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Abstract

The real core of the smart specialisation approach is embedded in what is known as the entrepreneurial process of discovery (EPD), which is a main novelty of this innovative policy framework. A successful EPD requires a relevant involvement of stakeholders, but this demands a careful actors' selection. This paper proposes an analytical method for the selection of private business stakeholders, based on a transparent and measurable criterion: the choice of the entrepreneurs who can best define an adequate resource allocation over time in a context of uncertainty. On the basis of a dynamic general equilibrium model with monopolistic competition, the paper proposes a simple test comparing the optimal decisions on factors' demand taken in different periods. The closer the factors' demands are, the better the entrepreneur's ability will be to predict the most adequate level of resources. The main contributions are three-fold. Firstly, it proposes an analytically-sound method to discriminate between entrepreneurs, which could minimise rent-seekers' behaviours. Secondly, the model incorporates new features in relation to previous references, such as monopolistic competition and consumer behaviour. Thirdly, the entrepreneurship discussion is broadened to consider not only labour but also private capital.

Keywords: entrepreneurship, monopolistic competition, total factor productivity.

JEL Classification: L26, L22.

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1 Introduction

The European Commission has repeatedly set out in a number of documents that Europe needs a comprehensive innovation strategy focused on investments in R&D and entrepreneurship (see, for instance, European Commission, 2012, 2010a, 2010b and 2010c). The idea is to design and implement national and regional strategies so that the EU's Structural Funds can be used more efficiently. The new policy approach known as 'Smart Specialisation' aims at capturing not only which are the main assets of a territory in terms of competitive advantages, but also developing them in a context of global challenges and rapid diffusion of knowledge. This new approach has been also integrated as an essential part for the EU's Structural Funds over the period 2014-2010, with an 'ex-ante conditionality' based on the existence of a Smart Specialisation Strategy for the territory (European Commission, 2012).

In such a context, the entrepreneurial process of discovery (henceforth EPD) plays a central role as one of the main defining features of the novelty of the smart specialisation approach (Foray and Goenaga, 2013). The EPD marks a clear break away from past practices, as regards inter alia the involvement of stakeholders. In the past, decisions on research and innovation strategies were often designed by regional authorities using a top-down approach in which they would lead and define this process, with no or little consultation and involvement of regional stakeholders, particularly in the decision-making.

The smart specialisation approach demands changing this culture and moving to a bottom-up process whereby the regional government acts more as a facilitator, rather than a sole leader of this process. This implies the swift to a process of 'collaborative leadership' which should involve all relevant regional stakeholders in the quadruple helix in the decision-making, including public administration, the research and education world, civil society and in particular business. The interest in involving the latter would not only be considered as a way to increase the effectiveness of European/regional policies, but it also reflects the conviction that the private economic agents know better than anyone which are the best potential businesses in a territory. Obviously, the information they have is not complete and perfect (and here the policy-makers have scope to act), but it is clear that entrepreneurs are in pole position to start a discovery process of new and profitable economic activities, both from a social and private interest viewpoints . However, it is impossible (and excessively costly) in practice to involve all entrepreneurs and a selection will need to be made. The question then becomes how these business stakeholders should be selected if this was to be done in an efficient, transparent and fair way.

This paper addresses precisely this question, by proposing one of the ways in which this selection of private business stakeholders can be made. There is definitely more than one efficient way to select these economic actors, but in most cases this implies again a breakaway from past practices

that only involved always the same actors, which are those actors that are better known and more directly connected to the regional authorities (a phenomenon that we can call the "usual suspects' vicious circle"). The move away from past practices of stakeholder involvement concern several policy dimensions. In particular, the policy needs identified in this regard can be summarised in at least three crucial aspects. First, a better grounded analytical base seems beneficial to adopt any criteria to select stakeholders. Second, it is necessary to establish a method that it is quantitative, measurable and based only on performance, so that it is as transparent as possible, and thus as fair as possible with all different stakeholders in the territory. All stakeholders, be them from large established activities or small emerging ones, should have the same opportunities and be measured only by performance, in a way that can be quantified, and thus compared (also to others in the region) in different periods in time. Third, we need a method that is not opened or subject to endogenous manipulations coming from firms behaving as rent-seekers, escaping from the aforementioned "usual suspects' vicious circle".

