Do innovation and internationalisation policies improve regional performance?

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Abstract: Over the past 20 years, innovation and internationalization capabilities are gaining more and more importance as key factors for economic growth and industrial competitiveness. R&D investments and internationalization process individually prove to enhance firm productivity, enrich firm skills and competencies and give more opportunities to face knowledge-based global competition. Moreover, innovation and internationalization are inter-dependent stimulus of a virtuous cycle leading to profitability improvement. These remarks has prompted a re-think of industrial policy-making by emphasising both pro-innovation and pro-internationalization programmes. However, the allocation of government resources to the stimulation of these phenomena could not provide the expected benefits because of the fragmentation and the lack of coordination of policy makers activities. This study bases on the idea that policy makers should plan subsidies taking into account the circular relationship between the two phenomena. In fact, even if the subsidies are targeted to specific industrial aspects, there is a substantial overlapping among them at local level. Both innovation and internationalisation measures granted in the same area can generate positive externalities: this justifies the integration of different incentive schemes in the same region. This study carries out an empirical analysis at regional level aimed at understanding the effectiveness and interaction of these two types of measures. The analysis takes into account innovation and internationalisation subsidies granted from 2000-2007 to Italian firms. Descriptive statistics and econometric estimations highlight that both innovation and internationalization policies positively affect the regional economic performance. However, regions can enhance the benefits of innovation incentives by matching them with effective internationalisation measures. In particular an equilibrium among innovation e internationalisation policies leads to high level of GDP.

1 Introduction

The fundamental sources of economic growth relate to those variables which have an important influence on a region's ability and capacity to accumulate factors of production and to invest in the production of knowledge. Among the major determinants for growth the literature highlights the importance of firms' internationalization and innovation as well as policy actions deliberately in place to promote growth. The crisis that affects the world economy since 2008 further enhanced governments' interventions aimed at stimulating the national economies.

Indeed, public support, for instance through capital subsidies has the potential to stimulate employment and growth, and virtually all developed economies use public money to promote private investments of firms A wide range of public support programmes, to small firms more particularly, in developed economies and their appraisal is reviewed by OECD (1995, 1996, 1997). Innovation and internationalization promotion policies have assumed an increasing role among the public policies oriented to growth and wealth creation in Europe, which results from the fact that the relevance of innovation and technology capability for growth and internationalization is now well established both at analytical and empirical level (Abramovsky et al., 2004; Goh, 2004; Aiginger and Sieber, 2005).

Despite the increasing significance of such policy tools, we know surprisingly little about their effects and systematic and rigorous analyses are still lacking (European Commission, 2007, 2008, 2010; OECD, 2009; Lin et al., 2010). Hence, the growth effect of public support, of capital subsidies in specific, continues to be a matter of debate in the theoretical and empirical literature (Martin and Scott, 2000; Vence et al., 2000; Lach, 2002; Goh, 2004; Rodriguez-Posi and Fatesi, 2004; Howells, 2005; OECD, 2005).

The policy evaluation is insofar as more important as, at the same time, the crisis lowered the financial capability of governments to support industry. Consequently, policy makers have more than ever to define priorities and allocate funds in the most effective way. This study contributes to this end. We analyse the effectiveness of two areas of policy action: innovation and internationalisation policies, looking at their impact upon regional economic development. While exploring the effects of policies upon regional growth, we investigate how regional structures influence this effect. We examine the interaction between these aspects to deepen our understanding of the role they play in enhancing growth by looking at the experience of the Italian regions in the last decade.

Owing to the potential of public support to spur firm and regional firms' dynamics we could expect favourable effects of policies on the regional growth. Whilst the regional impact of innovation and internationalization policy is a major issue at European level, so far, the majority of empirical growth studies on regions have neglected public policy and direct capital subsidies due to the lack of data (Vence and Metcalfe, 1996; Vence et al., 2000; Koetter and Wedow, 2008).

An additional novelty of this paper is that we test the hypothesis whether complementarities between internationalization and innovation policies reinforce their individual impact on regional growth. We demonstrate that only by planning concurrently innovation and internationalization policies policy makers can enhance the effectiveness of industrial policies measures in stimulating regional development.

2 Policy and regional growth

The fundamental sources of growth relate to those variables which have an important influence on a region's ability and capacity to accumulate factors of production and to invest in the production of knowledge (Gonzalez and Montolio, 2004; Crescenzi, 2005). On this regard, the relevance of innovation and technology capability and internationalization of an economy for growth is now well established both at analytical and empirical level (Furman et al., 2002). The relevance of regional technology capability differences in explaining regional disparities in Europe has been shown by different studies (Fagerberg and Verspagen, 1996; Vence and Metcalfe, 1996). As a consequence, innovation and internationalization policies have assumed an increasing role among the public policies oriented to growth and wealth creation.

