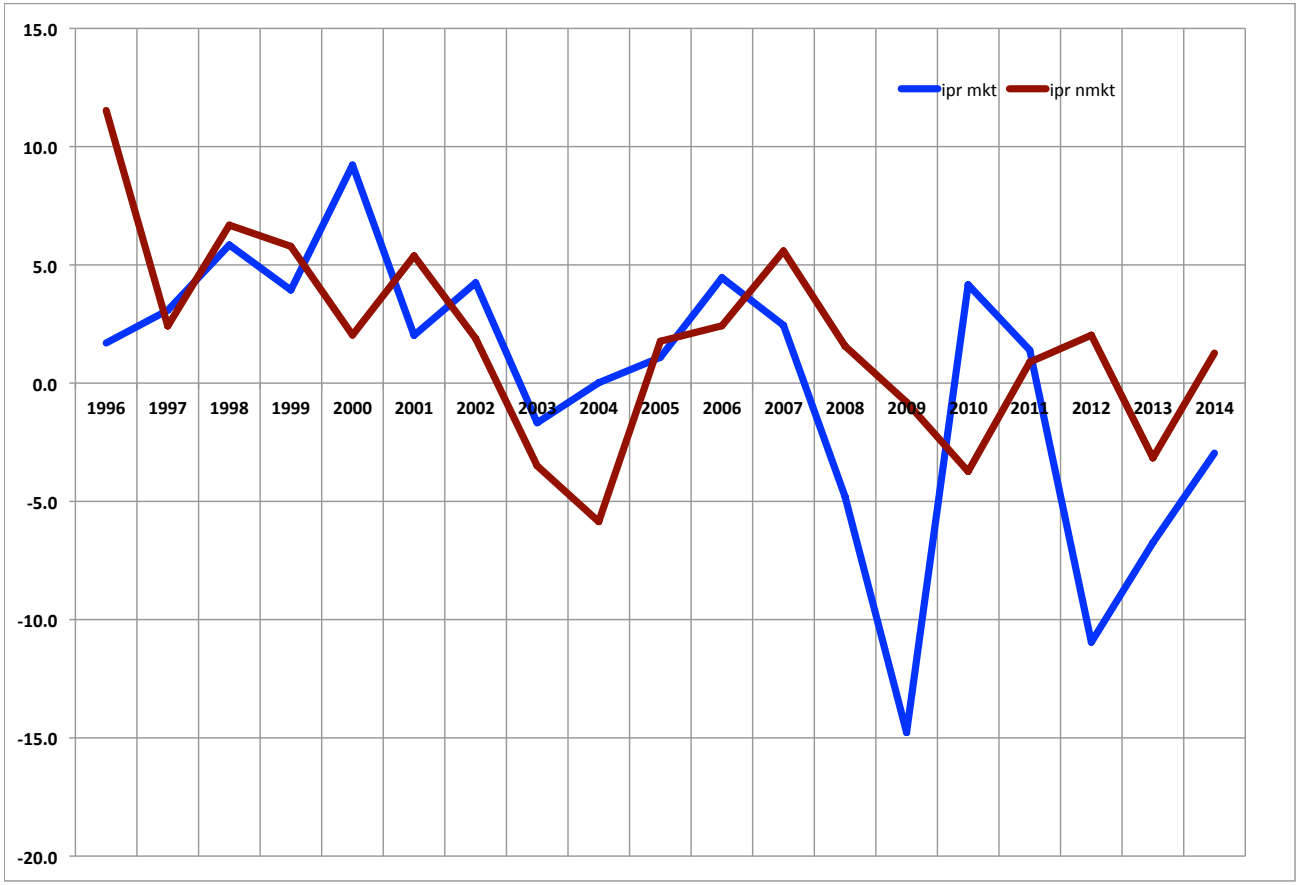
- while that for the representation by asset becomes

