



Guiding Principles for a New Industrial and Innovation Policy in Italy

Matteo Tranchero



SCENARI

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di

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About This Text

The Italian economy is plagued by structural deficiencies dating well before the current COVID-19 crisis. For too long a misguided rhetoric of “small is beautiful” and “we don’t need industrial policies” has blocked discussion and enactment of measures that could arrest Italy’s decline. And while the European *Recovery Fund* will provide a much-needed stimulus to investments and reforms, just using these resources without critically discussing a long-term vision for our country will likely result in yet another missed opportunity. This report outlines a few broad guiding principles for a new industrial and innovation policy, with the objective of starting the debate around which set of policies could be enacted in Italy to reverse its decline. The principles outlined will touch upon several policy-relevant topics, such as entrepreneurship, management training, scientific missions, as well as innovation policies that move beyond the agnostic horizontal approach followed in the past couple of decades.

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Guiding Principles
for a New Industrial and Innovation
Policy in Italy

Introduction

The Italian economy is plagued by structural deficiencies dating long before the current COVID-19 crisis. Even before the pandemic, the gross domestic product had yet to recover the levels seen before the financial crisis of 2008. During the past few decades, Italy has been characterized by a continuing stagnation of productivity growth (Figure 1). Despite being largely shortsighted by politicians and the public debate, this issue is first-order because in all advanced economies the bulk of economic growth is due to productivity increases (Bugamelli, Lotti, et al., 2018). Far from being an abstract concept, productivity enhancements are the result of innovation, diffusion of new technologies, adoption of better management practices, and accumulation of human capital. All these aspects constitute actionable levers for policy, as other advanced economies know all too well: from the German plan Industrie 4.0 to the Advanced Manufacturing plan of the Obama administration, via the recent pledge of Emmanuel Macron of making France a “Start-Up Nation”. This kind of policy is not easy to implement, and often their effects are below expectations; still, it is hard to even name a single successful instance of a country that reached the technological frontier without enacting similar measures (Lerner, 2009; Dosi and Tranchero, 2020). Bringing industrial and innovation policies back to the public debate is therefore essential for a country like Italy.

In this policy paper, the objective is starting the debate around which set of policies could be enacted in Italy to reverse this state of affairs. After years of silence, several policy circles are starting to openly address these topics, also as a reaction to the increasing number of sectoral measures adopted by governments all over the world (Hutschenreiter et al., 2019). Much of this recent shift is also

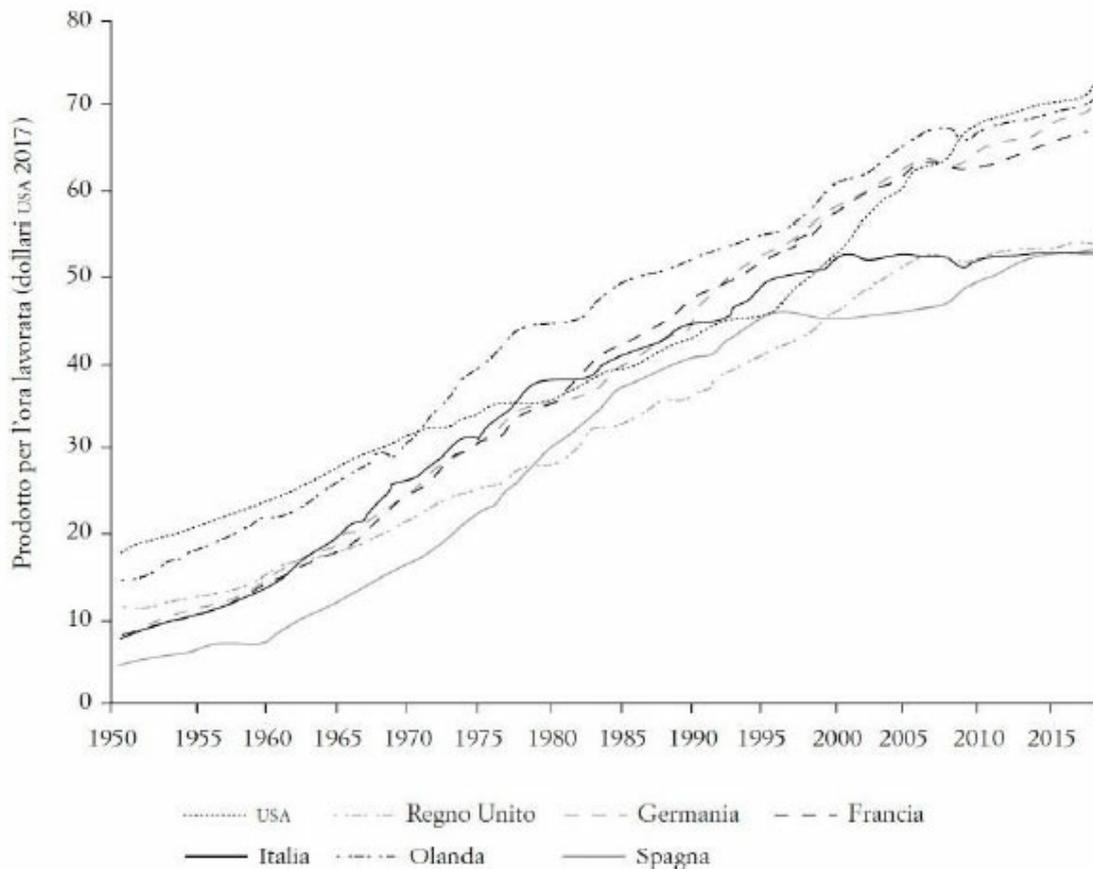
due to the growing popularity of the “mission-oriented” approach heralded by Mazzucato (2013, 2018, 2019). While a positive novelty, one should remember that missions are only a part (albeit important) of the innovation policy mix necessary to achieve sustainable growth. This paper will explore how missions as well as other sectoral and targeted approaches could be orchestrated together to put Italy back on a path of growth.

