Tax Policy, Investment Decisions and Economic Growth*

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Abstract

This paper evaluates, compares and contrasts the impact of several tax policy instruments, fiscal spending and ex-ante uncertainty on investment, economic growth and fiscal sustainability in Italy. This is performed on the basis of detailed measurement of the historical evolution of the user cost of capital and the unit cost of labour, accounting for numerous changes of the tax system through time. Moreover, the link between investment and the user cost is identified within the context of econometric modelling of its determinants, including aggregate demand, expectations and uncertainty. Finally, the macroeconomic transmission of policy changes and other shocks is explored.

JEL classification: E22, E21, E27, E44, E62, E66, G12

Keywords: user cost of capital; unit labour cost; expectations; uncertainty; corporate taxation.

1 Introduction

This paper evaluates the investment channel in the transmission of corporate tax policies, fiscal spending and uncertainty shocks to the macroeconomy in the case of Italy. The study is motivated by the significance of investment as driver of longer-term economic growth, as well as the dominance of that channel over consumption in the propagation of policy impulses and business cycle shocks in Europe (as in Angeloni et. al. 2003). Furthermore, empirical studies by McMahon et. al. (2005) and Vartia (2008) suggest that tax policies are particularly important determinants of ICT investment, which enhances productivity growth. We study closely the case of Italy, since it is the third largest Euro area economy, and because its relatively high public debt, subdued

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economic growth and stringent governance rules, stated in the Fiscal compact, impose critical trade-offs to fiscal policy-making in navigating towards the exit of the global economic crisis.

In order to quantitatively evaluate, compare and contrast the impact of several corporate tax policy instruments, fiscal spending and ex-ante uncertainty on investment, economic growth and fiscal sustainability, we firstly perform detailed measurement of the historical evolution of the user cost of capital and the unit cost of labour on the basis of scrupulous analysis of the numerous changes of the tax system in Italy. Secondly, we provide econometric model for the link between investment demand and the user cost of capital relative to labour in the context of a full rage of other determinants, including indicators of aggregate demand, expectations and uncertainty. Finally we analyse the transmission of policy changes and other shocks to macroeconomic activity on the basis of Prometeia's quarterly macroeconomic model, estimated on detailed sectorially disaggregated data.

The paper builds on the micro-founded theoretical and empirical literature, which aim at defining and measuring the user cost of capital and the unit cost of labour, as well as analysing their importance for the investment decisions and the macroeconomy in general, such as Jorgenson(1996), Bloom (2000), Guiso et al (2002), Bernasconi et. al. (2005), Cainelli et. al. (2013). The paper also extends efforts to explain the link between macroeconomic performance on one side, and ex-ante empirical expectations and uncertainty on the other, such as Giordani and Soederlind (2003), Zarnowitz and Lambros (1987) and Tsenova (2012).

The paper is organised as follows: Section 2 provides an overview on the evolution of corporate tax legislation in Italy, Section 3 presents the methodology, data and parametrisation, Section 4 reports on the empirical results on modelling investment dynamics, Section 5 explores the macroeconomic effects of policy interventions on the basis of Prometeia's multi-sectoral Vector Error Correction Model (VECM) based model for the Italian economy and Section 6 concludes.

2 Corporate tax system in Italy

This section provides concise overview of the structure of corporate taxation in Italy, as well as its evolution through time. Within the discourse we try to distinguish between general public finance problems addressed by the tax instruments and those specific for the Italian economy.

From the beginning of the 90s the Italian tax system has been reformed a number of times, more or less substantially, providing ample basis for analysis and comparisons. The goals of the Italian government are common for all market-based economies: reduction of tax burden to private agents, while at the same time increasing economic growth and public sector revenues; reducing distortions arising from corporate income accounting giving preference to debt funding

over equity finance; raising incentives to invest in productive activities, as opposed to consumption and financial or real estate wealth accumulation; fairer sharing of the tax burden and encouraging investment in sectors of strategic importance for country's long-term development and provision of public goods and services. Moving towards those complex and sometimes conflicting goals involves difficult trade-offs and decisions. The recent global economic crisis and public debt accumulation in Italy, as well as generally in Euro area's member states, further narrowed the feasible options for fiscal and economic policy maneuvre.

Before 1997 the corporate tax system predominantly consisted of a **corporation tax** called *Imposta sul Reddito delle Persone Giuridiche* (**IRPEG**) and a **local income tax** named *Imposta Locale sui Redditi* (**ILOR**). Both taxes were levied on corporate profit at a uniform rate nationally, the latter non-deductible from the corporate tax base. In addition, in 1992 the system was augmented to incorporate two more levies: a **tax on business net worth** *Imposta Patrimoniale* and a **local property tax** *Imposta Comunale sugli Immobili* (**ICI**). The health care system was financed by social contributions paid by both employers and employees.

In that period tax incentives were also provided to encourage new investment into capital. The first measure was introduced in 1994, drafted by Italy's Finance Minister Giulio Tremonti, called after him "Tremont's law".[1] The new rules granted firms special deductions from taxable income IRPEG for a period of three years, namely from 1994 to 1996. For each fiscal year, the special deductions were computed as 50% of the cost of new investment that exceeded the average of the cost of new investment made during the previous five fiscal years. These investment tax incentives applied in addition to the normal depreciation allowances with the result that, for income tax purposes, the investor was able to write off more than the cost of the investment and thus effectively reduce corporate income taxes.

In 1998 a comprehensive tax reform entered into force named "Visco's reform" after Vincenzo Visco, the Minister of Finance in charge of its design and implementation. The reform tried to reduce the corporate tax burden through a new **regional tax** on business activity **Imposta Regionale sulle Attivita Produttive** (**IRAP**), which substituted a number of taxes, such as ILOR, Patrimoniale, the health system payroll contributions and others minor taxes.[2] IRAP had a broad base, as it applied to the value added produced by companies, profit inclusive of interest payments and labour costs.[3] As a consequence, the statutory rate was significantly lower than

[1] D.L. 357/1994 converted into Law 489/1994.

[2] When Irap was introduce, there was an academic debate in favor of this kind of tax, but in practice the examples of its application were very few.

[3] IRAP could be considered a net income type of value added tax levied at the source, see Ceriani and Giannini, 2009. Due to its tax base, theoretically IRAP did not introduce distortion in the choice between capital and labour.

IRAP's predecessors at 4.25% on average with sectoral differentiation.[4]

Furthermore, the reform introduced a *Dual Income Tax* (**DIT**), which in addition to IRAP aimed at reducing the historical bias towards indebtedness typical for the Italian tax system. In this way the reform was designed to enhance its neutrality to financing decisions and favour companies' capitalisation.[5] Similar tax had previously been applied in the Nordic countries in the 1990s (for further details see Sörensen, 1998).

The DIT concerned only corporate income and the name duality referred to the different returns on capital. Business income was split into two parts, to which different tax rates were applied: a standard 37% rate on capital income minus "ordinary income" (i.e. return after-tax-return on new equity and retained earnings); the tax rate on "ordinary income" was 19%. To determine the "ordinary income", the Ministry of Finance set annually the "normal return" on the basis of the market interest rate.[6] To cap potential revenue losses for the state, the cumulative result of all allowances could not be reduced further than an effective average tax rate of 27%.[7]

The implementation of the IRAP and the DIT resulted in reduction of tax burden on firms in general, and particularly for those choosing to increase their capitalisation. In addition, they contributed towards reducing the gap between the cost of capital obtained through debt-financing and through own equity. To reinforce these effects and firms' capitalisation, in 1999 and 2001 the government decided to introduce a "Super DIT",[8] which expanded the definition of "ordinary income" coverage. Additional incentives broadened the tax base, to which 19% of tax rate applies. This enlargement corresponded to the volume of investment financed by equity. At the same time the floor of the minimum effective tax rate was reduced from 27% to 19%.