$$Z^{j} = (k^{j}, y, uc^{j}, liq, unc)$$

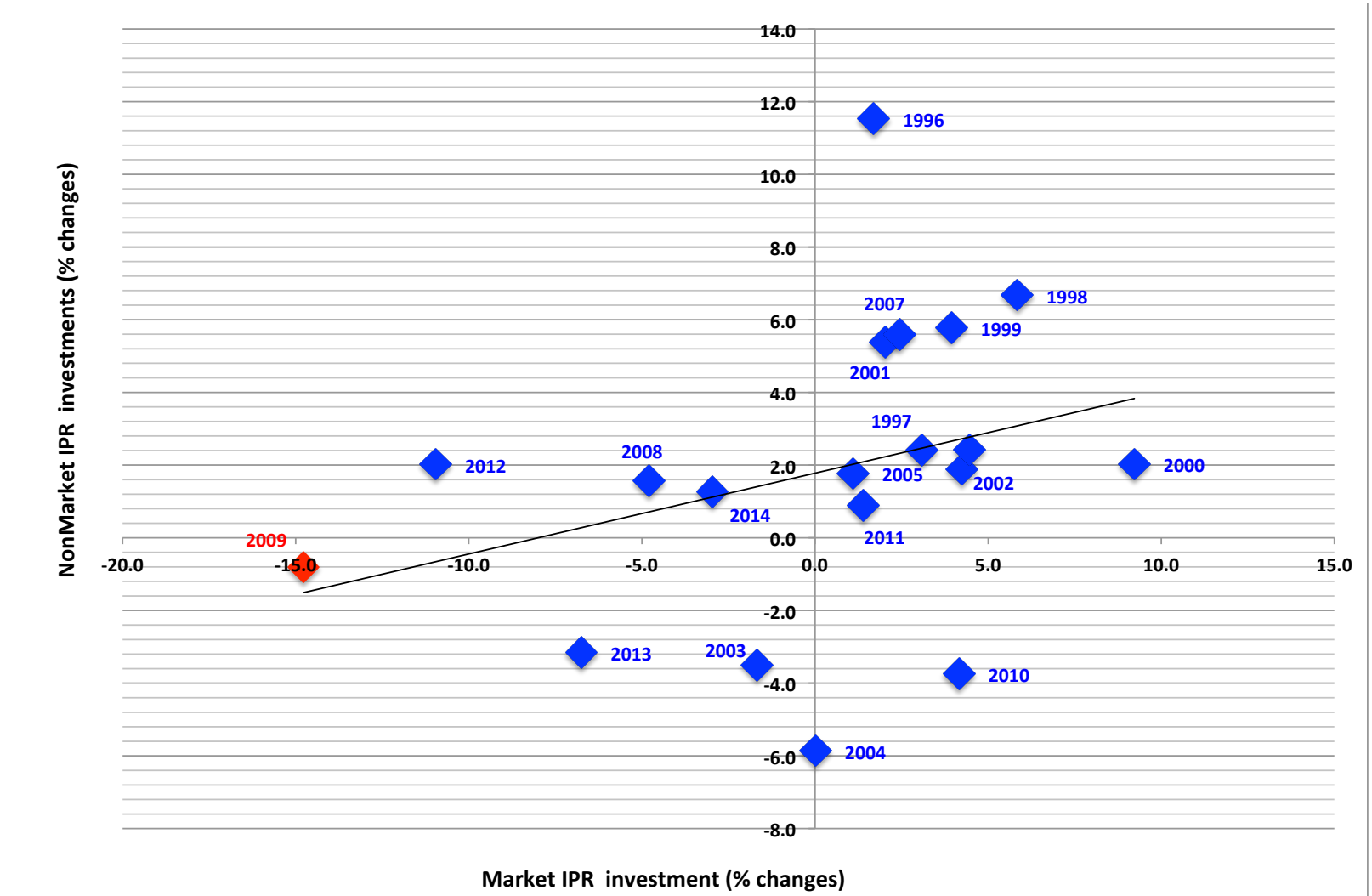
with $j = ipr_m kt, ipr_n mkt$;

Market vs nonmarket ipr investments: Italy 1995-2014

IPR-NMKT less sensitive to the business cycle compared to IPR-MKT



Growth rates of IPR-NMKT and IPR-NMKT are positively correlated



Testing for the determinants of IPR investments

$$\Delta lnI_t^{mkt} = \alpha_1 \Delta lnSubI_t + \alpha_2 \Delta lnLiq_t + \alpha_3 lnI_{t-1}^{mkt} + \alpha_4 \Delta lnI_t^{nmkt} + \epsilon_t \qquad (1)$$