This paper is also an attempt to bridge these policy needs, and studies precisely how to select the best entrepreneurs establishing a transparent and measurable criterion to do so. The criterion defined is the choice of the entrepreneurs who have defined an adequate resource allocation over time in a context of uncertainty. In particular, this is operationalised as the appropriate level of investment and labour hiring in new activities.

Starting from the seminal contribution by Hausmann and Rodrik (2003), we define a two-period model with monopolistic competition and where consumers and firms take decisions on a variety of goods, some of them completely new. At the beginning of the process, entrepreneurs do not know the value of total factor productivity (TFP) derived from the technology that they may use in the next period for a new business, and in order to find it out, they have to invest resources now with the hope of enjoying monopoly rents in the second period; in a sense, this can be seen as a learning-by-doing process (Romer, 1986; Chen, 2013).

When the corresponding optimisation problems are solved, we reach a characterisation of market equilibrium with different variables of interest. In particular, firms' factor demands are endogenously obtained in the initial point of time $t = 1$, for both periods. In $t = 2$, the entrepreneurs will in turn check how accurate was their past TFP forecast and, if necessary, they will modify their optimal choices to take the new and (now) known values of TPF into consideration, including those concerning conditional demands for labour and capital.

On this basis, a simple test, which compares the difference between the two different optimal decisions on factor demands made in periods 1 and 2, provides indications on the accuracy and efficiency of entrepreneurs' expectations. The closer both optimal demands for factors (labour and capital) are, the better the ability of the entrepreneur will be to predict the most adequate level of resources, which is a crucial parameter to determine its success.

The main contributions of this paper are as follows. In policy terms, it is a novel contribution in relation to a key question of smart specialisation, which is how to select business stakeholders in the process of entrepreneurial process of discovery. In this context, it presents a selection method, which can be used in practice, is transparent, ensures equality of treatment of stakeholders regardless of the previous history of connections with public administration and it is, above all, measurable, which is key to ensure both the transparency and the equality of treatment. In this sense, it provides an easy criterion to discriminate between "bad" and "good" entrepreneurs, avoiding the possibility of manipulation of firms behaving as rent-seekers when public resources are on the table.

In terms of the actual model presented to select business stakeholders and the methodology used, the main contributions are three-fold. Firstly, the model presented here incorporates new features which are relevant in terms of entrepreneurial activity, such as monopolistic competition (Andersson and Johansson, 2008) and consumer behaviour. Secondly, in contrast to Hausmann and Rodrik (2003), the discussion in terms of entrepreneurship is broadened to consider not only labour as production factor, but also private capital. The resulting new environment implies then a general equilibrium framework. And thirdly, it proposes the aforementioned simple new analytical methodology to broadly determine how accurate are the entrepreneurs in predicting a key variable in the economic performance of both individual firm and the overall economy, such as TFP. This selection method can be also used to select a pool of entrepreneurs in other contexts of economic decision-making, beyond smart specialisation.

The structure of the paper is as follows. After the introduction, section 2 puts this article into the broader policy context, explaining its connection with smart specialisation, and more in particular with the entrepreneurial process of discovery. Section 3 presents the theoretical framework of the model used to select entrepreneurs. Then, section 4 of this paper sets out a simple test to assess entrepreneurs' expectations so that they can be measured and compared. Finally, the paper ends with some brief concluding remarks, policy implications and links to further research.

2 The policy context: the entrepreneurial process of discovery within smart specialisation and the role of stakeholders

The term 'smart specialisation' first originated out of the literature examining the transatlantic productivity gap between the US and Europe. However, the concept as such was initially developed as the leading idea of the 'Knowledge for Growth' expert group advising the European Commission with Dominique Foray in the framework of the European Research Area (ERA), which also extended the concept further at an initial stage (Foray et al., 2009; Foray et al., 2011). While EU regional innovation policies have existed for almost two decades, it was only in response to the Europe 2020

strategy that smart specialisation was developed in the policy domain to support these policies. This integration has been more evident in the reformed EU Cohesion Policy, where the smart specialisation logic has been found to be broadly consistent with the overall cohesion policy reforms (McCann and Ortega-Argiles, 2011).