Virtually all developed economies promote innovation and internationalization of firms. Indeed, the increase of innovation and internationalization activity in a region is a common objective of supranational, national and regional industrial policies (Rothwell and Zegveld, 1981). Sometimes this assistance is a direct financial payment in the form of subsidies to encourage investment in human or physical capital. In other cases public support takes the form of free or subsidized advisory services, for example in starting or developing small business or in specialist areas such as exporting, entering new markets or the use of new technology. Taxpayers money may also be used to bribe individuals or organisations to behave in a way which is perceived to benefit both businesses and the economy as a whole.

The rationale of public support for R&D and internationalization activities is, on one side, the positive impact of both practices on the industrial development and economic growth. On the other side, it is the lower than desired level of firms' expenditures in such activities in absence of external pushes (European Commission, 2010). Apart from their specific goals, innovation and internationalization support, as the other industrial policies, aim at maintaining sustained growth in productivity, in employment or attaining international competitiveness. Hence, government interventions aim to contribute to the economic and social well-being by affecting the resources allocation generated by market forces and by correcting market failures (Rodrik, 2004).

As we mentioned above, industrial policies embody a complex set of incentives to establish a course of action to support the achievement of development goals. Government interventions provide support for specific firms or industries by picking winners or supporting losers (i.e. vertical policies) or target general development interests by facilitating access to information, strengthening legal and institutional frameworks, build capacity and expand infrastructure, enhancing quality of human resources (i.e. horizontal policies) (Ainginger, 2007). Today in European countries the incentives structure is dominated to some moderate degree by the horizontal approach. The analysis of such industrial policies' effects is complex. Previous studies provide contrasting results that vary according to the level of analysis and of exploited performances proxies. Existing research does not provide definitive evidence about the impact of policies upon firms (Bergstrom, 2000; Hart et al., 2000; Skuras & Tzepelis, 2004; Martini et al., 2006; Gabriele et al., 2007, Craig et al. 2008). There is a lack of studies investigating the impact of policies upon economy wide growth, but the controversial results about the effects of industrial policies upon firms make scholars doubt about the general effectiveness of government interventions or the capacity to design right support to promote economy wide growth at national or regional level (Koetter and Wedow, 2008).

2.1 Innovation policy and economy wide growth

R&D investments enhance firm productivity, enrich firm skills and competencies and give more opportunities to face knowledge-based global competition. Innovation is a source of competitive advantages that positively affect the economic performance at firm level but also engenders positive spillovers at territorial level that improve macroeconomic conditions. Briefly, innovative activities are welcome to sustain economic regional growth.

Basing on these remarks, in the last years, as stated also in Lisbon Strategy 2000, European governments strengthen their efforts improving science and technology (S&T) development process. Governments' interventions aim at increasing the efficiency of public research, at motivating the private actors in R&D activities or at fostering closer interaction between universities, government labs, firms and civil society (Rothwell and Zegveld, 1981; Abramovsky et al., 2004; OECD, 2004; Rodrik, 2004; Lin et al., 2010).

Public financial support for R&D activities usually takes the form of tax incentives or direct grants for specific R&D projects. All these measures, at regional, national and European level, are launched to stimulate R&D activities and technology transfer, spurring innovation and, hence, economic growth (Rothwell and Zegveld, 1981; Goh, 2004; Rodrik, 2004; OECD, 2004 and 2005; Howells, 2005). Public incentive to R&D is thought to be necessary to motivate firms to undertake the "social optimal" level of innovative activity (Abramovsky et al., 2004). The measures aim to tackle the imperfections of the market to finance innovation, externalities and systemic failures (Martin and Scott, 2000). Although nowadays venture capital mitigates the challenges related to high capital costs, financial markets are still insufficient to provide the necessary resources to develop high innovative ideas and technologies. Uncertainties characterizing R&D activities, the presence of information asymmetries and moral hazard problems between lenders and borrowers generates high funds' rationing (OECD, 2004).

This translates into the need for public interventions to enforce risky but socially valuable R&D investments. Moreover, the public good nature of R&D activity leads to a lower than desired private R&D expenditure (Arrow, 1962). The patent system provides only a partial solution to the difficulties in fully appropriating the returns from new knowledge development process (Howells, 2005).

Hence, public policies are needed to lower the private costs of the R&D projects. This is particularly so for projects characterized by the non-rival nature of knowledge outputs, such as basic research. A further rationale for innovation subsidies is related to the need to support continuous interaction between different organizations and individuals involved in the innovation (O'Doherty & Arnold, 2001). Governments expect that by granting support through subsidies for example, additional research projects will take place.

Unfortunately, the main goal of public financial support is not always reached. For example, empirical studies on this topic provide conflicting answers about the nature of the relationship between public and private R&D spending (for a review see David et al., 2000). Sometimes public grants crowd out private investment whilst in other cases they prove to increase the

private funding of R&D. In any case, by enabling the purchase of R&D infrastructure, equipment and other R&D facilities, public R&D funding lowers fixed costs and consequently, it lowers the private cost of an R&D project and makes an unprofitable project profitable (Wallsten, 2000; Lach, 2002; Evangelista, 2007). If Innovation policy indeed plays an important role in influencing innovation performance of firms, than it will have an impact upon economy wide growth. Hence we raise the following Hypothesis:

H1: Capital subsidies to promote firms' innovative activities contributes positively to the growth of the region.