In the second half of 2001 the new government changed the structure of the corporate tax system, especially with reference to the DIT, that was firstly limited and at the end of 2003 completely abolished.[9] Other fiscal incentives were introduced in 2001 (from 2001Q2 to 2002Q4) and in 2009 (from 2009Q3 to 2010Q2). These provisions were referred to as "Tremonti-bis"[10] and "Tremonti-ter"[11] since they reproduced similar provision introduced previously, namely in 1994.

[4]For the agricultural sector the rate was 2.5%; for the banking and financial intermediation - 5.4%.

[5]Bontempi et al. (2003) and Bernasconi et al. (2005) show empirically that in the period 1998-99 firms' debt declined.

[6]The DIT was different in its application to the Nordic countries with having wider tax base. It was levied not only on corporate income, but also on personal income.

[7]For further details on the "Visco's reform" see Bosi et al. (1999), while for the Italian tax system Caiumi et. al. (2013).

[8]D.L. 63/1999 converted into law 133/1999

[9]D.lgs. 12.12.2003, n.344.

[10]L. 383/2001.

[11]D.L. 78/2009 converted into law 102/2009.

Partially offsetting the effect of the abolition of DIT, a **thin capitalisation scheme** was implemented in 2004, according to which companies excessively financed by debt could deduct interest rate payments only up to a certain upper threshold. In the meanwhile the statutory tax rate on corporate income was reduced from 37%[12] to 33%, as the new philosophy was to decrease the corporate tax in general without any distinction between different sources of finance. This corporate tax was renamed into *Imposta sul Reddito delle Società* (**IRES**).

Another reform was introduced in 2008, stating a further reduction of statutory tax rates: from 33% to 27.5% for IRES and from 4.25% to 3.9% for IRAP. In order to induce some more neutrality amongst means of financing further to the thin capitalisation scheme, accelerated capital depreciation allowances were abolished and greater restrictions to interest deductibility from the base rate were implemented.

Reform named "Salva Italia" was introduced in December 2011, in the heat of the European debt crisis, and currently still in force. It consisted of one of three exceptional budget adjustment packages enacted in order to reduce public deficit and reassure financial markets after the deepening of the sovereign debt crisis. It provided for *Aid to Economic Growth* (**ACE**)(i.e. *Aiuto alla Crescita Economica*) on the example of the United Kingdom (Allowance for Corporate Equity), which represents a fiscal measure aimed at stimulating companies' capitalisation, designed to favour entrepreneurship and economic growth. According to this scheme, taxable income is split into two parts: ordinary, exempted, and extraordinary, taxed at the normal IRES tax rate. The ordinary return is calculated by applying to new equities a notional rate, set annually by the Minister of Finance, which in the period 2011-2013 happened to be 3%. In 2014 notional rate was changed to 4%. Even though ACE is similar to DIT, it is designed to have stronger impact on reducing user cost of capital because double taxation on business income is completely eliminated.

Over the years IRAP achieved many of its original goals, such as expansion of the tax base, reduction of average tax rates, facilitation of tax compliance, fair burden-sharing between employers and employees. However, it also received criticism on part of the entrepreneurs, and especially the self-employed. The reason was that some companies might de facto run a loss, while at the same time owe a IRAP tax payment, because the tax is levied on profit (or loss) plus labour costs. Furthermore, self-employed need to pay the share of both the employer and the employee.

Pressures to reduce or even to abolish IRAP were recurrent over the last ten years. For that reason some modifications to the implementation of IRAP were made. In 2008 10% of IRAP payments could be deducted from the tax base of IRES. In addition, as regards permanently

[12] Already reduced to 36% in 2001.

employees, firms could deduct from the tax base of IRAP all social contributions and a fixed amount of 4600 euro for each employee. Later in 2011 "Salva Italia" law further enabled firms to deduct from the tax base of IRES and income tax base of self-employed and the amount of IRAP paid on the labor cost. To encourage the employment of women and young people, firms could deduct 6000 euros for each woman or young person (under 35 years) newly employed with a permanent contract from the tax base of IRAP.

3 Methodology and data

This section explains the methodology linking theoretically and empirically taxation to the user cost of capital and labour costs, investment and the macroeconomy. It also summarises the data used and modes of parametrisation.

3.1 The user cost of capital and the unit labor cost: theory and measurement

The user cost of capital and the unit labour costs have neoclassical foundations and represent the minimum of return required by profit-maximising firms from one unit of investment and labor. They are formally derived by Jorgenson (1963) considering the problem of a firm maximising its present discounted value of current and future profit, subject to the capital accumulation equation and the production function. As a result, the user cost of capital U^k is defined as:

$$U_t^k = \frac{q_t(r_t - \pi_t + \delta_t)(1 - \tau_t F_t)}{p_t(1 - \tau_t)}$$

where τ is the statutory corporate tax rate; p and q - output and investment prices respectively; π - inflation rate; r - the market interest rate; F - the present value of depreciation allowances per unit of investment, i.e. the discounted sum of depreciation allowances; δ - economic depreciation rate.

The user cost of capital U^k increases with the opportunity cost of holding capital rather than buying government bonds or lending to others at the rate r and the relative price of investment to output $\frac{q}{p}$. It decreases with the present value defined as fiscal depreciation rate F. The effect of τ on the user cost of capital is *per se* indeterminate. Generally it is negative, but it also depends on the interaction with the present value F. In the extreme case of F equal to 1, then taxation would be neutral with respect to the user cost of capital.

The above theory is augmented to incorporate the specifics of various tax policies. For that purpose, we modify the above formula in order to account for changes in the rules on accelerated fiscal depreciation allowances (F), different treatment of investment financing and temporary

fiscal incentives for purchasing investments in Italy. As regards the depreciation rate F, the law defines a number of depreciation rates for different assets and industries.

The user cost of capital is also affected by the way firms finance their investment, trough equity or through debt. Taking these things into account, we developed two different user costs of capital: one which firm finances with debt and the other with equity.[13] In the equity financing case, in the starting period of analysis 1996 until 1997, the formula is modified as follows:

$$U_t^k = \frac{q_t(r_t - \pi_t + \delta_t)[1 - F_t(\tau_t^i + \tau_t^g)] + \tau_t^k}{p_t(1 - \tau_t^i - \tau_t^g)} \tag{1}$$

This formulation incorporates the value of the statutory tax rate on corporate income IRPEG τ^g, the local tax rate on corporate income ILOR τ^i and the tax rate on net wealth of firms τ^k. In principle, τ^i and τ^g reduce the opportunity cost of financing investment. For example, in 1996 those parameters have the value of 37% for τ^g, 16.2% for τ^i and 0.75% for τ^k.