At a later stage, the smart specialisation concept has been integrated more explicitly in the legislative proposals for the EU Regional and Cohesion Policy 2014-2020. In fact, one of the new elements proposed in the new legislation is to put in place ex-ante conditionalities, which are conditions that have to be fulfilled before spending any funds in specific fields, ensuring that investments from regional policy are efficient and effective. A Research and Innovation Strategy for Smart Specialisation (henceforth RIS3) is one such ex-ante conditionality for interventions on research, innovation and ICT access.

Smart specialisation, which focuses on the microeconomics of competitiveness, is a new policy approach based on five main characteristics for the development of the smart specialisation strategies. First, RIS3s focus on policy support and investments on key priorities, challenges and needs for knowledge based development, including ICT-related measures. Second, they build on each country's/region's strengths, competitive advantages and potential for excellence. From these two features it can be deducted that the central principle of is that governments should focus their investments on activities where a region or country has some advantage (specialisation) or emerging areas where entrepreneurs could develop new activities (diversification). Smart specialisation thus focuses on a more vertical and non-neutral logic of intervention (Foray and Goenaga, 2013), implying that the process of identification and selection of desirable areas for intervention, results in choices of fields, technologies, sub-systems that could be favoured by regional policy. This is supposed to end up in specialisation effects, with relevant returns to size and critical mass in R&D and other innovation-related activities, which have been identified by the empirical literature in this field (Henderson and Cockburn, 1996; Agrawal et al. 2011, and Trajtenberg, 2002).

Third, the next element that characterises smart specialisation is that RIS3s support technological as well as practice-based innovation and aim to stimulate private sector investment. Forth, they are evidence-based and include sound monitoring and evaluation systems. And fifth, they get stakeholders fully involved and encourage policy innovation and experimentation. The aim of this paper focuses in particular on this last feature, which has been often neglected, but it is absolutely key for a proper smart specialisation strategy to succeed.

At the heart of this policy concept of smart specialisation is the entrepreneurial process of discovery (EPD), which stems from part of the New Industrial Policy literature, in particular the literature on "self-discovery" and informational externalities (Haussman and Rodrik, 2003; Rodrik, 2004). The concept of "entrepreneurial discovery" used in smart specialisation has its origins on the development

economics literature, reflecting in particular Hausman and Rodrik's (2003) work on a "self-discovery process" in development. The EPD is set to produce an interactive process in which market forces and the private sector are discovering and producing information about new activities and the government assesses the outcomes and empowers those actors most capable of realising the potential. This process would achieve informational spillovers that would become a rationale for public funding and would facilitate the territory's successful evolution towards smart specialisation. The EPD would then tackle the detected lack of connection of strategies with the existing capabilities in the territory as suggest by recent literature on related varieties, 'revealed skill relatedness' and specialised diversification indicating that regional innovation often departs from a set of current capabilities, and facilitates the generation of new activities connected to existing ones (Frenken and Boschma, 2007; Frenken et al. 2007; Neffke et al., 2011; Neffke and Svensson Henning, 2009).

The aim of the EPD is indeed that the activities that could be selected have some anchoring in the regional economy and also that they should show potential. This potential can be because they are new activities, aim at experimenting and discovering technological and market opportunities or have the potential to provide learning spillovers to others in the economy. These activities should be able to produce scale and agglomeration economies or suffer from coordination failures that provide a rationale for public intervention. This analysis aims to build a systematic understanding of the areas in the economy that have the greatest potential for future development, and that are ready to be tapped, or that would require to be encouraged further. This analytical effort carried out in the EPD in order to generate the input for a RIS3 focuses on the regional entrepreneurial environment, assessing how dynamic/static it is in terms of flows of experiments, innovation ideas, or entrepreneurial discoveries and proposals in order to find out if they should be specifically supported or not (European Commission, 2012).