2.2 Internationalisation policy and economy wide growth

Outward internationalisation of domestic firms became an important target of public intervention in most OECD countries in recent years (UNCTAD, 2001). In the past, many governments viewed outward FDI as an undesirable transfer of capital and jobs to other countries but, from the 1990s, they started look at it as a way to build globally competitive firms, to accelerate the development of high value activities and productivity, to technological transformation and to better allocation of home resources (Westhead *et al.*, 2001; Dunning and Lundan, 2008; European Commission, 2007, 2008, 2010). Strong FDI increases innovation as inward FDI is an important channel for knowledge diffusion, while outward FDI is a mean of sourcing technologies and knowledge from elsewhere. But internationalisation is a process demanding specific resources and capabilities, with the access to financial and human capital being a critical aspect (Westhead et al., 2001; European Commission, 2010). For these reasons, governments have implemented home country measures (HCMs) to encourage or otherwise influence outward internationalisation (UNCTAD, 2001; Lou et al., 2003; Te Velde, 2007). The rationale for HCMs is that FDI is good for home country development, so these measures are launched to mitigate market, information and coordination imperfection that deter investments and increase the costs of projects. In particular, the promotion of internationalisation seeks to correct for market imperfection to finance FDI projects, to increase the profitability of the investments, to reduce economic and political risks, to overcome uncertainties and to alleviate any shortfall in resources and capabilities in a company initiating the internationalisation process or seeking to invest in an environment that is distant in geographical, cultural and/or institutional terms (Sarmah 2003; Maeseneire and Claeys, 2007; Te Velde 2007). These measures include

financial support, investment insurance, fiscal intervention, information provision and technical assistance (Sarmah, 2003).

Very few studies have empirically addressed government programs explicitly designed to promote more demanding forms of internationalization. While the extensive research on the efficiency of government export promotion incentives (e.g. Bernard and Jensen, 2001; Wright et al., 2007) raises doubts about the effectiveness of such programs, on the contrary the only three empirical studies we found addressing the effectiveness of FDI promoting programs (Duran and Ubeda, 2001; Maeseneire and Claeys, 2007; Amorim et al, 2010) suggest that these scheme are effective in promoting outward FDI.

In this paper we test whether public support to internationalization had an impact upon regional growth.

H2: Capital subsidies to promote firms' international activities contributes positively to the growth of the region.

2.3 The interaction between internationalization and innovation and the need for coordinating policies

Even if there are few investigations that study at the same time innovation and internationalization activities of the firm (Filipescu rt al., 2009), scholars have found that exists a circular relationship between the two phenomena (Kotabe et al. 2002; Kafouros et al. 2008). On the one hand, innovation provides firms with opportunities to compete on international markets. As international markets are characterized by a greater competitive pressure than national markets, in order to survive, the innovation seems to be unavoidable (Filipescu et al., 2009). On the other hand, the innovation-performance relationship is moderated by a firm's degree of internationalization (i.e., the extent to which it operates beyond its national borders) (Kotabe et al. 2002; Kafouros et al. 2008). Only by acting in international markets, firms can better capitalize the exclusive rents of R&D expenditures (Cooke & Morgan, 1998). Multinational firms can offer products to a larger number of potential buyers, thereby enhancing profits from innovation efforts and spreading innovation costs. Internationalization lowers the risk of R&D by avoiding fluctuations and business cycles specific to a single market or region. Moreover, internationalization can reduce costs associated with innovation because international firms have more opportunities to buy R&D inputs from the cheapest available sources. Furthermore, international investments enhance

firm's knowledge about the environment and the competition in different countries. This knowledge will be very helpful in maintaining the competitive advantages and in creating others which in turn can generate more innovation.

Despite these positive effects, internationalization may negatively contribute to innovation by increasing the risk of knowledge leakage (the costs of outgoing spillovers may even outweigh the benefits from incoming spillovers) and by increasing the costs that the coordination and control of a global network requires.

Concluding, innovation virtuously impacts on the degree of international growth which in turn positively influences innovation activities and then firm's performance.