In the same period, firms predominantly financed by debt are also able to deduct their interest rate costs. This leads to a modification of their user-cost of capital. In that case,

$$U_t^k = \frac{q_t[r_t(1 - \tau_t^i - \tau_t^g) - \pi_t + \delta_t][1 - F_t(\tau_t^i + \tau_t^g)]}{p_t(1 - \tau_t^i - \tau_t^g)} \tag{2}$$

After the reform in 1998, the user cost of capital for equity-financed firms becomes:

$$U_t^k = \frac{q_t(r_t - \pi_t + \delta_t)[1 - F_t(\tau_t^r + \tau_t^g)] - r_t^*(\tau_t^g - \tau_t^{gg})}{p_t(1 - \tau_t^r - \tau_t^g)} \tag{3}$$

where τ^r is the statutory tax rate on value added IRAP, τ^{gg} - tax rate applied to new capital - new subscriptions capital and retained earnings set at 19%; r^* - return on ordinary income.

In the case of debt-financing the user cost of capital is:

$$U_t^k = \frac{q_t[r_t(1 - \tau_t^g) - \pi_t + \delta_t][1 - F_t(\tau_t^r + \tau_t^g)]}{p_t(1 - \tau_t^r - \tau_t^g)} \tag{4}$$

In the last period of analysis, the user cost of capital, currently in force, is affected by the introduction of the ACE:

$$U_t^k = \frac{q_t[r_t - \pi_t + \delta_t][1 - F_t(\tau_t^r + \tau_t^g)] - r_t^*\tau_t^g}{p_t(1 - \tau_t^r - \tau_t^g)} \tag{5}$$

For the debt-financing case, the formula is identical to Equation 3 except for the value of the taxation parameters.

[13] Note that we do not take into account personal capital income taxation.

Similarly, the marginal unit labour costs are also derived from the first order conditions of a profit-maximisation problem facing a firm under perfect competition. The marginal labour costs U^l represent a relationship between real wages, augmented with the social payments, to the price of output. In the case of labor costs being completely deductible from the tax base, the definition is:

$$U_t^l = \frac{w_t(1+s_t)}{p_t} \tag{6}$$

where w represents wages before personal income tax, s - is the rate of social contributions.

After the introduction of IRAP the formula becomes:

$$U_t^l = \frac{w_t(1+c_t^s)*(1-\tau_t^g)}{(1-\tau_t^g-\tau_t^r)}$$

where c^s is social contribution without the health system payroll contributions. After introduction of Irap, the corporate taxes influence the marginal labor cost because the labor cost is not deductible from the tax base of IRAP.

Deductability of social costs and other allowances directly affect the formation of marginal labour costs. For example, before "Salva Italia" tax reform the formula was

$$U_t^l = \frac{w_t[(1+c_t^s)(1-\tau_t^g)-\tau_t^r c_t^i-\alpha^1\tau_t^r(c_t^s-c_t^i)]-\tau_t^r\alpha^1 4600}{p(1-\tau_t^g-\tau_t^r)} \tag{7}$$

while after becoming

$$U_t^l = \frac{w_t\{(1+c_t^s)(1-\tau_t^g)-\tau_t^\gamma[(c_t^s-c_t^i)(\alpha^1(1-\tau_t^g)+\tau_t^g)+(c_t^i+\tau_t^g)]\}-\tau_t^\gamma(1-\tau_t^g)(\alpha^1*4600+\alpha^2*6000)}{p_t(1-\tau_t^g-\tau_t^\gamma)} \tag{8}$$

where where c^i denotes contributions for workers' illnesses and occupational accidents and bonuses paid by the employers; α^1 - the share of permanent employees in total number of employees; α^2 - the share of women and young people with permanent contract in the total number of permanent contracts.

Finally, the overall costs of capital are determined by aggregating the costs of both debt-financed and equity-financed firms and their relation to the user labour costs, i.e.$U_t^{k/l} = \frac{U_t^k}{U_t^l}$.

3.2 Determinants of investment dynamics: theory and econometric modelling

According to the theoretical literature the demand for business investment is primarily influenced by costs to the supply of final goods, such as the user costs of capital and labour (see Angeloni

et. al., 2003, Guiso et. al., 2002 and Cainelli et. al., 2013), while in the case of information asymmetries and credit rationing giving rise to external financing premium, indicators such as internal cash-flow (pre-tax profits) are also considered. On the other hand aggregate demand factors also play an important role. Often empirical studies in the area find difficulties in validating the importance of the user costs of capital and labour to investment and macroeconomic performance, which motivates further careful econometric investigations on the transmission of tax policies to the wider economy.

In addition, there is a growing theoretical literature on the impact of uncertainty on investment. When investment is irreversible and investors are able to optimally choose the timing of their investment, then expectations and volatility of product demand influence the investment decisions. Demand needs to increase above certain threshold in order for new investment to be initiated. While most studies converge to the views that investment is a declining function of demand volatility, i. e. uncertainty (see for example Guthrie, 2012), Bloom (2000) provides a theoretical model, based on stochastic optimisation, which distinguishes between the long and short-term effects of the real options effect of uncertainty, and demonstrates that demand uncertainty could only influence the short-term fluctuations in the stock of capital and investment, but not their long-term levels.

Demand expectations and ex-ante uncertainty are difficult to measure in practice. Best measures of those could be extracted from survey expectations and the financial markets (e.g. sovereign debt spreads and term premia). Surveys of economic sentiment and confidence are increasingly being used to measure bouts of pessimism and optimism, which could be an important amplification mechanism or independent source of economic fluctuations. Indicators of subjective expectations and ex-ante uncertainty are also being extracted from the Survey of Professional Forecasters, following methodologies by Zarnowitz and Lambros (1987), Giordani, Paolo, and Paul Söderlind (2003), D'Amico and Orphanides, Boero et.al. (2008) and Tsenova (2012).

We evaluate and test the link between investment and the user cost of capital to labour in the context of a range of other determinants. For that purpose, we employ both a Vector Error Correction Model (VECM) for investment applying Johansen's cointegration method and a two stage estimation method by Engle-Granger. Firstly, we identify the long-run equilibrium relationship of business investment (gross fixed capital formation) with several variables traditionally suggested by theory, such as ratio of capital to labour costs and aggregate demand composed of domestic consumption and exports. We test the residual of the regression for non-stationarity. Secondly, we model the short-term convergence dynamics of investment in relation to the same factors and additional exogenous variables characterising demand expectations and uncertainty.

In order to establish the presence of a long-run equilibrium relation between investment

I, user cost $U_t^{k/l} = \frac{U_t^k}{U_t^l}$ and aggregate demand C, as well as evaluate the parameters of such relationship, we estimate Equation 10. The equation additionally incorporates a constant and a linear deterministic trend. The time subscript $t-1|t$ indicates the quarterly information lag, with which national accounts data becomes available.

$$I_{t-1|t} = \alpha^C C_{t-1|t} + \alpha^U U_{t-1|t}^{k/l} + \alpha^T t + \alpha^0 + z_t \quad z_t \in iid(0, \sigma^z) \tag{9}$$

$$\Delta I_{t-1|t} = \beta^z z_{t-1} + \beta^C \Delta C_{t-1|t} + \beta^U \Delta U_{t-1|t}^{k/l} + \sum_{n=1..N} \sum_{l=1..L} \beta^{X^n} X_{t-l}^n + \varepsilon_t \quad \varepsilon_t \in iid(0, \sigma^\varepsilon) \tag{10}$$

where the term X represent the additional measures of expectations, disagreement and uncertainty, with which to augment the traditional benchmark equation and l represents the order of lags where $l \in (0, 1, 2...)$.