Therefore, the EPD in smart specialisation would facilitate strategies that are much more bottom-up than traditional industrial policies (European Commission, 2012; OECD, 2012) and, as explained more in detail in the introduction, it implies a clear break from past practices in research and innovation strategies, regarding inter alia the involvement of stakeholders. Smart specialisation requires deep involvement in the strategy design process of entrepreneurial actors, who are not only firms, but also any individuals and organisations with some entrepreneurial knowledge. The idea is that in order to tap the potential of related variety and smart specialisation, regional authorities and development agencies will need to break away from top-down approaches of traditional public bureaucracies and more like innovation animators, brokering new connections and conversations in the regional economy.

These connections and coordination between different organisations represent a main policy challenge in the field of experimentation, discovery and innovation (Aghion et al., 2009; Foray and Rainoldi, 2013), and in fact the success of RIS3 policy measures is closely dependent on this capacity of regional

government institutions to act as coordinators or facilitators of the interventions (Rodríguez-Pose et al., 2013). The EPD implies changing to a culture of 'collective leadership', which engages entrepreneurial actors in identifying the key activities, both as active partners in selecting areas, and to observe where entrepreneurs invest.

The question then becomes which actors should be involved in this process. Smart specialisation considers innovation processes as complex systemic interactions and thus the fruit of collective endeavours (Morgan, 2013). Entrepreneurial actors and management and governance bodies responsible of RIS3 need to engage in direct discussion for an effective appreciation of entrepreneurial dynamic to be completed successfully (European Commission, 2012).

With the aim of integrating and structuring the divided and dispersed knowledge, this requires the involvement of what we can call the "Quadruple Helix model", involving jointly government, education and research institutions, civil society and industry (business). The participation of the latter has received particular attention because entrepreneurs are in a privileged position to kick-start the aforementioned discovery process of new and profitable economic activities. Priorities will be identified where and when opportunities are discovered first by entrepreneurs. Prioritisation will result from an interactive process, in which the private entrepreneur is discovering and producing information about new activities, and the government assesses potential and then empowers the actors who are better able of realising this potential (Rodrik, 2004). Therefore, the new policy strategy pursues objectives that must be aligned with those of private entrepreneurs.

However, it is impossible in practice, as well as excessively costly, to involve all entrepreneurs and a selection will need to be made. There is a huge variety of them with different features and needs: business from manufacturing, services, primary sectors, financial sector, creative industries, social sector, large firms, SMEs, young entrepreneurs, students with business ideas, cluster and business organisations. This difficult but crucial selection of entrepreneurs to be involved in the smart specialisation strategies needs to be done adequately. The question then becomes how these business stakeholders should be selected suitably if this was to be done in an efficient, transparent and fair way, escaping from other more subjective practices in the past. This is the aim of the rest of the paper and the following sections propose one of the possible ways in which this selection can be done, starting with the presentation of the model that will allow distinguishing how successful entrepreneurs are.

3 The theoretical framework

Our starting point is the well-known model by Dixit and Stiglitz (1977) that has been conveniently modified to deal with features related to entrepreneurship. We develop a general equilibrium framework with decisions taken by consumers and firms in two time periods. We have an economy with a representative household whose preferences are assumed to have a taste for variety expressed by a

standard CES function:

$$U[x_0, (\sum_{i=1}^{n} x_i^{\rho})^{\frac{1}{\rho}}], \tag{1}$$

where x_0 is a numeraire good and x_i are n differentiated goods, with $\rho \in (0,1)$ being the substitution or "love-for-variety" parameter. For this range of parameters, x_i are neither complements nor perfect substitutes. Let $y \equiv \left[\sum_{i=1}^{n} x_i^{\rho}\right]^{\frac{1}{\rho}}$ be a quantity index with q as price index. The household budget constraint is given by:

$$x_0 + qy = I, \tag{2}$$

where I is household income. Household is endowed with initial amounts of labour and capital which are inelastically supplied in competitive factor markets.

As usual, household optimisation is carried out in two stages. Firstly, the consumer chooses between x_0 and y. And secondly, he/she decides over the set of goods x_i. Then, the demand function for each good is obtained: $x_i = y[\frac{q}{p_i}]^{\frac{1}{1-\rho}}$. From it, the inverse demand function is easily found: $p_i(x_i) = q[\frac{x_i}{y}]^{\rho-1}$. In period $t = 1$, the household only decides over traditional goods.