This interdependence among innovation and internationalization suggests that policy makers, that aim at correcting for market and coordination failures, pushing country development should plan policy subsidies taking into account the circular relationship between the two phenomena (Figure 1). In fact there is a substantial overlapping among them at local level. Although the complementarities among different programs nowadays, each measure operates in isolation, and the evaluation of the different incentives does not take into account their relationship. Both innovation and internationalisation measures granted in the same area can generate positive externalities: this justifies the integration of different incentive schemes in the same region. Therefore, there is a need of a better understanding of the effectiveness and interaction of these two types of measures designed to promote economic growth.
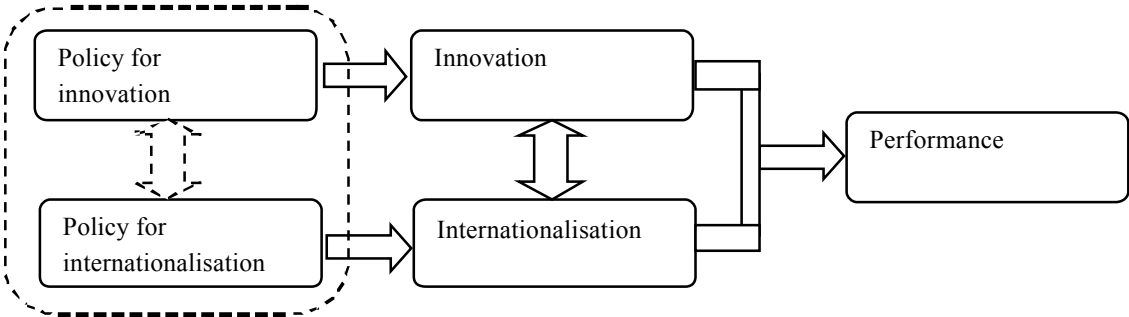

Figure 1: Circular relationship between innovation and internationalisation

Thus, by supposing that the relationship between innovation and internationalization phenomena is reflected in the interaction between industrial policies, we argue that:

H3: Capital subsidies to promote firms' innovative activities interact with capital subsidies to promote firms' internationalization activities in the improvement of regional economic performance.

3. Empirical analysis

The empirical analysis is carried out at the regional level taking into account the developments in the 20 Italian regions. The choice of a regional level approach is driven by the ascertainment of the heterogeneous performance of Italian region as well as by the willingness to understand how the role of public policies changes according to the regional context. After reviewing the basis of the innovation and internationalization policies in Italy, we explore the descriptive statistics and then the econometric empirics.

3.1 Empirical setting: Innovation, internationalization and other policies in Italy

In the last years European countries are characterized by the implementation of several public policies for the growth and competitiveness of national economy. These subsidies are designed and executed by different actors and managed according to complementary and co-competitive logic. At the European level, a large consistent set of instruments is exploited. These tools, characterized by different goals, are developed according to a subsidiary approach that underlines the relevant role of policies elaborated at national level.

Although Italy is characterized by a large set of industrial policies and the public funding is very high, the country is characterized by a low amount of R&D expenditures insomuch as it is the economy with the lowest amount of R&D resources among the industrialized European countries. This is the consequence of the specialization in low to medium tech industries and the narrow presence of large firms (EUROSTAT, 2009). Italian government tries to fill up this gap by assigning, on average, 20% of industrial policies resources to stimulate innovation. It funds different kinds of R&D expenses such as employees salary, consulting services, infrastructures and instrumentation, patent registration. Whilst the most traditional initiatives encourage the renewal of machinery and equipment incorporating innovation, since the 1990s there is an increasing emphasis on technology transfer and in promoting the development of local innovation systems. Moreover, in 1999 the Italian innovation policies were thoroughly revised and the plethora of laws rationalized in order to improve the effectiveness of these policies that, in the past, proved to be too fragmented.

In comparison to other European countries, in Italy the management of innovation policies is more peripheral that is to say that the most of innovation subsidies is managed at regional level. For instance, in 2004-2005, among the 124 different tools for the public support of innovation, 89 were regional and 28 were regionalized (Met, 2006). Yet, the amount of subsidies provided by regional innovation policies is low in comparison to national programmes (Evangelista, 2007). As a consequence, national policies still play the main role in supporting industrial R&D activities. In particular, the Fund for the promotion of Research (FAR) and the Fund for Technological Innovation (FIT) are the main policy measures. FAR is the public instrument to fund firms' research activities, both oriented and non-oriented, collaborative and non-collaborative, carried out by private firms or public-private consortia. FAR has replaced the special Fund for Applier Research established in 1968 and other measures for industrial research (Law 488/92) as established in the industrial research funding reform (Law 297/99). The fund is managed by MIUR Ministry of University and Research, as established in the Legislative Decree 297/99. FIT, managed by the Ministry of Economic Development, is aimed at strengthening the industrial research and the cooperation among private and public research. The fund is addressed to firms involved in the development of product and process innovation technologies.

As concerns policy for internationalisation, Italy has been traditionally active in promoting both outward and inward FDIs and started to invest earlier than other European Union countries (UNCTAD, 2001). Between 2000 and 2006, the Italian government spent more than 1,000 million euro to promote outward investment and export, with about three percent a year of public funds to be used for industrial policy. In particular, since the late 1990s, the major public instruments in support of outward internationalisation have been the acquisition of equity in direct investments abroad by Italian Firms (Law 100/90; Law Decree 143/98; Law 35/05; Law 19/91); venture capital funds (Law 100/90; Law 296/06); financial support to feasibility studies; training programmes and technical assistance for exports and direct investment abroad (Law Decree 143/98; Law 35/05; Ministerial Decree 136/00); the provision of financial resources for the creation of permanent marketing structures abroad (Law 394/81) and participation in international tenders (Law 304/90); the stabilisation of interest rates for export credits and for capital goods; interest rate support on bank financing of the Italian share of investments in foreign companies in which public agencies have a stake (Law Decree 143/98; Law 100/90).