Given that the dependent and independent variables are I(1) processes, the presence of a cointegration relationship between them would produce a stationary I(0) error term, i.e. temporary deviations from equilibrium. Alternatively, there could be a spurious relationship between the variables producing non-stationary persistent errors z_t. In order to test this possibility we assess the augmented Dickey-Fuller regression in which the first difference of the residual Δz_t is regressed on its own lag and its lagged difference, Equation 11.[14]

$$\Delta z_t = \gamma^0 z_{t-1} + \gamma^1 \Delta z_{t-1} + \epsilon \tag{11}$$

The relationships are estimated through OLS in order to identify and test the role of expectations and uncertainty factors on investment over and above the impact of fundamentals, rather than imposing *à priori* structural links via full information methods. We evaluate the stability of the coefficients through rolling regressions.

3.3 Macroeconomic framework

The transmission of tax policies is further investigated incorporating the investment dynamics and its determinants in Prometeia's empirical macroeconomic model. Taking into account the latest data and parameter estimates, we execute comparative analysis on the transmission of shocks to the tax rates on IRAP and IRES. Furthermore, we compare and contrast their transmission to other shocks on investment, such as public investment and uncertainty.

The Prometeia's empirical macroeconomic model is a large-scale multi-sectoral quarterly model evaluated and used in the fundamental production of Prometeia's outlook. Over the years

[14]The same result is obtained with Trace and Lambda tests.

it has been constantly elaborated to keep abreast of the econometric theory and forecasting practice. Institutional forecast models are rarely published in their entire details, but one could grasp the model's complexity from Ferrari et. al. (1992), who provide a detailed account on the structure of its early predecessor.

The model has prevailing New-Keynesian features, incorporating detailed sectorial disaggregation for the Italian economy, inclusive of nearly 1000 structural equations, of which 150 of stochastic nature. It is able to investigate both cyclical and structural factors in the short- and medium-term. It incorporates financial, monetary and real side, inclusive of government, services, manufacturing, construction and agriculture. From the point of view of flow of funds, the model takes into account detailed revenues and expenditures of the public sector, such as income taxes on households, firms, deposit and bond interest, housing and land, indirect taxes (VAT and fuel excise duties), social contributions, interest payments, goods and service expenditures, wages, pensions, health care and public investments.

3.4 Data

The study utilises publicly available National Accounts statistics provided by NSI and financial statistics compiled by Banca d'Italia. The period of analysis spans over the available time-series data in the period 1996Q1-2013Q1.[15]

In the case of estimating the user-cost of capital and labour, we use producer prices of manufacturing goods to capture the effect of output prices p, the deflator on investment of machinery equipment for prices on investment and transport. The value we use for the depreciation rate δ of 12% per year corresponds to the average of several depreciation rates on machinery and equipment, and is the standard applied in other studies (see Bontempi at.al., 1995). For equity-financed investment we use the interest rate on corporate bonds, while for debt-financed investment we use interest rate on corporate loans on average.

In the analysis, financial uncertainty is proxied by the spread between 10-years sovereign debt yield of Italy and Germany, short-term business sentiment for Italy - by the corresponding aggregate indicator released by EC survey. Furthermore, proxies for Euro area's expectations and uncertainty are derived from individual reports from the Survey of Professional Forecasters, conducted by the ECB.

[15]Note that there is one quarter lag in the availability of National Accounts Statistics.

4 Empirical results

Provided the described methodology, we estimate the historical impact of taxes on the ratio of the user cost of capital to labour and its components. Furthermore, we estimate the effect of the user-cost of capital to labour on investment dynamics in the shorter and longer-term. Then applying the Prometeia's empirical macroeconomic model we evaluate the macroeconomic consequences of changes in tax policies and compare those to other policy interventions.

4.1 The user cost of capital to labour and components: historical evolution

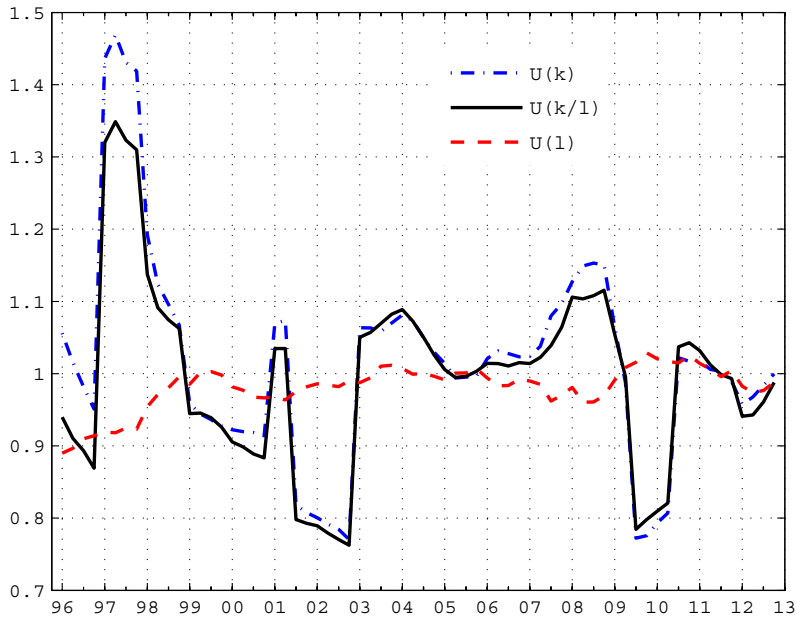
The results of the evaluation, depicted in Figure 1, show that the ratio of the user cost of capital to labour has generally been declining since the beginning of the analysed period, 1996Q1. At the same time, it is characterised by pronounced shorter-term fluctuations. Comparison of the dynamics of its components reveals that the user cost of capital is the major determinant. Instead, the user cost of labour has very limited fluctuations, but have an important role in dampening upper extremes in the level of the user cost of capital to labour. The reason is that episodes of higher capital costs coincide with modest declines in the level of the unit labour cost.

The user cost of capital registered a peak in 1997 due to the abolition of temporary fiscal incentives previously taking place. The reduction in the user cost of capital in 1998 could be traced back to reduced cost for equity-financed investment. In that period the government implemented a scheme to reduce the excessively strong advantage of debt-financing over equity-finance. The effects were re-enforced by Italy's decision to join the European Monetary Union, which brought down the nominal yields on long-term government bonds and to a lesser extent interest rates on loans to businesses. In additional to tax policies, interest rates have also been a factor. For example, an increase in Italian nominal bond yields and interest rates during the global economic crisis exercise upward pressure on the user cost of capital.

The sliding trend in the user cost of capital could mostly be associated with the statutory tax on corporation income, which has been reduced progressively since the beginning of 2000. The tax rate of IRAP has been stable, but tax policies have been executed through reduction in the tax base. Tax policies are also motivated by international competition amongst governments to provide favorable treatment to investment activity under global capital mobility.

After 1998 large downward swings in the user cost of capital could mostly be associated with fiscal incentives, as evident from Figure 2. In practice, Tremonti's law had larger impact on the user cost of capital than the Super DIT, because the latter measure applied only to firms taking advantage of the DIT, i. e. have undertaken a new capital increase through either new subscriptions or retained earnings.

Figure 1: **Evolution of the user-cost of capital to labour (Index 2005=1)**



Note: $U(k/l)$ is the ratio of the user cost of capital to labour; $U(k)$ - normalised user cost of capital; $U(l)$ - normalised user cost of labour.