This proposal will outline a few broad guiding principles for a new industrial and innovation policy. While of a less applied and practical nature than fully-fledged measures, the contention here is that this is what is needed now to jumpstart the debate on these crucial topics. Detailed plans with ready-made proposals abound, the last in time having been prepared by the Colao commission in mid-June 2020. Despite being complete, thoughtful, and detailed, this kind of endeavor are generally followed by lack of implementation. The quick dismissal of the Colao plan serves again a useful example of the little value contained in technical proposals that do not enjoy political backing. The purpose of this document is to provide a document that highlights some principles that could be used to inform the public debate, possibly as a starting point to build the political consensus needed to enact measures inspired by them. This is not to say that the principles highlighted here are necessarily the “right ones”, as this is an assessment that can only be made on political grounds. Still, all of them will be informed by sound academic research to avoid engaging in mere speculations.

Italy has been lacking a similar debate for all too long. Major developed countries routinely outline their vision for growth and innovation during the subsequent ten or fifteen years, setting clear goals that then are reflected in specific policies and laws. The absence of anything similar in our country denotes the low priority accorded to the issues at stake. In the absence of such debate, lawmakers and policy executives remain anchored to outdated ideas and visions, that no longer suit the needs of Italy in the face of the new technology paradigms. Overall, this policy report aims at filling this gap. The principles

outlined will touch upon several policy-relevant topics, such as entrepreneurship, innovation subsidies, scientific missions, as well as policies that move beyond the agnostic horizontal approach followed in the past couple of decades. Faced with the long economic decline of Italy, policymakers need to take urgent action to address the structural deficiencies of the productive and scientific systems. This paper can be read as an attempt to start a debate on how to avoid becoming the Florida of Europe: a beautiful country to visit, but incapable of offering a future to its young generations.

Figure 1. Labor productivity in major European countries, 1950-2018



Fonte: Felice et al. (2019).

There are not many alternative way store main at the technological frontier

Following the so-called “Economic Miracle” that took place in Italy after WWII, economists and policymakers have long praised the strengths of Italian capitalism. Flexibility and scope economies of the small and medium enterprises populating the many industrial districts seemed to offer an alternative to the declining Fordist model (Piore and Sabel, 1984). When analyzing the Italian innovation system, Malerba (1993) noted that Italy has not simply one, but rather two innovation systems: a network of SMEs, historically the most dynamic part of the economy, and a restricted core of big industrial groups. The Italian case showed the seeming paradox of a country that was able to join the club of developed economies without possessing a formal system of scientific and industrial research and development (Nuvolari and Vasta, 2015). But will it be possible to keep growing in this peculiar way when facing the challenges of globalization and technological progress, asked Malerba over twenty-five years ago? Indeed, a development strategy based only on SMEs and their self-sustaining streams of incremental innovations has proved to be insufficient to sustain economic and productivity growth (Bugamelli, Lotti, et al., 2018; Felice et al., 2019).

The Italian case is just an example of a broad shift that from the 1990s onward has swayed the European policy debate away from targeted and effective industrial policies. On the one hand, the policy debate shifted toward the adoption of diffusion-oriented policies that abandoned the sectoral dimension almost altogether (Ergas, 1986). In most OECD countries, industrial

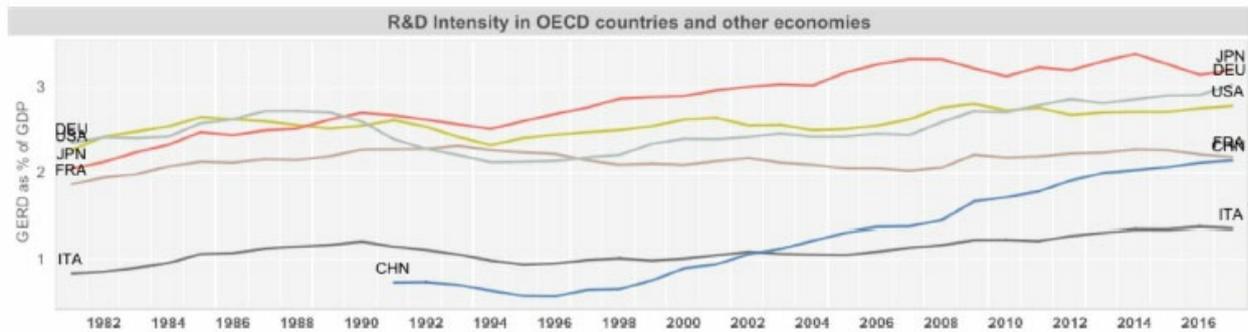
policy became more “horizontal”, focusing on generic public support for innovation and to simply create business-friendly framework conditions. This has often been done at the expense of targeted measures directed at addressing specific weaknesses of the economy. In European countries, such a shift was enforced by the adoption of new regulations by the EU Commission, which strictly regulated the use of direct public support and pushed toward the introduction of generic measures such as indiscriminate R&D subsidies (Hutschenreiter et al., 2019). On the other hand, a new strand of academic research on National Systems of Innovation (NSIs) emerged and consolidated in both academia (Lundvall, 1992; Nelson, 1993) and policy-making (OECD, 1997). The main thrust of the NSI approach is that innovation and technical change are the outcomes of a complex pattern of interactions among a wide variety of actors such as firms, universities, and government research institutes. This new policy framework brought welcomed attention to the quality of interactions between the science and business sectors and among firms but unfortunately did so at the expense of the traditional attention to the sectoral dimension. Indeed, the results of empirical work on innovation systems have been the recognition of the wide heterogeneity of “successful” NSI configurations apparently compatible with strong economic performance (Nelson, 1993). The interpretation of the qualitative and comparative evidence put forward in the NSI literature suggests that innovation systems are possibly characterized by strong equifinality, that is, similar outcomes or levels of performance can be achieved in different ways through original solutions and institutional instruments (Cirillo et al., 2019). The popularity of the NSI concept in the policy arena has contributed to popularizing the view that idiosyncratic systemic arrangements (i.e. configurations of actors and institutions) could all be potentially successful, leading to a certain complacency toward the shortcomings of some countries. For instance, the structural deficiencies and low investments in research and development by Italy were largely accepted as the somewhat inevitable consequence of its strength in traditional manufacturing and food sectors (Fortis, 2016). The implicit assumption was that a comparative advantage in