The main Italian measures are described by Law 100/1990, which provide a particular form of financial HCM. They consist of venture capital funds and capital loans at interest rates below

the market rate that are not paid back in case of failure of the foreign project (Law 394/1981). Public agencies can directly acquire up to 25% of the equity of a foreign venture, and benefiting firms agree to buy back the agency equity share within eight years. Although in principle, investment proposals presented by firms, partners of cooperative agreements, cooperatives, consortia and business associations are accepted, priority is given to initiatives by SMEs investing in Eastern Europe. Projects in the same sector as the parent company are encouraged, while the support programmes exclude FDIs in the European Union and FDIs that entail the divestment of R&D, sales or production activities in Italy (Law 80/2005).

Since the beginning of the law operation, the two agencies have approved over 1,000 investment projects outside the European Union and acquired shareholdings in Italian foreign affiliates with a total value of more than one billion Euros.

As regards other measures, in the last years, industrial policy makers mainly propel firms' general industrial investments. A moderate attention is paid for local development, new entrepreneurship and internationalisation. Minor importance is given to subsidies for business crisis, easing access to credit, structural and dimensional strengthening of enterprises, reduction of the environmental impact.
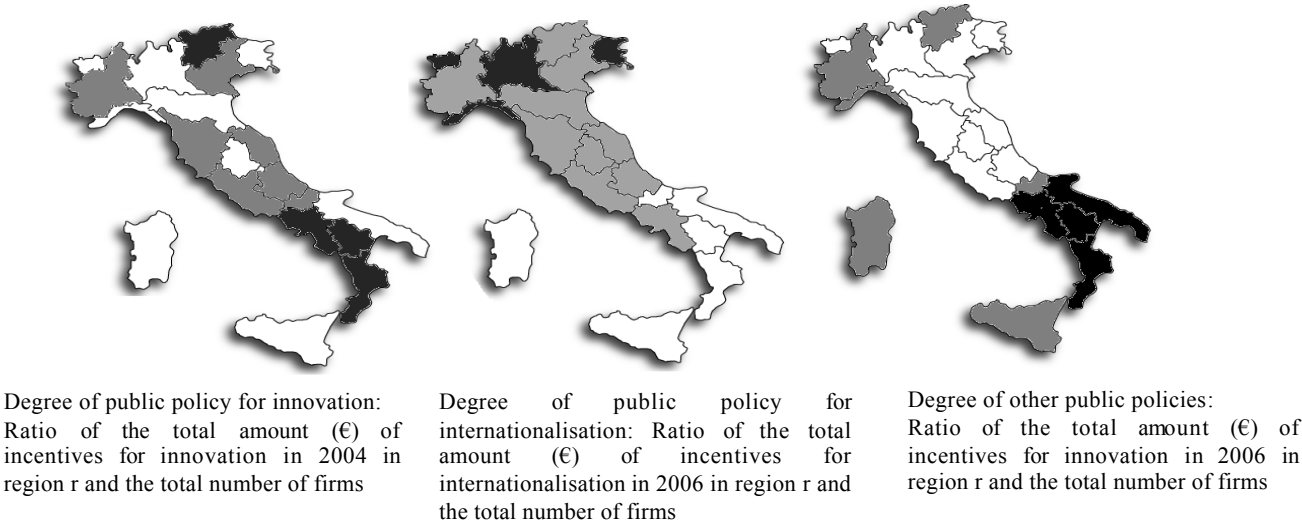

Degree of public policy for innovation: Ratio of the total amount (€) of incentives for innovation in 2004 in region r and the total number of firms

Degree of public policy for internationalisation: Ratio of the total amount (€) of incentives for internationalisation in 2006 in region r and the total number of firms

Degree of other public policies: Ratio of the total amount (€) of incentives for innovation in 2006 in region r and the total number of firms

Figure 2: Public Policies across Italian Regions

Both innovation and internationalisation subsidies are not equally distributed among Italian regions. Figure 2, that depicts the level of public incentives 2004/2006 across Italian regions is representative of annual policies' allocation of the last years. The empirical evidence suggests that there is not high regional asymmetry in what regards the distribution of

innovation policy- related incentives. Even tough, the ratio total incentives on total number of firms is higher in Southern regions.

In what concerns internationalization related support, the evidence suggests higher intensity of support in the Centre and in the North of Italy.

Disparities regard also the allocation of other public policies. Yet, this is not surprisingly since many of the other measures aim at correct the regional disparities and are assigned according to the regional economic performance.