Our economy consists of two sectors, traditional and modern. Production technology in both cases involves fixed costs (F) and constant marginal costs (c), which imply increasing returns to scale as the average cost is decreasing in x_i.

$$C(x_i) = cx_i + F \tag{3}$$

Optimisation by traditional firms implies choosing x_i to maximise profits $\pi = p_i(x_i)x_i - cx_i - F$. At this point, the equilibrium price is obtained and is clearly higher than the marginal cost c: $p_e = \frac{c}{\rho}$. As a result of free-entry condition ($\pi = 0$), the output per firm is given by $x_i = \frac{F}{p-c}$. The number of varieties comes from solving for n the equality between supply and demand:

$$\frac{F}{p_e - c} = \frac{s(p_e n^{\frac{\rho-1}{\rho}})}{p_e n}, \tag{4}$$

where the right-hand side is a simplified version of the demand function.

Let's characterise now the behaviour of firms in the modern sector. The main feature of this sector is that in the initial period the entrepreneurs must take decisions on production over time in a context of uncertainty. This uncertainty may come from a number of situations: producing a new good in the modern sector requires learning about the production technology, a good knowledge of local conditions and production factors availability, etc. We will encapsulate all the dimensions concerning uncertainty on a unique issue: the new firms do not know the true value of the total factor productivity (TFP).

A clarification is needed here about the concept of TFP used in this paper. TFP has been traditionally seen as a residual coming from growth accounting exercises. However, this approach may hide a relevant interpretation of TFP as a measure of the efficiency with which the firms combine the

production factors[1]. Consequently, as long as TFP is closely related to the aggregate knowledge and innovation capabilities available in the economy, it is reasonable to deal with TFP as an efficiency measure and one of the key determinants of entrepreneurial investment.

The sequence of decision-taking by the entrepreneurs is as follows. In period 1, they invest k_1^j to know the total factor productivity (TFP, A) in period 2, but nothing is produced. Following Hausmann and Rodrik (2003), the expected TFP (A^E) is defined as an increasing function of k_1^j but at decreasing rate: $A^E = A^E(k_1^j)$, with $A^{'} > 0$, $A^{''} < 0$. Particularly, we have used $A^E = (k_1^j)^\gamma$, with $0 < \gamma < 1$. At this stage, entrepreneurs consequently build expectations on TFP and, on this basis, take decisions on k_1^j, k_2^j and l_2^j.

Formally, the optimisation problem is set up as follows:

$$Max \quad \pi = \delta \left[p(x_j)x_j - cx_j - F_2 \right] - \bar{F}_1, \tag{5}$$

where δ is the discount factor and $\bar{F}_1$ the sum of fixed cost in period 1 and the investment in k_1^j times interest rate. This gives the optimal supply of x_j^* (for new products, indexed by j). But it is more interesting to deal with the dual problem because the factor conditional demands can be derived from it. Indeed, we set up the following optimisation problem:

$$Min \quad C = rk_1^j + F_1 + \delta(w^j l_2^j + rk_2^j + F_2), \qquad s.t. : x_j^* = A^E \left(l_2^j\right)^\alpha \left(k_2^j\right)^\beta, \tag{6}$$

which allows us to obtain $\left(k_1^j\right)^*$, $\left(k_2^j\right)^*$ and $\left(l_2^j\right)^*$. Note that in the modern sector the demand for labour in period 1 does not exist. Let us recall that in the initial point of time entrepreneurs only invest with the aim of discovering the true TFP in the next period.

It is assumed that labour supply is inelastically offered by the consumer, and thus the total amount of labour available for production is fixed. Capital supply comes from the rest of the world at a constant and exogenous interest rate. Consequently, clearing conditions in both markets are the following:

$$\sum_{i=1}^{n} l_1^i + \sum_{i=1}^{n} l_2^i + \sum_{j=n+1}^{p} l_2^j = \bar{L}_1 + \bar{L}_2 \tag{7}$$

$$\sum_{i=1}^{n} k_1^i + \sum_{i=1}^{n} k_2^i + \sum_{j=n+1}^{p} k_1^j + \sum_{j=n+1}^{p} k_2^j = K_1 + K_2, \tag{8}$$

where capital letters denote supplies.