these economic activities would act as a substitute for the lack of investments in technology and innovation, allowing never the less to achieve the same level of prosperity (Felice et al.,2019).

However, after taking a closer look at the data available,it appears that there exist strong complementarities among the building blocks of an NSI (firms, universities, government, agencies, etc.). Countriesexcelling on any innovation dimension tend also to do well on all the others, which means that it is empirically difficult to identify different sub- components of the innovation system that may work as “substitutes” for the attainment of effective innovation performance in different structural configurations (Cirilloetal.,2019). The policy implication of this lack of substitutability is less consolatory into nethan the (ab)used policy implications in the original NSI literature, and it be ars important consequences for Italy. For too long the structural fragility of the Italian science and technology base was overlooked by policymakers because of the conciliatory narrative of the innovative dynamism of small and medium-sized firms (Nuvolari and Vasta, 2015).

Dismal international comparisons like the one showed in Figure 2 abounds, and very similar graphs could be produced for the number of college graduates, the share of high-productivity firms, the number of patents, and so on. The rhetoric of successful industrial districts undoubtedly spurred complacency in the face of weak performance along specific dimensions (Adamo, 2016); however ,the endemic short comings of the Italian innovation system cannot be overlooked anymore by hoping the other parts of the innovation system will be enough to compensatefor them. Also, at this point assuming that generic or horizontalmeasures will be enough to fill the growing technological gap of Italy vis-a'-vis the other advanced economies would be nothing more than wishful thinking.

Figure 2: Research and Development intensity as a share of GDP in selected OECD economies



Source: OECD Main Science and Technology Indicators Database, August 2019

This evidence calls for a holistic approach to innovation policies to integrate all public actions that influence innovation processes and to avoid neglecting core components of the NSI (Edquist, 2019). Good policy designs should be broadly based and refer to several actors, being sure that the core elements of the innovation system are all tied together and well-functioning, therefore targeting especially the weak spots of the system. In addition, policymakers should also strive to achieve leadership in specific technological areas, going beyond sheer horizontal measures. Indeed, this policy consensus has recently started to change with the re-emergence of a “mission-oriented” approach, pioneered by Mariana Mazzucato (2013) and increasingly accepted in European policy circles (Mazzucato, 2018, 2019), as well as with the discussion on “smart specialization” (Foray et al., 2011). As Aghion et al (2011) put it, the debate should no longer be in favor or against an industrial policy, but on how to devise proper policy design and governance. Beyond the labels, the central points are that specialization patterns are not neutral to economic prosperity: engaging in high-value sectors (such ICT or biotechnology) characterized by a high- income elasticity of demand and many opportunities for technological learning will likely result in better opportunities for growth than traditional sectors (Dosi and Tranchero, 2020). Still, comparative advantages might not induce a country to specialize in those sectors, because if left to themselves, countries tend to remainlocked into the past trajectories of specialization because of static

economic efficiencies. Targeted public policies will be needed to steer the economy toward sectors that create more technological externalities, have higher technological opportunities, and exhibit higher rates of innovation. Note that this kind of interventions has been routinely implemented throughout history by countries all over the world and at various stages of development, so that virtually no currently advanced economy refrained from using them (Dosi and Tranchero, 2020). What is perhaps surprising is how slowly the policy and academic debate is moving toward reconsidering the practical importance of this kind of intervention, and how crucial it could be to reverse the economic decline of a country like Italy.

Key points:

- Countries at the technological frontier show remarkably similar National systems of innovations, all characterized by a strong research ecosystem, a proactive role of government in fostering innovation, and specialization in dynamic and technologically progressive industrial sectors.

- In the last decades, academic and policy circles have neglected sectoral policies assuming a horizontal approach would suffice, at the expense of targeted measures directed at addressing specific weaknesses of the economy.

- Specialization patterns are not neutral to economic prosperity, and policies should explicitly target high-value sectors characterized by a high-income elasticity of demand and many opportunities for technological learning.