Figure 2: **Evolution of user cost of capital with and without fiscal incentives (Index 2005=1)**

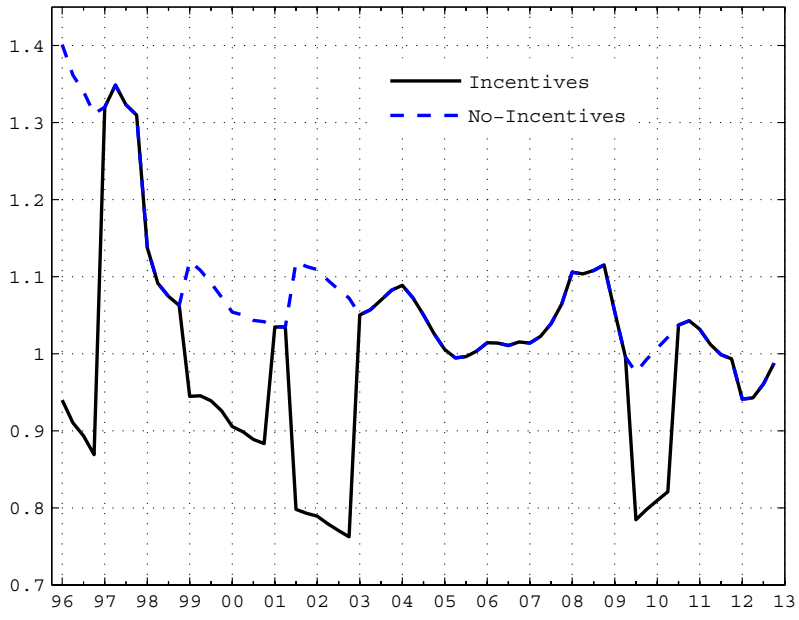
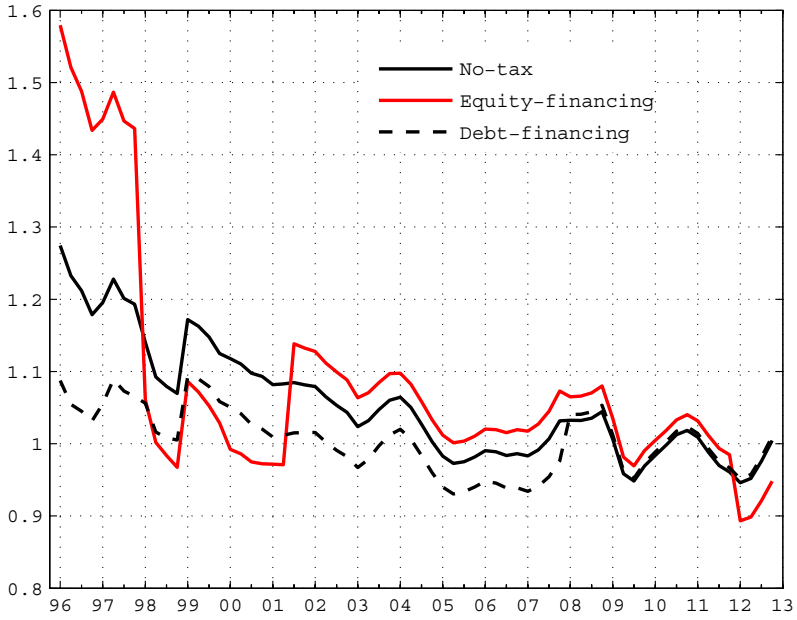


Figure 3: **User-cost of capital without incentives: debt vs. equity-financing (Index 2005=1)**



Note: User cost of capital for equity-financed and debt-financed firms is with tax, but no tax incentives.

Before 1998 the user cost of capital was higher for firms financed through equity than through debt, see Figure 3. In the period 1998Q2-2001Q2 this tendency was successfully reverted by the IRAP, which is levied also on interest paid by firms, and by the equity capital incentives enacted with the DIT and Super DIT. Later, debt financing enjoyed smaller, but positive cost advantage brought to a very small margin only during the global economic crisis after 2008.

Altogether, taxation policies have significant impact on the user cost of capital to labour. We find that while tax incentives generally account for cyclical fluctuations in this indicator, tax policies affecting the tax rate and/or tax base of corporate income tend to influence its trend.

4.2 Modelling investment dynamics

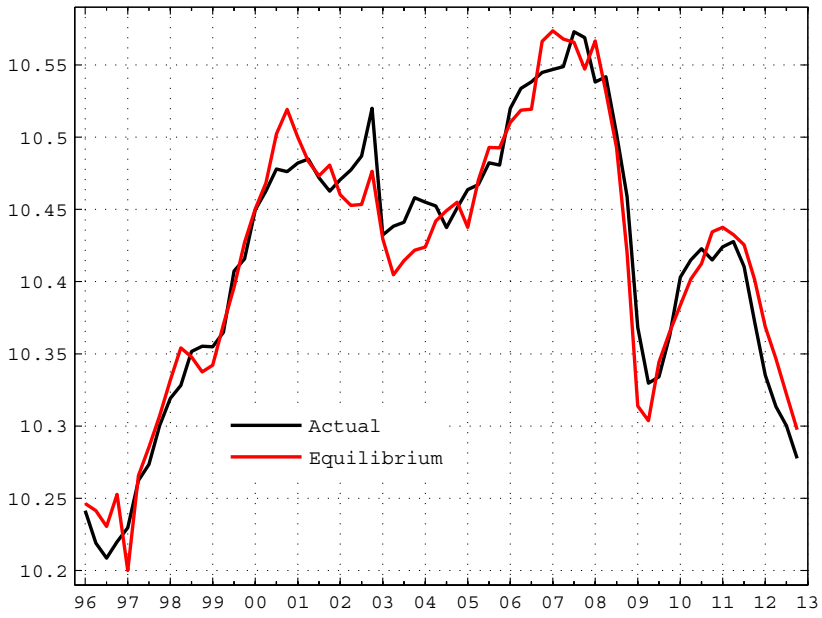
We evaluate an econometric model on the dynamics of investment in the longer and shorter term to estimate its relationship with the user cost, and consequently taxation, in the context of other determinants. Following the methodology described in the previous section, we find the presence of a long-term equilibrium relationship between investment (gross fixed capital formation) I, aggregate demand C and the user cost of capital to labour $U^{k/l}$, see Equation 12.

Within the sample period, this relation is furthermore accompanied by a slight downward deterministic trend, which could represent a crude measure for exogenous technological progress giving rise to increased efficiency of investment per unit of output. Investment I tends to rise with improvements in aggregate demand (both domestically and abroad) C, as well as with decline in the user cost of capital to labour $U^{k/l}$. As suggested by the standard errors reported in parenthesis, all coefficients are significant at 1% level. Investment does not seem to linger far from its long-term equilibrium given the relatively high explanatory power of Equation 12 at 95% and relatively low mean root standard error σ^z of the Error Correction Term (ECT) z.

$$\begin{aligned} I_{t-1|t} \;=\; & 2.569^{***} C_{t-1|t} - 0.106^{***} U^{k/l}_{t-1|t} - 0.007^{***} t \; - 20.597^{***} \; + z_t \quad R^2 = 0.947 \quad (12) \\ & \quad (0.081) \qquad\quad (0.020) \qquad\quad (0.000) \qquad\quad (0.947) \qquad \sigma^z = 0.022 \end{aligned}$$

To validate the estimated long-term equilibrium relationship, we test the hypothesis of presence of a unit root in the regression residual applying Augmented Dickey-Fuller test, i.e. that the coefficient γ^0 in Equation 11 is significantly different from unity. Equation 13 summarises the OLS estimates, reporting in parenthesis the standard errors and in bold the $t-test$ statistics of each coefficient.

Figure 4: **Investment dynamics: actual vs. fundamental equilibrium** I_t



Note: Variables are expressed in natural logarithm.