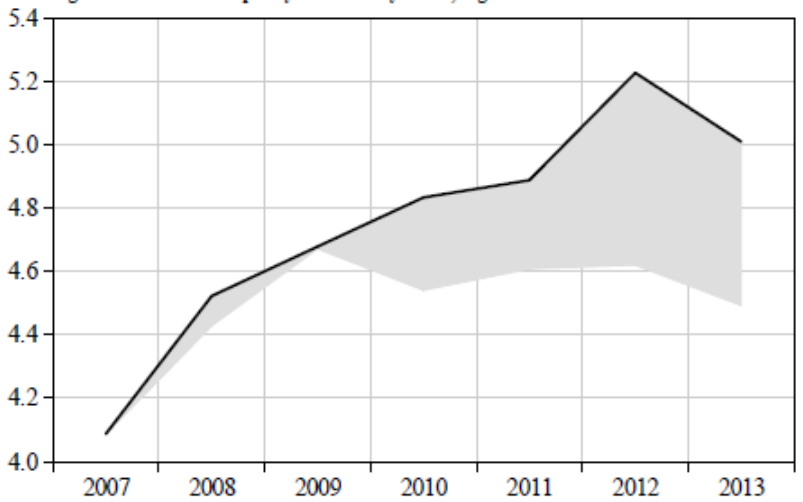
- where *SubI* denotes investment subsidies
- *Liq* is a measure of financial condition (it is from an Istat monthly business survey, where firms are asked "how do you judge the current level of liquidity (quite good, normal, bad)".

Empirical results: IPR_{mkt}

	coeff	std	t-stat	p-value
$\Delta lnSubI_t$	0.177	0.127	1.392	0.175
$\Delta lnLiq_t$	0.007	0.038	0.174	0.863
lnI^{mkt}_{t-1}	-0.042	0.022	-1.880	0.071
ΔlnI^{nmkt}_{t}	0.650	0.269	2.422	0.022
Obs	33			
R-squared	0.816	**Mean dependent var**		0.047
Adjusted R-squared	0.790	**S.D. dependent var**		0.083
S.E. of regression	0.038	**Sum squared resid**		0.040
Durbin-Watson stat	1.345	**J-statistic**		5.143
Instrument rank	8.000	**Prob(J-statistic)**		0.162

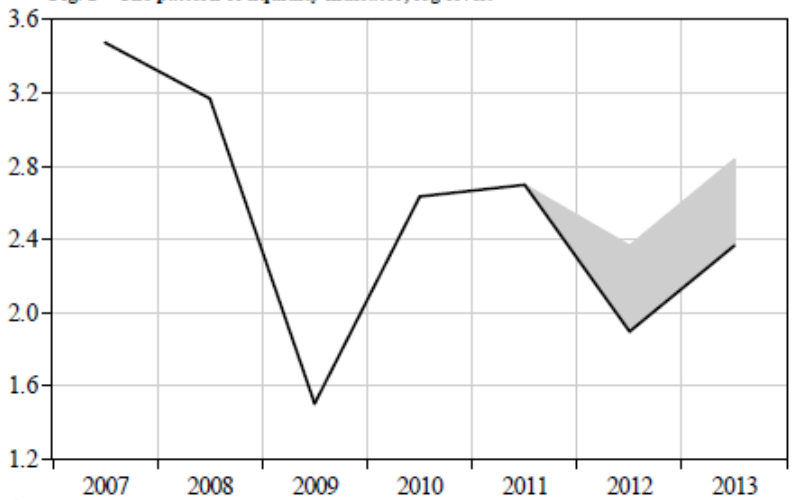
Counterfactual exercise

Fig. 1 – The economic policy uncertainty index, log-levels [a]



(*) Bold line: the Italian index; grey shaded area: distance between the Italian index and the average of Germany, France and Spain indexes.

Fig. 2 – The pattern of liquidity indicator, log-levels [a]



(*) Bold line: the historical pattern; grey shaded area: distance between the historical pattern and an alternative of less credit crunch in 2012-2013, whose liquidity levels are those of the historical figures one-year later.

Tab. 6 - The price of the political uncertainty and financial conditions [a]

	uncertainty	*liquidity*	*total*
GDP	0.2	0.2	0.4
Business investments	2.1	2.5	4.8
- ICT	15.0	9.3	25.7
- Machinery & equipments	0.5	1.8	2.3
- Non-residential buildings	0.5	1.2	1.7
Capital stock	0.6	0.6	1.2
Full time equivalent employees	0.1	0.1	0.2

[a] % changes in 2013 with respect to the actual levels.

Summing up and policy challenges

- Previous work showed that individual investment characteristics matter since, in the market sector, assets behave differently over the business cycle.
- In the short run, liquidity constraints and uncertainty are key determinants of capital accumulation.
- In the long run, instead, uncertainty and output are the main drivers coherently with the flexible neoclassical model.
- NMKT intangibles are not very reactive to liquidity constraints compared to MKT intangibles
- Positive correlation between MKT and NMKT intangibles
- NMKT intangibles can be a key policy instrument to foster MKT investments.