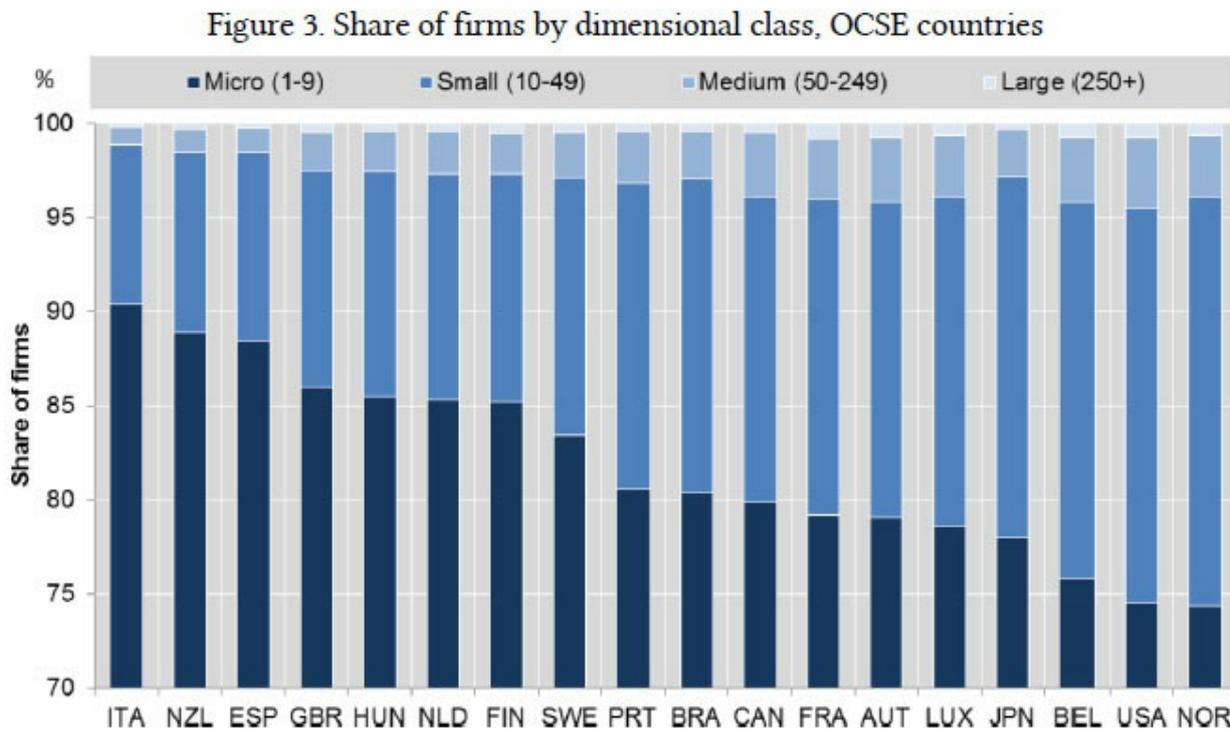
Small is beautiful only if willing to grow

Substantial statistical evidence points toward the key and often neglected importance of large firms in the economy (Atkinson and Lind, 2019). Larger firms are on average more productive (e.g. Bugamelli, Lotti, et al., 2018) and therefore can pay higher wages to their employees. Bloom et al (2018) show that in the United States a 10,000-employee firm pays around 20% higher salaries to its work force compared to a 100- employee firm. Large firms are also the main performers of research and development, and in many countries, they still account for over 90% of R&D expenditures (Foster et al, 2020). Their larger dimension enables them to keep up with the latest technological advances, and to muster the resources to invest and diversify in more technological areas (Dosi et al., 2017). Another dimension where firm size brings clear advantages is the ability to export in international markets, which has been proved to be a key determinant of growth. Grazzi and Moschella (2019) document that the share of exporters is 66.3% for firms with more than 20 employees, compared to an Italian average of just 13.5%. Large firms are also known to offer more benefits to their workers, such as more opportunities for internal career or on-the-job training, as well as more benefits, more worker training, job security (Atkinson and Lind, 2019). Taken together, all this amounts to a convincing case for why policy makers would want to support the establishment and growth of large companies.

Nevertheless, in the last few decades, policies tended to increasingly concentrate on small and medium-size denter prises (Hutschenreiter et al., 2019). Of course, this can be justified if one thinks that small companies are on average

more in need of public support because of wide spread credit constraints (Bottazzi et al., 2014) and if the objective is making them grow into high-wage and productive corporations; however, behind these choices, there are also many common popular misconceptions about the role played by SMEs in the economy (Atkinson and Lind, 2019). While it is true that a large fraction of workers in developed economies are employed by small firms (in Italy this share is over 80%), this does not mean that small businesses create the most private-sector jobs. As Haltiwanger et al (2013) showed for the US economy, net job creation is mostly due to firm births and not to incumbent SMEs. Said otherwise, any finding of an inverse relationship between firm size and net growth rates is due to the fact that new firms tend to be small, and not to any virtue of the average SMEs. Indeed, it has been documented that conditional on survival, young firms grow more rapidly than their more mature counterparts (Haltiwanger et al, 2013): an important clue that in business dynamics it is young, and not small, to be beautiful. Besides these Schumpeterian dynamics of firms and job creation, it is also important to remember that the greatest majority of businesses fail within few years, and the median surviving young business does not create jobs but remains small (Haltiwanger et al, 2013, Catalini et al., 2019). Using survey evidence for the United States, Hurst and Pugsley (2012) highlight the heterogeneity in the motivation for starting a business and hence their potential growth. In many cases, the choice to become an entrepreneur simply reflects occupational and lifestyle choices, such as wanting to be their own boss, rather than any entrepreneurial desires to innovate and grow (Levine and Rubinstein, 2017). This fact, however trivial as it might at first appear, has crucial consequences for the design of public policies, because it suggests that offering undifferentiated support to small businesses will probably miss the target. Instead of spreading available resources over low productivity and low growth ventures, policies should concentrate their resources on the ventures showing greater potential (and willingness) for growth. This argument applies all the more to the Italian case. As Figure 3 shows, when analyzing the productive system of Italy (and

its shortcomings) one cannot but notice the startling structural presence of micro-enterprises.