In the next sections we explore whether innovation and internationalization policy, and innovation and intenationalization activities had a positive influence on the wealth of the regions, creating capability and promoting regional growth in Italy.

3.2 Descriptive analysis

Taking into account the time lag between R&D and internationalisation investments and the rise of the relating economic benefits, a first empirical analysis is carried out by comparing innovation and internationalisation subsidies granted respectively in 2004 and 2006 with the regional economic performance in 2007. The result is showed by figure 3 where white circles are regions with a GDP per capita lower that Italian GDP per capita, blue circles are regions with an higher than national GDP per capita and the size of the circles represents the distance of the regional GDP per capita from the national GDP per capita.
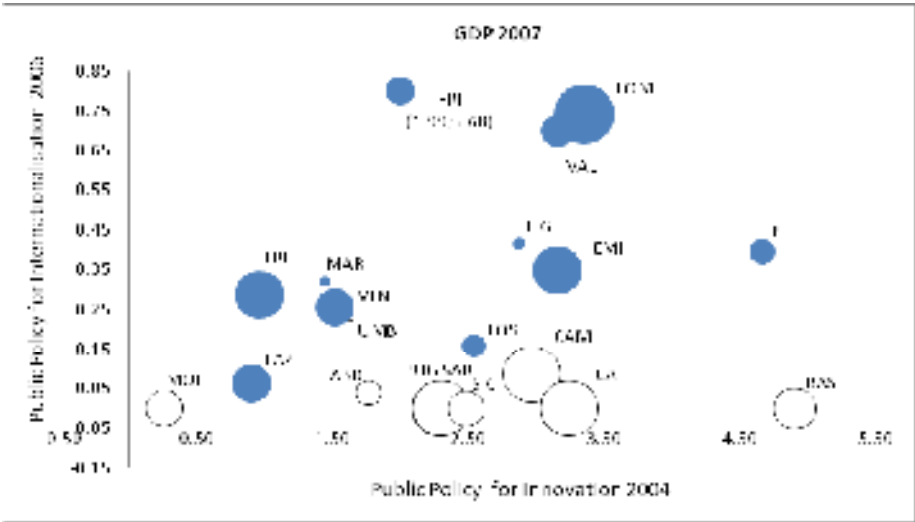

Figure 3: Intensity of public policy and GDP

The scatter plot highlights that regions where innovation policies are not joined by public subsidies for firms' internationalisation are characterised by a lower than average GDP. This suggests that policies for R&D and those for internationalisation should be put side by side in order to actually impact on the regional economic performance.

3.3 The econometric model and the variables

The fundamental need for all public policy evaluations is to assess whether the observed outcomes are actually caused by the examined public policies (Marschak, 1953; Wollman, 2007; Marschak, 1953). The evaluation of public policy requires a model that links the target variables (i.e., GDP) to the policy tools and to the other potential explanatory variables in a causal relationship (Duran & Ubeda, 2001). Hence, the estimated model is:

$GDP_{r,t} = f$ (Innovation public policy$_{r,t-2}$, Internationalisation public policy$_{r,t-1}$,
Other policy support $_{r, t-1}$, Control var$_{r,,t}$) $\qquad$ (1)

$GDP_{r,t} = f$ (Innovation public policy$_{r,t-2}$, Intern. public policy$_{r,t-1}$, Innovation public policy$_{r,t-2}$*
Intern. public policy$_{r,t-1}$, Other policy support $_{r,}$ Control var$_{r,t}$) $\qquad$ (2)

where the subscript r refers to the region and the subscript t to time. The dependent variable is regional GDP. The estimates of the panel data are conducted using a random effects approach. The role of timing in estimating impacts is very important (Venetoklis, 2001). A fundamental assumption that is implicitly accepted in all causality arguments is that public intervention precedes the dependent variable in occurrence. The analysis of the impact of industrial policies for innovation and internationalisation on regional economic performance has to take into account the time lag between R&D expenditures and international investments and their financial results. A time lag between the public intervention and the measurement of expected impacts assures that causal relationships have time to evolve. As in the observed financial incentive allocations, public intervention is granted before the investment implementation, we assume a time lag between incentive allocation and investment realization equal to one in the case of internationalisation measures while we consider a time lag between innovation measures equal to three.

In one model we consider only each policy individually while in the other we considered also their interaction. Thus, we test if the interaction of innovation and internationalization

subsidies spurs growth due to the relationships between these two activities of the firms. In addition to the funds for innovation and internationalization, we included other public support.

In the model we include innovation and internationalization of the economy as non-policy determinants of growth. Within these, we find aspects related to innovation activities and to the degree of integration into global markets. We control in addition to the sectoral composition of the region economy, geographical location and infrastructure availability.

The capacity to create sustained wealth largely depends on the innovation and knowledge creation capacity of the regions (Crescenzi, 2005). Regional innovative activities (RIAs) play a significant role in determining differential regional growth patterns. As measure for RIAs we considered the employees involved in R&D activities and the number of patents in each region.