In period $t = 2$, consumer optimises over old and new products. The new utility function is then $U[x_0, (\sum_{m=1}^{p} x_i^\rho)^{\frac{1}{\rho}}]$, where $m = 1, ..., n, ...p$, that is, a broader set of goods than in period 1. Again, optimisation is firstly carried out over x_0 and y, and after over the mth x_m. Traditional firms in this period $t = 2$ replicate their optimisation problem in the same way than before although, as it will be shown later, the number of varieties changes.

[1]In fact, it can be said that this is the original concept of TFP. By contrast, ex-post empirical approaches have extensively exploited the macroeconomic view of TFP in growth contexts.

Things are quite different in the case of modern firms. Indeed, two alternative scenarios arise in period 2. One is that where the expected value of TFP in period $t = 2$ equals the true value ($A^E = A$). In this case, equilibrium values remain unchanged. The second scenario is that where $A^E \neq A$, that is, a situation in which the entrepreneurs did not make appropriate expectations on TFP. Under this environment, a new optimization problem must be set up for modern firms:

$$Max \quad \pi = p(x_j)x_j - cx_j - F_2 - \frac{\bar{F}_1}{\delta}. \tag{9}$$

As previously, we obtain a new x_j^* which is used in the dual approach:

$$Min \quad C = w^j l_2^j + rk_2^j + F_2 + \frac{\bar{F}_1}{\delta}, \qquad s.t. : x_j^* = A\left(l_2^j\right)^{\alpha}\left(k_2^j\right)^{\beta}. \tag{10}$$

Again, the new conditional demand for private capital and labour, $\left(\underline{k}_2^j\right)^*$ and $\left(\underline{l}_2^j\right)^*$, respectively, are obtained now, where a bar below k or l denotes factor demands defined in period $t = 2$. Using the free-entry condition ($\pi = 0$), we have

$$(p - c)x_j = F_2 + \frac{\bar{F}_1}{\delta}, \tag{11}$$

and solving for x_j we obtain the equilibrium output per firm $x_j^* = \frac{F_2 + \frac{\bar{F}_1}{\delta}}{(p-c)}$. Total number of varieties (p) is given by noting that the sales of each sector must equal the consumers' income:

$$np_i x_i + (p - n)p_j x_j = w^i \sum_{i=1}^{n} l_2^i + w^j \sum_{j=n+1}^{p} l_2^j, \tag{12}$$

where the left-hand side represents the sales in each sector, and the right-hand side the labour income coming from both sectors and received by the household. Given symmetry ($p_i = p_j$, $w^i = w^j$ and $x_i = x_j$), the above expression yields: $p = \frac{w(\sum_{i=1}^{n} l_2^i + \sum_{j=n+1}^{p} l_2^j)}{p_i x_i}$. While the total number of varieties is given by the labour force, the number of varieties in each sector is the same ($p/2$).

4 A simple test on entrepreneurs' expectations

As discussed in the introduction, the definition of the entrepreneurial process of discovery and their links with RIS3 are complex, and it thus faces a number of conceptual and practical challenges. The above theoretical framework just aims to clarify how entrepreneurs take decisions over time in a context of uncertainty and, particularly, to what extent their expectations on TFP turn out to be appropriate.

We propose here to use this conceptual framework as a basis for obtaining information regarding to what extent expectations and forecasts made by the entrepreneurs are (more or less) close to the true values. Particularly, we focus on the comparison between the conditional factor demands defined

in period 1 and those of period 2, taking the first one as expectations and the second one as the values effectively materialised in period 2.

Formally, we set up that entrepreneurs are good predictors of TFP if:

$$\left|\left(k_2^j\right)^* - \left(\underline{k}_2^j\right)^*\right| < \varepsilon \tag{13}$$

$$\left|\left(l_2^j\right)^* - \left(\underline{l}_2^j\right)^*\right| < \mu, \tag{14}$$

for given values of ε and μ. In practical terms, both ε and μ can be fixed as small as necessary and, obviously, regarding so many factors as reasonable.