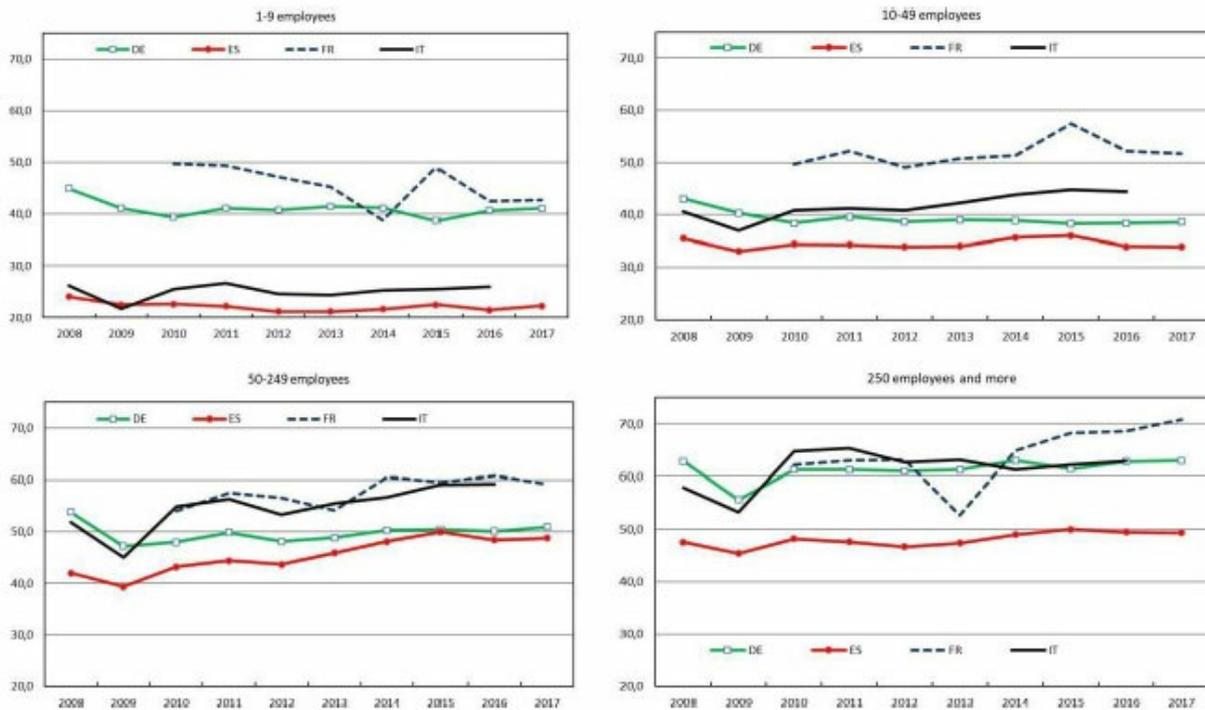
Source: Criscolo et al. (2019).

The long productivity decline of Italy certainly reflects its specialization in traditional manufacturing sectors (textiles, food, etc.) where innovation rates are relatively low. Still, this explanation is not enough to explain the overall disappointing dynamics, unless it is put in relation to the peculiar productive structure of Italy (Felice et al, 2019). As shown by Bugamelli, Lotti et al. (2018), medium and large Italian companies are no less productive than their European counterparts, but this is not true for micro-enterprises. As Figure 4 plastically shows, even conditional on having the same dimensional size, Italian SMEs are much less productive and there is no sign of improvements over time. Therefore, aggregate dynamics reflect a compositional effect, where the dismal national averages reflect the negative performance of SMEs which however constitute the large majority of the economy. Only 0.1% of Italian firms have more than 250 employees, compared to 0.5% and 0.2% of German and French firms respectively (Bugamelli, Lotti, et al., 2018). This helps explain why the good performance of medium and large companies is not enough to positively affect the aggregate

productivity trends. Of course, there exist also positive exceptions of innovative and high-productivity SMEs. Still, even these frontier firms are much rarer and smaller than in comparable European countries (Lotti and Sette, 2019), reflecting structural constraints to firm growth.

In the years following the so-called *Miracolo Economico*, economists and policymakers have long praised the positive aspects of Italian capitalism, emphasizing the flexibility and scope economies of small firms populating industrial districts (Piore and Sabel, 1984). This has led to the creation of a large number of measures and exemptions applied to small businesses, whose only eligibility requirement was the sheer small size. Unfortunately, instead of helping them grow, these size-dependent provisions have the perverse effect of incentivizing the firms to remain small, with large losses in terms of productivity and employment growth (Garicano et al., 2016). As Felice et al. (2019) note, one is bound to ask: is it possible that complacency and unwarranted praise of the small-size Italian capitalism have been counterproductive by crowding out technological investments and measures aimed at firm growth?

Figure 4: Labor productivity by firm size class
(value added per worker in thousands of euros, 2005 PPP)



Source: Bugamelli, Lotti et al. (2018).