However, existing empirical studies also demonstrate that an increase in innovation alone (e.g. patent applications, R&D personnel) is not likely to produce the same effect in all European regions. In less favored regions there is smaller capacity to translate innovation into economic growth (Greunz, 2002; Ougthon et al., 2002; Crescenzi, 2005). Weak industrial base and an unfavourable industrial structure negatively influence the region's capacity to translate innovation into growth. On this regards we considered the existence of large leading firms (firms with more than 250 employees). Growth in certain regions is also hampered by industrial structures which offer little technological opportunities and lack R&D capabilities. The concentration of employment in low productivity sectors contributes to the low level of GDP in lagging regions (Aumayr, 2007; European Commission, 2007). Hence we considered in our model the number of employees in advanced industries (i.e., machinery and equipment, electrical apparatus and electronics, precision instruments) and the number of firms in 'made in Italy' industries (i.e., textile, clothing, leather, footwear, wood and furniture) in each region.

Finally, regarding the degree of integration into global markets, we considered the degree of export activity of a region's economy and its involvement in inward and outward FDI. Infrastructure is closed linked to the new economic geography framework as they link regional growth to spatial factors and transport facilities and costs. These variables can also be seen as proxies for international interaction between regions. We used the number of fly routes in each region as proxy for infrastructure.

For a detailed description and definition of policy and control variables see Table Appendix 1 and Appendix 2.

3.4 Econometric findings

Econometric estimations (Table 1) suggest that innovation and internationalization policies are complementary, in the sense that internationalization and innovation policy reinforce their individual impacts on regional development. Supports included under other public policies maybe too broad. Thus, they have not the expected impact on firms competitiveness. Their allocation criteria (i.e. economic disparities), for which we do not control in this model, could be a further explanation of the negative impact of other policies.

	MODEL 1 Coeff.		Std. Err.	MODEL 2 Coeff.		Std. Err.
Region characteristics						
$OUT\_FDI_{r,t-1}$	+0.060	***	0.023	+0.065	***	0.023
$IN\_FDI_{r,t-1}$	+0.109	***	0.018	+0.109	***	0.019
$Export_{r,t-1}$	+0.073	***	0.023	+0.071	***	0.024
$Input\_Innovation_{r,t-2}$	+0.130	***	0.023	+0.123	***	0.024
$Output\_Innovation_{r,t-1}$	+0.025	***	0.009	+0.027	***	0.010
$Advanced_{r,t-1}$	-0.028		0.021	-0.027		0.022
$Made\_italy_r$	-0.103	***	0.031	-0.105	***	0.031
$Leader_r$	-0.220	***	0.036	-0.215	***	0.036
$Infrastructure_{r,t-1}$	+0.001	***	0.000	+0.001	***	0.000
$North\_west_r$	+0.052		0.032	+0.056	*	0.032
$North\_east_r$	+0.071	**	0.031	+0.073	**	0.031
$Centre_r$	+0.046		0.028	+0.051	*	0.028
Policy variables						
$PP\_int_{r,t-1}$	-0.012		0.010	+0.018	***	0.005
$PP\_inn_{r,t-3}$	+0.001		0.004	+0.005		0.004
$PP\_int_{r,t-1}*PP\_inn_{r,t-3}$	+0.020	***	0.006			
$PP\_other_{r,t-1}$	-0.015	***	0.005	-0.015	**	0.006
Constant	+4.588	***	0.101	+0.575	***	0.103

	Number of years = 6	Number of years = 6
	Number of groups = 20	Number of groups = 20
	$P>\chi^2 = 0.000$	$P>\chi^2 = 0.000$
	R-sq: Within = 0.863	R-sq: Within = 0.844
	Between = 0.885	Between = 0.890
	Overall = 0.884	Overall = 0.888
	Sigma_u = 0.039	Sigma_u = 0.039
	Sigma_e = 0.01	Sigma_e = 0.009
	Rho = 0.949	Rho = 0.943

Table 1: Results of the random effects GLS regression

Regional GDP is stimulated by both firm's efforts in R&D activities (i.e. Input_innovation and Output_innovation are positive and significant at p<0.01 in both models) and the presence of multinational firms (i.e. IN_FDI and OUT_FDI are positive and significant at p<0.01 in both models). Hence, an effective push towards firms' innovation and internationalization commitment by policy makers is important to promote growth. Instead, a high share of 'made in Italy sectors' and of large firms reduces growth (both coefficient are negative and significant at p<0.01 in model 1 and 2). On the contrary infrastructure contribute positively to GDP in both models (i.e. Infrastructure is positive and significant at p<0.01). Moreover regional GDP is stimulated also by location in the North of Italy.

Concluding, the preliminary findings highlight that both innovation and internationalization policy and phenomena provide competitive advantages to regional economic systems. As a consequence, public policies aimed at promoting the growth of internationalization and the efforts in innovation practices are welcome.