As stated in the introduction, this method has at least three clear advantages. Firstly, it allows revealing how accurate the entrepreneurs are in forecasting future values of TFP. As explained, this is done through the definition of conditional factor demands at different moments in time. Secondly, this method is quantitative and measurable, and thus comparable, establishing a more transparent criterion that breaks away from past practices of selection that were far more subjective. In doing so, it provides a level playing-field for entrepreneurs to be selected, be them established or emerging, or large or small. Thirdly, it avoids rent-seeking behaviours by entrepreneurs based on inefficient strategies, given that they do not have any incentive to modify their optimal choices (of factor demands in our case), different from their own interest in optimising resources, in order to get policy support. Actually, the opposite should happen: entrepreneurs are very interested in being as accurate and consistent as possible in their prediction of future TFP because they would offer a positive signal to governments about their ability to forecast TFP correctly.

Taking this model as the basis, there are different tools that can be used to implement this approach in practice. For instance, there are quantitative databases that provide the information required in this model (for instance, the Global Entrepreneurship Monitor project). This relevant data can be also gathered through interviews, surveys or case studies that focus on this optimal use of resources.

5 Concluding remarks, policy implications and further research

This paper has presented a novel contribution in relation to a key question of smart specialisation, which is how to select business stakeholders in the process of entrepreneurial process of discovery. This process implies a break away from past practices, as regards inter alia the involvement of stakeholders. In this spirit, the paper has proposed a new entrepreneurs' selection method, which relies on using the criterion of the optimisation of resource allocation, operationalised in the best forecast of TFP over time in a context of uncertainty.

On the basis of Hausmann and Rodrik (2003), we have included two new features in the model: one is monopolistic competition in goods markets, which allows us to take into consideration demand-side effects in a context of general equilibrium models; the second one is that we have broadened the scope

of Hausmann and Rodrik (2003) by considering a new production factor (capital) and a particularly interesting way of dealing with uncertainty, in terms of TFP. In this context, equilibrium relationships for labour and capital are derived, and price and quantity indexes in good markets as well.

In so far as the new approach of smart specialisation needs to capture information from the entrepreneurial process of discovery, conceptual and methodological efforts must be done in order to characterise it. This paper provides a theoretical framework where these ideas can be rooted. For this purpose, our approach has at least three particular assets, which reflect well the policy implications emerging from this paper. The first one is describing roughly how the best entrepreneurs can be identified, operationalised as those with the best abilities to optimise resources and forecast TFP. The second one is to do precisely that, without allowing endogenous manipulations coming from firms behaving as rent-seekers. The third one is that our proposed method is quantitative, measurable and based solely on performance, and it thus transparent, breaking away from past practices in this regard. The policy needs identified at the start of the paper are therefore addressed by this method.

Let us now briefly discuss the opportunities for further research in this particular area. A number of new avenues for further research can be drawn up. The most relevant may be the one that stems from the link with the initial motivation of this paper and its territorial dimension, i.e. the model must adopt a regional approach to better suit the discussion in terms of EU regional policy. Consequently, at least a couple of new main challenges should be faced. The first one is to take into consideration the spatial dimension derived from new economic geography developments, involving agglomeration forces and transport costs. The second one is closely related to policy making. Given that entrepreneurs take decisions in an uncertain environment, it is unlikely that market equilibria would be efficient without insurance markets. This leaves room for further policy interventions in order to close the gap between the private and social returns of entrepreneurial investments (Boadway and Tremblay, 2005).

Apart from these main lines of research that could be further developed, some technical improvements could be considered to the current state of research of our model. For instance, the process through which the entrepreneurial investment in period 1 affects TFP in period 2 admits different specifications, with relative advantages and disadvantages of each one. Therefore, a broad analysis of many of these alternatives should be taken into account. A second point of interest is related to managing the number of (old and new) products available in the market. In this context, it is clear that the arrival of new varieties as result of entrepreneurship affects demands for previously existing varieties and this must be reflected in the exit of old goods, which also needs to be appropriately modeled. Finally, the uncertainty in decision making could be extended on the quality and characteristics of production factors dealing with information asymmetries by defining conditional demands for capital and, especially, labour (Boadway and Sato, 2011).

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