Data from Eurostat, Structural Business Statistics.

For decades, the public debate on industrial and innovation policies has been limited by preconceived assumptions on the positive roles played by SMEs. As some argue, it might well be that this rhetoric has brought a false perception of reality according to which more ambitious industrial policies were not needed thanks to the performance of industrial districts (Adamo, 2016). Be that as it may, we can no longer afford this attitude. Instead of sticking to the outdated and misconceived belief that “small is beautiful”, the priority for new industrial and innovation policies should be helping promising startups and innovative SMEs that want to scale, going beyond policy interventions that aim at small businesses but ignore their age or potential. Note that recent works have shown the feasibility of this task. By leveraging detailed data on the characteristics of firms at the founding, Catalini et al. (2019) show that a few characteristics allow for the construction of predictive models that determine the entrepreneurial

quality and thus allow to identify successful entrants. Likewise, Ng and Stuart (2016) use machine learning on a large sample of LinkedIn resumes to accurately categorize high and low growth firms in the USA tech sector. These examples clearly show the potential for public policies to move beyond passive funding of small firms toward a more targeted use of public resources to foster business growth.

Key points:

- The policy debate in Italy has historically been informed by the maxim “small is beautiful”, uncritically favoring measures targeted to micro and small enterprises.

- All existing evidence shows that small companies are less productive and innovative than large ones; this is particularly true for Italy, where small companies are much less productive than their European counterparts even conditional on having the same dimensional size.

- Policy measures should not be dependent on size, because this provides perverse incentives to forfeit dimensional growth, but rather be targeted toward young and growing businesses.

The good and bad of entrepreneurship, beyond the hype

Academic scholarship is increasingly conscious of the heterogeneity in the motivation for starting a business and hence their potential growth (Hurst and Pugsley, 2012; Levine and Rubinstein, 2017). But the same cannot be said for the sometimes obsessive “cult of the entrepreneur” that media and the public discourse continue to spread. The rise of Silicon Valley and the amazingly quick rise of unicorn startups (firms valued at \$1 billion or more) has turned successful founders into something close to mythical heroes, reinforcing the old stereotype of the genius in the garage. While undeniable that the past decade has seen many success stories like that, policies should not be guided by this kind of collective hype. Rather, one ought to recognize that entrepreneurship is a multifaceted phenomenon, and only taking an objective stance one could design the right policies.

Besides the fact that most startups fail very soon (Haltiwanger et al, 2013), cases like Facebook or Uber are the exception even among the few that manage to survive and grow. When thinking about entrepreneurship policies, one has to clear the mind from imagining the average entrepreneur as anything like Bill Gates or Elon Musk. Also, the very image of the unquestioned founder that inspires a cult of personality in the company and among investors is false: a part few outliers, startups in which the founder has maintained control have significantly lower valuations than those where the founder has relinquished control (Wasserman, 2017). And besides destroying value, this myth of the founder-emperor has led to many cases of abuse and major debacles, as the

recent case of WeWork exemplifies well. But once we clear the air from these outliers, we can still appreciate that there is enormous heterogeneity in performance and innovativeness among entrepreneurs (Catalini et al., 2019; Ngand Stuart, 2016; Levine and Rubinstein, 2017). Treating all entrepreneurial ventures as being the same is conceptually and practically wrong because they are distinct both in the antecedents and in the outcomes.

Most successful entrepreneurs have previous experience in the industry of their venture, and any additional year of experience leads to better entrepreneurial outcomes (Azoulay et al., 2020). Indeed, contrarily to the common presumption, the average entrepreneur is middle-aged: for the period 2007-2014, Azoulay et al. (2020) find that founders in the US are on average 41.9 years old in the USA, a number that even goes up if one only looks at the most successful businesses. The crucial role of experience and human capital highlights two other important misconceptions. First, entrepreneurship in most cases does not work as an opportunity for social or income mobility. Quite the contrary, since recent evidence points out that almost all of the individual gains associated with increased entrepreneurship accrue to the top 10 percent of the income distribution (Marinoni and Voorheis, 2019). This should not really come as a surprise if one thinks of the importance of resources, talent, personal connections and social capital required to start a business, and that are more likely to be found in the upper tail of the income distributions. Second, the very idea that heroic entrepreneurs are responsible for the most important innovations is not confirmed by the data (Singh and Fleming, 2010). Scientific and technological endeavors are increasingly the domain of large teams with specialized resources (Wuchty et al., 2007), with little space left to entrepreneurial hero is malone.

Against this backdrop, it is self-evident that policies aimed at the sheer entry of new businesses are not warranted. Few new firms enter to innovate, and very few entrepreneurs hire anyone except themselves and have no interest or ability to expand after creating a job for themselves. Therefore, interventions aimed at stimulating entrepreneurship will at best encourage the marginal entrepreneur to