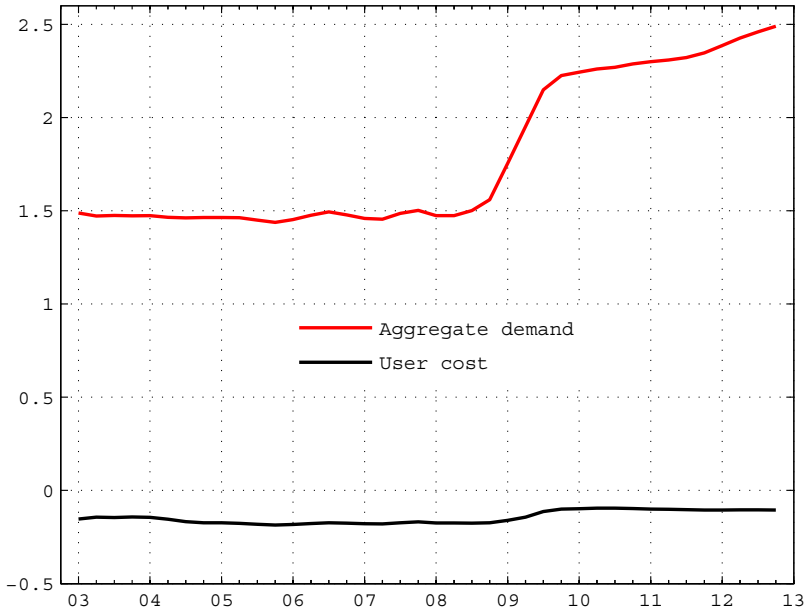
$$\begin{aligned} \Delta z_t &= -0.388 z_{t-1} + 0.009 \Delta z_{t-1} + \epsilon \qquad (13) \\ &\quad (0.112) \qquad (0.125) \qquad (0.018) \\ &\quad \textbf{-3.46} \qquad \textbf{0.07} \end{aligned}$$

Given that the coefficient is significantly negative with $t - test$ statistics at -3.46, which is less than the approximate critical value of -2.60 for 1% confidence and a small sample,[16] we could safely reject the hypothesis of a unit root and presence of a spurious regression results underling Equation 12.

The estimated long-term dynamics of investment to user cost and aggregate demand validate the theoretical literature represent a rare empirical finding. It also provides an equilibrium notion for investment dynamics, as depicted on Figure 4. Through time, there were short periods of investment over and undershooting the path suggested by the user cost and aggregate demand. However, towards the end of the sample, i.e. after mid-2010 the actual investment has been persistently undershooting its equilibrium, which could be associated with the Great Recession and the global economic crisis.

[16] Enders (1995) pp. 223 and Hamilton (1994) pp. 763

Figure 5: **Evolution of coefficients on equilibrium relationship of investment with aggregate demand and the user cost**



We evaluate the time-variation in the equilibrium dynamics of investment through rolling regressions on the coefficients of aggregate demand and the user cost of capital to labour, Figure 5 depicts the results. The rolling regressions were with expanding window, as from 2003Q1. The results show that the relationship between investment and its fundamental equilibrium determinants is relatively stable. However, while in the latter part of the sample the user cost preserve their link to investment relatively unchanged, the importance of aggregate demand increases since 2009. While before the Great Recession there was a substantial stability of the coefficient of aggregate demand at about 1.6, after that the demand coefficient took on a rising path. This suggests an increasing role for the demand factors in the longer term during the Great recession. Still, there had been better times for the impact of the user cost on investment with values reaching -0.19 in the period before 2009.

The shorter term investment dynamics is estimated to be determined by a number of fundamental and other factors. Table 1 reports on the results of the alternative specifications.[17]

To evaluate the role of fundamentals we estimate a benchmark specification, where changes

[17]To test, compare and contrast the explanatory power of the additional factors related to expectations and uncertainty, the sample is restricted NSI data for 1999Q3-2012Q4 and corresponding expectations and uncertainty data for 1999Q1-2013Q1. The difference in the periods is due to a one period information lag of the NSI data, availability of series on the Euro area and the lag structure of the specifications which include expectations and uncertainty variables.

in investment depend on changes in aggregate demand, user cost and the deviation of investment from its equilibrium, see Column (1). Investment increases with aggregate demand and reduction in the user cost of capital to labour, with tendency to converge gradually to its longer-term equilibrium, judging by the estimated coefficients. The high significance of the reported coefficients and the relatively good explanatory power of the regression (R^2 of 59%), indicate that fundamental factors are key for future investment.

Figure 6 plots the insample predictions of the benchmark regression towards observed changes in investment. The model performs relatively well, except for the last sample period. Since the middle of 2010, the model over-predicts the short-term investment dynamics.

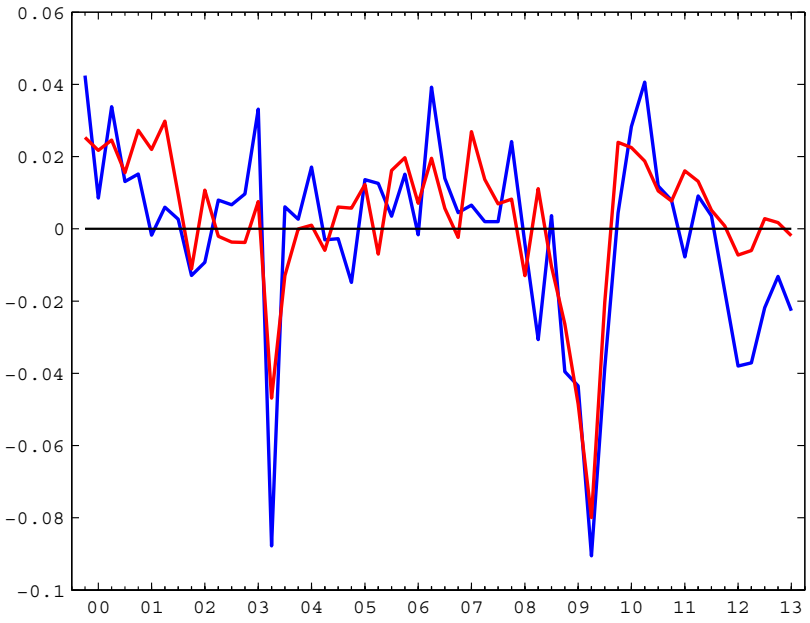
In order to evaluate the role of fundamentals in the context of other determinants, we estimate several other specifications for the short-term dynamics of investment, see Columns 2-5 of Table 1. The benchmark model is augmented to include indicators of Euro area's short-term output gap expectations, unemployment uncertainty, the spread between the Italian and German long-term government bonds and Italian sentiment for the short-term. The inclusion of these factors increases the explanatory power of the model to 70%-75% (i.e. by 15%-20%). All fundamental factors remain significant, with the inclusion of additional factors mostly reducing the role of aggregate demand in the short-term. This is understandable, since the additional factors are mostly linked to demand's expectations and uncertainty, rather than supply. The additional factors have become particularly important during the global financial and economic crisis, which explains also their usefulness in improving the predictability of investment changes, see Figure 7.

4.3 Taxation and economic activity

This section evaluates, compares and contrasts the macroeconomic effects of several fiscal policy instruments and an uncertainty shock, using the Prometeia's empirical quarterly macroeconomic model for Italy. We analyse the transmission of a reduction in the corporation income tax IRES, the regional tax on corporate revenues IRAP and macroeconomic forecast uncertainty, as well as an increase in public investment. For that purpose we integrate the series on the user cost of capital relative to labour and the structure of the investment model estimated in the previous section within the econometric framework of Prometeia's quarterly model.