4 Concluding remarks

Regional disparities have been a major policy issue in the European Union. Nonetheless, most studies on growth have not yet been applied to regional data sets which gives scope for future interesting applications. Moreover, previous studies on regional growth in Italy neglect these substantial subsidies. Research on the influence of policies on growth is relevant to regional development in the EU because it identifies conditions favouring or harming growth that policies can promote.

Over the past 20 years, innovation and internationalization capabilities are gaining more and more importance as key factors for economic growth and industrial competitiveness (Parker, 2004; Dunning & Lundan, 2008). In our paper we have shown that innovation and internationalization are interdependent stimulus of a virtuous cycle leading to improvement (Simmie, 2003). Therefore, the vicious circle for lagging regions, low R&D and low internationalization means low growth, and vice versa, meaning increasing the GAP to core regions. Within this context the role of government in driving the recovering of technological growth and economic performance is fundamental. However, in these regions, S&T policies alone may fail to hit the target. Instead the latter should be integrated into a global, structural policy aimed at building up and reinforcing technological transfer.

Both innovation and internationalization policies together positively enhance regional economic performance. In particular the combination of innovation and internationalization is the most advisable option when domestic markets are limited.

These remarks and our findings suggest a re-think of industrial policy-making by emphasizing both pro-innovation and pro-internationalization programmes (Goh, 2004; UNCTAD, 2001). In particular an interconnected design of innovation and internationalization policies is desirable. In less developed regions public policy should indirectly act in order to enhance business internationalization and R&D activities, and to strengthen the industrial base. Innovation and internationalization policies maybe considered especially relevant for lagging regions as part of their adjustment to the changing international, economic, and technological order as well as improvements to their own economic situation.

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Variable	Description
Dependent variables	
$GDP_{r,t}$	Logarithm of gross domestic product (euro) in region r and year t-1
Region characteristics	
$OUT\_FDI_{r,t-1}$	Logarithm of total number of outward FDIs, in region r and year t-1
$IN\_FDI_{r,t-1}$	Logarithm of total number of outward FDIs, in region r and year t-1
$Export_{r,t-1}$	Logarithm of total amount of export, in region r and year t-1
$Input\_Innovation_{r,t-2}$	Logarithm of R&D employee in region r in year t-1
$Output\_Innovation_{r,t-2}$	Logarithm of the number of PCT patents in region r in year t-1
$Advanced_{r,t-1}$	Logarithm of the number of employee in advanced industries (i.e., machinery and equipment, electrical apparatus, electronics, precision instruments) in region r in year t-1
$Made\_italy_r$	Logarithm of the number of firms in made in Italy industries (i.e., textile, clothing, leather, footwear, wood and furniture) in region r in 2001
$Leader_r$	Logarithm of the number of firms with more than 250 employees in the region r in 2001
$Infrastructure_{r,t-1}$	Number of fly routes in region r and year t
North_west	Dummy variable equal to 1 if the region r is located in the north west of Italy
$North\_east_r$	Dummy variable equal to 1 if the region r is located in the north east of Italy
$Centre_r$	Dummy variable equal to 1 if the region r is located in the centre of Italy
$South_r$	Dummy variable equal to 1 if the region r is located in the south of Italy
Policy Variables	
$PP\_int_{r,t-1}$	Logarithm of total amount (euro) of public policy allocation for internationalisation in year t-1 and region r
$PP\_inn_{r,t-1}$	Logarithm of total amount (euro) of public policy allocation for innovation in year t-1 and region r
$PP\_other_{r,t-1}$	Logarithm of total amount (euro) of other public policy in year t-1 and region r

Table APPENDIX 1: Description of variables

	Source	Years
Dependent Variables		
$GDP_{r,t}$	ISTAT Annual Data	2001-2008
Explanatory Variables		
Region characteristics		
$OUT\_FDI_{r,t-1}$	REPRINT Database	2000-2007
$IN\_FDI_{r,t-1}$	REPRINT Database	2002-2007
$Export_{r,t-1}$	ISTAT Annual Data	2002-2007
$Input\_Innovation_{r,t-2}$	ISTAT Annual Data	2002-2007
$Output\_Innovation_{r,t-2}$	ISTAT Annual Data	2002-2007
$Advanced_{r,t-1}$	ISTAT Annual Data	2002-2007
$Made\_italy_r$	ISTAT Census Data	2001
$Leader_r$	ISTAT Census Data	2001
$Infrastructure_{r,t-1}$	INNOVATA	2002-2007
$North\_west_r$; $North\_east_r$, $Centre_r$, $South_r$	--	
Policy variables		
$PP\_int_{r,t-1}$	MET, Ministry of Economic Development	2002-2007
$PP\_inn_{r,t-1}$	MET, Ministry of Economic Development	2002-2007
$PP\_other_{r,t-1}$	MET, Ministry of Economic Development	2002-2007

Table APPENDIX 2: Sources of data for dependent and explanatory variables