enter, which is far from being the kind of businesses these policies would like to actually stimulate (Acs et al., 2016). This does not mean that there is not a role for public policies in entrepreneurship. We must in fact remember that the public sector is often directly or indirectly responsible for the creation of the most successful firms (Mazzucato, 2013), as well as being the critical catalyst to the growth of ecosystems such as Silicon Valley (Lerner, 2009). On the other hand, the State cannot obviously substitute the entrepreneur and his specific knowledge. As argued by Foray et al. (2011), the quintessential entrepreneurial knowledge combines technical expertise with knowledge of market growth potential, competition, as well as the value proposition for the customer embedded in the business model. This idiosyncratic kind of knowledge cannot be created by law, however well-intended the bureaucrats. Rather, their role is to devise ways to mobilize and support individuals with such knowledge, setting the stage for their ventures (as well as providing the necessary inputs such as technical and scientific knowledge, by financing public research and education). Emphasizing the role of entrepreneurial discovery implies a key role for policy, which should actively create an institutional environment that facilitates experimentation by entrepreneurs. Policies should eliminate barriers to entry and provide the means to try out business ideas, but also let losing and unproductive incumbents fail in the face of “creative destruction” (Kerr et al., 2014). For instance, one such policy measure could be providing downside insurance to eligible unemployed workers who decide to start a business, which has empirically been found to be very effective (Hombert et al., 2020). If anything, one could try to nudge people to experiment in strategic technologies and sectors by means of targeted calls within broad mission-oriented programs (Mazzucato, 2013). This could help to spur the business dynamism of Italy, where many low-productivity firms are stagnant and survive thanks to the absence of Schumpeterian competition (Dosi et al., 2012).

Besides creating an institutional environment ripe for entrepreneurial experimentation, a second way by which policymakers could spur high-growth entrepreneurship is by designing start-up competitions. In a competition, early-

stage startup founders present their business ideas to panels of expert judges, whose evaluation determines which ventures win each competition round. Prizes could vary, ranging from monetary financing to coaching, but either way, the winners should be given large publicity. As shown by Howell (2020), new venture competitions help to alleviate information frictions in new venture finance, operating as a “certification” that signals quality to the market and reduces uncertainty for potential investors. Empirically, winning a start-up competition increases a venture’s chances of raising subsequent external finance by over nine percentage points, increases survival and growth rates, and the chances of an acquisition or IPO (Howell, 2020). Setting up similar nation-wide start-up competitions would be a relatively quick and low-cost way to spur high tech entrepreneurship.

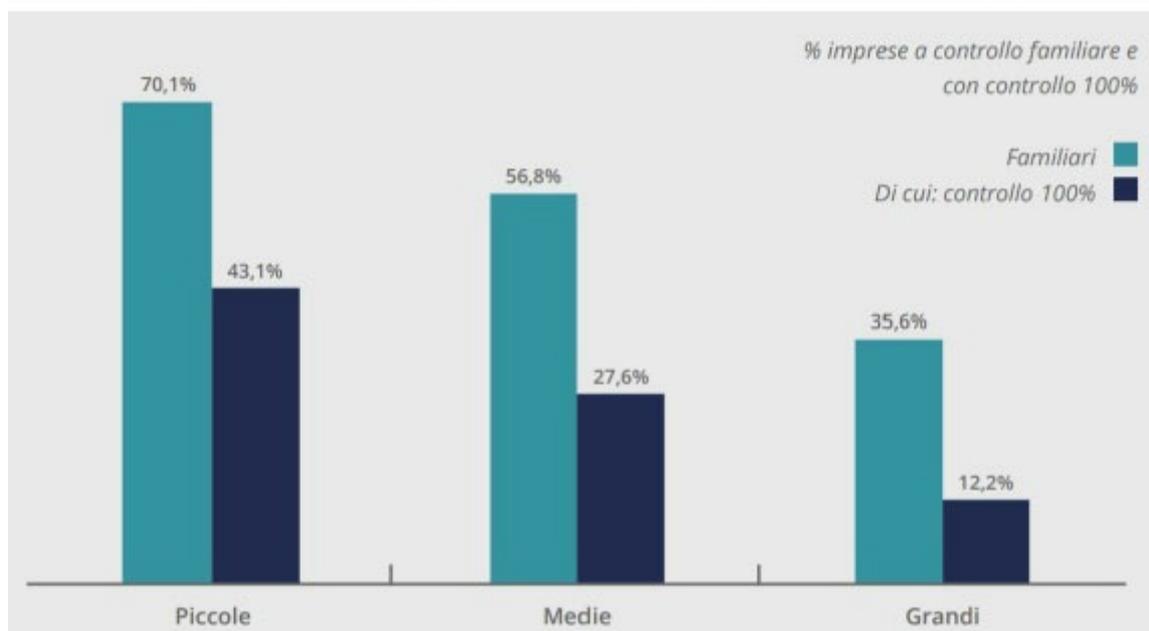
Key points:

- Entrepreneurship is a broad and hyped term that encompasses a large variety of different realities. Most entrepreneurs have no intention to grow, are active in low productivity sectors and earn less than salaried workers.
 - Entrepreneurship policies should create the conditions of private business experimentation and foster “creative destruction”, not subsidizing the marginal entrepreneur to enter the market.
 - Start-up competitions and safety nets for failing entrepreneurs are examples of policies that encourage the development of good ideas without tying them to failing ventures.

The need for a managerial revolution

Managerial ability is a key (and often neglected) input in firms' production activities. The reason behind its relative neglect by researchers in economics and policymakers alike has much to do with the difficulties connected to its measurement. Unlike other aspects of production, there is no clear metric to measure managerial ability and no readily available source of data. The only exception so far has been the work of Bloom and Van Reenen (2007), who have designed and performed an ad-hoc survey, which has, later on, inspired the U.S. Census Bureau to include similar questions in its quinquennial Census of Manufacturers (Bloom et al., 2020). Not surprisingly, the key takeaway of this research is that management does indeed matter for corporate productivity (Bloom and Van Reenen, 2010). Firms with more structured processes and management techniques are shown to achieve higher productivity, growth, and profitability.