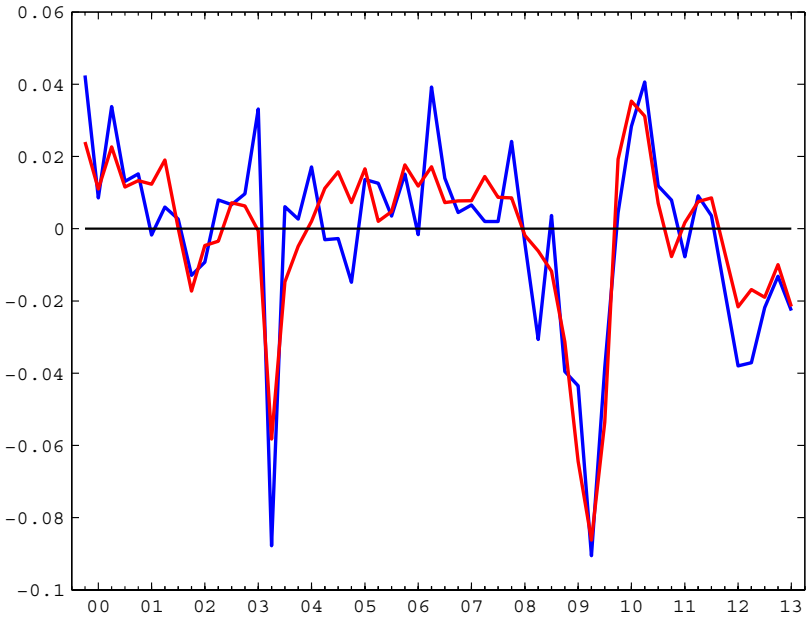
Given the model's structure and the last period of analysis as initial conditions, we firstly evaluate the impact of two tax shocks, namely the statutory tax rate of IRAP and IRES. The shocks are independent and permanent. The relative price of capital to labour falls in both cases, but less in the case of IRAP. This is a direct result of the fact that the tax base of IRAP

Figure 6: **Insample predictions from benchmark short-term regression**



Note: Blue line indicates observations of $I_{t-1|t}$; the red line - predictions based on benchmark regression Table 1 Column (1).

Figure 7: **Insample predictions from short-term regression augmented with Italian and Euro area's expectations and uncertainty ΔI_t**



Note: Blue line indicates observations of $\Delta I_{t-1|t}$; the red line - predictions based on augmented regression Table 1 column (2). Levels of variables are expressed in natural logarithm.

Table 1: **Modelling investment dynamics in Italy**

Long-term dynamics:

$$I_{t-1|t} = \underset{(0.081)}{2.569^{***}} C_{t-1|t} \underset{(0.020)}{- 0.106^{***}} U^{k/l}_{t-1|t} \underset{(0.000)}{- 0.007^{***}} t \underset{(0.947)}{- 20.597^{***}} + z_t \quad R^2 = 0.947 \quad \sigma^z = 0.022$$

Short-term dynamics:

$$\Delta I_{t-1|t} = \beta^z z_{t-1} + \beta^C \Delta C_{t-1|t} + \beta^U \Delta U^{K/L}_{t-1|t} + \sum_{n=1..N} \beta^{X^{n,l}} X^n_{t-l} + \varepsilon_t \quad \varepsilon_t \in iid(0, \sigma^\varepsilon)$$

S	β^S	β^S	β^S	β^S	β^S
	(1)	(2)	(3)	(4)	(5)
$z_{t-2\|t-1}$	-0.398***	-0.283***	-0.429***	-0.455***	-0.427***
	(0.108)	(0.095)	(0.103)	(0.093)	(0.098)
$\Delta C_{t-1\|t}$	1.750***	0.741 ***	0.923***	0.852***	0.795***
	(0.221)	(0.278)	(0.244)	(0.255)	(0.239)
$\Delta U^{K/L}_{t-1\|t}$	-0.082***	-0.076***	-0.062**	-0.103***	-0.083***
	(0.030)	(0.027)	(0.026)	(0.025)	(0.026)
$\Delta \widehat{y}^{e\,Euro}_{t\|t}$		0.006**	0.006**		0.007***
		(0.003)	(0.003)		(0.003)
$\Delta \widehat{y}^{e\,Euro}_{t-2\|t-2}$		0.012**	0.011**		
		(0.005)	(0.005)		
$\Delta \widehat{y}^{e\,Euro}_{t-3\|t-3}$		-0.015***	-0.015***		-0.007***
		(0.004)	(0.004)		(0.002)
$\phi^{e\,(95\%-5\%)Euro}_{t\|t}$		-0.016**			
		(0.007)			
$R^{Long(IT-DE)}_{t-1\|t}$			-0.006***	-0.007***	-0.006***
			(0.002)	(0.002)	(0.002)
$\Delta y^{e\,IT}_{t-1\|t}$				0.140**	
				(0.057)	
$\Delta y^{e\,IT}_{t-3\|t-2}$				0.205***	0.163***
				(0.053)	(0.051)
N	54	54	54	54	54
σ rmse	0.017	0.014	0.014	0.014	0.013
R^2	0.587	0.740	0.761	0.763	0.782
R^{2Adj}	0.563	0.702	0.726	0.734	0.749
F	24.2	19.1	21.4	25.8	24.0
ll	143.6	156.2	158.4	158.7	160.8

Note: I is gross fixed capital formation (machinery, equipment and transports); subscript $t-1|t$ means that the latest observation is available in period t, but refers to period $t-1$; z - error correction term (ECT) of the long-term equation; C - aggregate demand, consisting of household consumption plus export of goods and services; $y^{S^e\,IT}$ - level of short-term expectations reported in the Italian business climate survey; $U^{k/l}$ - ratio between the user cost of capital and labour; $\Delta \widehat{y}^{S^e\,Euro}$ - short-term expectations on the output growth gap in the Euro area, i.e. the difference between the short-term (one-years-forward) and long-term (five-years-forward) point forecasts on output growth in the Euro area; $\phi^{S^{e\,(95\%-5\%)}Euro}$ - disagreement (uncertainty) on short-term forecasts of the unemployment rate in the Euro area, measured by the distance between the 95-th and 5-th percentile of the cross-sectional distribution of point forecasts; $R^{Long(IT-DE)}_{t-1|t}$ - spread between the 10-years government bond yields of Italy and Germany; the variables I, C, $U^{k/l}$ and $y^{S^e\,IT}$ are in natural logarithms; $\phi^{S^{e\,(95\%-5\%)}Euro}$ and $R^{Long(IT-DE)}_{t-1|t}$ are demeaned; standard errors are reported in parenthesis ; σ is measured in root mean squared errors; *** denotes 1% or less significance level, ** 5% or less significance, * 10 % or less significance level; N - number of observations; F - F test statistics; ll - Maximum likelihood test statistics.

Table 2: **Macroeconomic effects of a reduction in corporate taxes**

Shocks on →	$\Delta IRES$		$\Delta IRAP$	
Effects on ↓	After 1 year	After 4 years	After 1 year	After 4 years
ΔI	1.83	2.27	0.67	1.78
ΔGDP	0.20	0.19	0.10	0.59
Δ Consumption	0	-0.06	0.12	0.87
Δ Employment	-0.07	-0.23	0.10	0.97
Δ Consumer prices	-0.01	-0.1	-0.27	-0.59

Note: The policy change constitutes reduction in corporate taxes equivalent to 1% of GDP. Results are evaluated on the basis of Prometeia's quarterly macroeconomic model for Italy and expressed in percentage deviation from the model's baseline. I denotes business investment (i.e. gross fixed capital formation).

includes not only profit, as in the case of the IRES, but also labour cost. Consequently, its change influences in the same direction both the user cost of capital and the unit labour cost. Therefore, a one percentage point decline in IRAP causes reduction in the user cost by 0.8 percentage point, as result of -1.4 percentage point change in the user cost of capital and -0.59 percentage point change in the user cost of labour. A corresponding change in IRES translates into 1.3 percentage point decline, which is entirely due to the reduction of the user cost of capital.

Taking into account the econometric model determinants of investment demand, IRAP increases permanently investment demand by 0.08 percentage points per quarter, while IRES rises permanently investment demand by 0.14 percentage points per quarter. The full convergence to that pace takes about two years.

The predicted increase in investment demand could materialise in a larger or smaller extent depending on various endogenous macroeconomic linkages additionally incorporated in the macroeconomic model. We follow the transmission of the tax changes evaluating both the direct and second round effects to the wider economy.

To enable policy relevant judgements, we adjust the shocks to be fiscally neutral in terms of generating revenues for the government budget. In general, the overall incoming revenues from the two tax schemes are currently rather similar. For example, in 2013 the revenues from IRES amounted to 36 billion and from IRAP to 32 billion, of which 10 billion paid by the government administration. However, the bases for the two taxes are very different, and as a consequence, so are their statutory rates. Thus, the shocks are selected to be of the same amount in terms of their ex-ante effect on public deficit, namely at 1% of GDP.[18]

[18]Inevitably, in doing this we have to abstract from ex-post budgetary effects of reduced taxes on economic

Table 3: **Macroeconomic effects of an increased aggregate demand and reduced uncertainty**

Shocks on →	Δ Public Investment		Δ Uncertainty	
Effects on ↓	After 1 year	After 4 years	After 1 year	After 4 years
Δ Total Investment	7.4	7.0	0.47	0.76
Δ GDP	1.14	1.35	0.05	0.13
Δ Consumption	0.05	0.47	0	0.06
Δ Employment	0.48	0.99	0.01	0.11
Δ Consumer prices	0.02	0.05	0	0

Note: The policy change constitutes reduction in corporate taxes equivalent to 1% of GDP. The uncertainty change - return to pre-crisis levels of ex-ante uncertainty of Euro area's unemployment forecasts. Results are evaluated on the basis of Prometeia's quarterly macroeconomic model for Italy and expressed in percentage deviation from the model's baseline.

According to the simulations, a decline in the statutory rate of IRAP amounting to 1% of GDP results in a rise in the Italian GDP of 0.10 percentage point after 1 year and 0.59 percentage point after 4 years, see Table 2. Note that this is equivalent to a policy shift reducing the statutory rate by 2.9 percentage points, from the current 3.9% to 1%. The main drivers of GDP growth are investment and household consumption.

Corporate investment increases by 0.67 percentage point in 1 year and 1.78 percentage points in 4 years, while consumption increases by 0.12 percentage point in 1 year and 0.87 percentage point in 4 years. This is the effect of reduction in the labour cost (by around 4percentage points for the whole economy) that translates into consumer prices' reduction (lower by 0.59 percentage point). At the same time the reduction of the real cost of labour, in addition to the lower cost of capital, increases employment by 0.97 percentage point in 4 years, further strengthening disposable income and welfare.

In addition, there is an improvement in competitiveness with positive effects on exports. The fiscal measure has a more favorable effect on employment in the service sector (that increases by 1.72 percent after four years) in comparison with that in manufacturing (0.17 percentage points), because of the difference in the intensity of labour on the value added, higher in services.

A 1 percentage point of GDP cut of IRES imply a reduction of 13 percentage points of the statutory rate (from 27.5% to 14.5%). To get an idea of the magnitude of such a reduction, consider that a 10 percentage points cut has taken twenty years to materialise with 5 percentage points reduced in a single period, i.e. in 2008Q1. In this scenario, the model predicts investment

activity and thus budget revenues.

to increase with respect to the baseline by 1.83 percentage points in the first year and by 2.27 percentage points after four years. GDP is expected to be higher with about 0.2 percentage points after one year and beyond. In comparison with the cut on IRAP, a cut of IRES rate is more effective in boosting investment than GDP, not only because the increase in domestic demand raises imports, but also because the reduced price of capital is detrimental for labour demand.

As shown in the previous paragraphs, taxes are not the only determinants of investment, aggregate demand and uncertainty being even more important, especially during the financial crisis. As an example of the size of the impact of aggregate demand on investment and hence on Italian economy, Table 3 shows the results of a scenario in which the expansionary fiscal policy (of 1 percentage point of GDP) is pursued by means of an increase of public investment. The model predicts that the macroeconomic effects are much higher: total investment improves by 7.4 percentage points and GDP by 1.14 percentage point in the first year; after the fourth year the rise in investment constitutes 7.0 percentage points, while for the GDP reaches - 1.35 percentage points.

The effect of uncertainty is sizeable as well, see Table 3. In a scenario in which the level of short term ex-ante uncertainty unemployment forecasts in the Euro area comes back to its pre-crises level, business investment increases by 0.47 percentage point in the first year and by 0.76 percentage point the fourth year. GDP growth increases by 0.05 percentage point the first year and by 0.13 percentage point the fourth year.

5 Conclusion

This paper evaluates the ex-ante impact of a reduction in two corporate tax rates in Italy, namely IRES and IRAP. The expected transmission of those shocks is compared and contrasted to two alternatives: increased spending in public investment and macroeconomic uncertainty reduced to pre-crisis levels. For that purpose, the paper offers detailed measurement of the historical evolution of the user cost of capital and the unit cost of labour, accounting for numerous changes of the tax system since the middle of the 1990s. The empirical link between investment and the user cost relative to labour is identified within the context of econometric model of its determinants, including aggregate demand, expectations and uncertainty. Prometeia's quarterly macroeconomic model is applied in assessing the multi-sectoral and overall transmission of those policies and shocks to the macroeconomic activity and welfare.

The results show that since the beginning of the analysed period the user cost of capital relative to labour is characterised by a slight downward trend and marked cyclical fluctuations.

This is predominantly driven by the user cost of capital, but the user cost of labour plays a role in dampening upward movements. While cyclical fluctuations in the user cost of capital are mostly associated with temporary fiscal incentives, the tax rate policies determine its trend. Overall, we show that the user cost of capital to labour is strongly affected by the system of corporate taxation in place.

Furthermore, we demonstrate that reductions in the user cost of capital relative to labour have significant positive effect on business investment, both in the short and longer-term. The dynamics of investment is fundamentally explained by the user cost and aggregate demand factors. In addition, short-term fluctuations are also be impacted by demand expectations and uncertainty indicators. According to the results of the macroeconomic simulations, a reduction in the IRAP boosts investment and output growth gradually, with significant positive effects felt only after four years after its implementation. A comparative reduction in the IRES rates boosts more modestly investment and economic growth, but the improvements are seen from the first year. The most favorable outcome is estimated to occur after an equivalent increase in public investment. Reduction of ex-ante uncertainty on the Euro area's unemployment outlook to pre-crisis levels also has important positive impact on business activity and welfare.

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