Figure 5: incidence of family firms in Italy by dimensional class



Source: Rapporto Cerved PMI 2018

This point bears important consequences for an economy like Italy, where a large fraction of firms is family- owned and, as a consequence, family-managed (Figure 5). According to the data of Bloom and Van Reenen (2010), family-managed firms achieve a significantly lower management quality score than the average dispersed shareholders' company (Figure 6). This finding is well in tune with research showing the deleterious consequences of control inherited through primogeniture on firms' subsequent performance. In the context of Danish firms, Bennedsen et al. (2007) find that male primogeniture results in a sizeable liability for family firm performance. Interestingly enough, the disadvantage of family firms completely disappears when the owners appoint an external CEO. This result can be easily rationalized if we assume that managers external to the family are selected for their abilities only, while relatives could end up occupying managerial roles just because of inherited rights, irrespective of their capacity to do the job.

Figure 6: Ownership structures and average management scores



Source: Bloom and Van Reenen (2010). The dark line is the kernel density for dispersed shareholders companies for comparison.

A key challenge to achieve economic growth is thus finding policies that could lead to better management in family-owned SMEs. One way to do so could be favoring the separation of ownership from direct management, which data show is usually enough to increase average managerial quality. This could happen through diversification of equity-holders in SMEs, enacting measures requiring higher firm capitalization. Specific incentives could be put in place when control shareholders go below a certain ownership threshold (e.g. 60%), favoring the issuance of equity to external investors even if the control stakes remain in the hands of the founding family.

However, other measures could go a long way even without forcing family ownership to dilute their shares. For instance, accessing regulated financial markets to issue corporate debt usually requires companies to comply with several regulations on financial reporting and internal processes, but also to satisfy the requests of prospective investors.

Increased accountability in the form of debt-holders oversight could spur managerial reform, such as accepting to relinquish operational control. This is very different from a system where credit is mostly issued by banks, often prone to subjective criteria that relate to personal networks more than to actual credit merit. Making it easier for SMEs to access financial markets (such as the FTSE

AIM) could be a way to diffuse best practices in management and internal control systems, while at the same time reducing over-reliance on the banking system. It is not surprising that Italy is characterized by both high incidence of family-managed firms and high reliance on local bank credit, as these two factors work together in favoring the perpetuation of poorly managed and low-productivity firms.

A second interesting pattern emerging from Figure 6 is the low management scores of “founder firms”, namely firms where the current CEO founded the firm (Bloom and Van Reenen, 2010). What this seems to suggest is that skills required during the start-up phase, like creativity and risk-taking, are not the same required to grow the business later-on. Suggestive evidence of this comes from studies of founder replacements spurred by venture capitalists’ requests (Ewans and Marx, 2018). One channel through which VC funds create value is by scaling-up promising business ideas, and they do so by a mixture of advising and direct reshaping of companies’ management. Measures aimed at increasing the thickness of Italian VC markets, while at the same time making it easy and convenient for young firms to raise external capital, could be extremely beneficial in this respect.

Finally, the educational achievements of managers are also strongly correlated with high-quality management scores (Bloom and Van Reenen, 2010). Indeed, a key long-term challenge for Italy is to address the fundamental educational and cultural gap that affects the whole country. Among Western democracies, Italy still has one of the lowest shares of degree-holders on the population, with clear reverberations on firms’ management as well. It is hardly surprising that managers and entrepreneurs tend to lack educational qualifications, despite evidence that founders with a degree hire more people and grow their business faster (Levine and Rubinstein, 2017). Part of this phenomenon is certainly due to the peculiar productive specialization in traditional sectors populated by micro-enterprises, where the returns of holding a STEM or business degree might be lower than in more technologically sophisticated sectors. However, the classicistic orientation of the Italian

educational system and the widespread perception that “studying does not pay” (as testified by often-reported stories of graduates forced to work in supermarkets while low educated politicians often achieve ministerial positions) have probably much to do with the current state of affairs.

Key points:

Managerial ability is a key input into productive activities, which however has been long neglected in policy and academic circles due to difficulties in measurement.

In a country like Italy characterized by a large share of family firms, managerial education and separation between ownership and management are fundamental levers to increase productivity growth.

Family firms should not have privileged treatments that disincentivize hiring professional managers or relinquishing operative control.

Big champions for big environmental and technological challenges

The world is facing a major environmental crisis that requires us to tackle climate and environmental-related challenges. Every year, pollution destroys entire ecosystems, while the atmosphere is warming and generating negative externalities such as drought, deforestation, and migration (Aghion et al, 2011). Addressing these issues will take great political will and commitment, but also major investments in developing new clean technologies. Among the others, a key challenge is developing technologies that can substitute oil and carbon with cleaner sources of energy, such as electricity or hydrogen. Meanwhile, manufacturing and industrial sectors are undergoing major and rapid technological transformations. A couple of years ago, the OECD released a report that examined the economic and policy ramifications of a set of technologies deemed likely to be important for production over the near term. In doing so, the starting point was that “the next production revolution is occurring through because of a confluence of technologies” (OECD, 2017), which have been collectively labeled “Industry 4.0” after the German Federal initiative launched in 2011. Think tanks and management consultancies have been advocating that a large number of technological novelties are opening possibilities for prosperity and large gains in productivity. However, they also pose incredible new challenges to existing firms, that need to learn how to stay abreast of technological novelties such as artificial intelligence, robotics, big data analytics, and cloud computing.

In the United States, technological developments in these areas are being

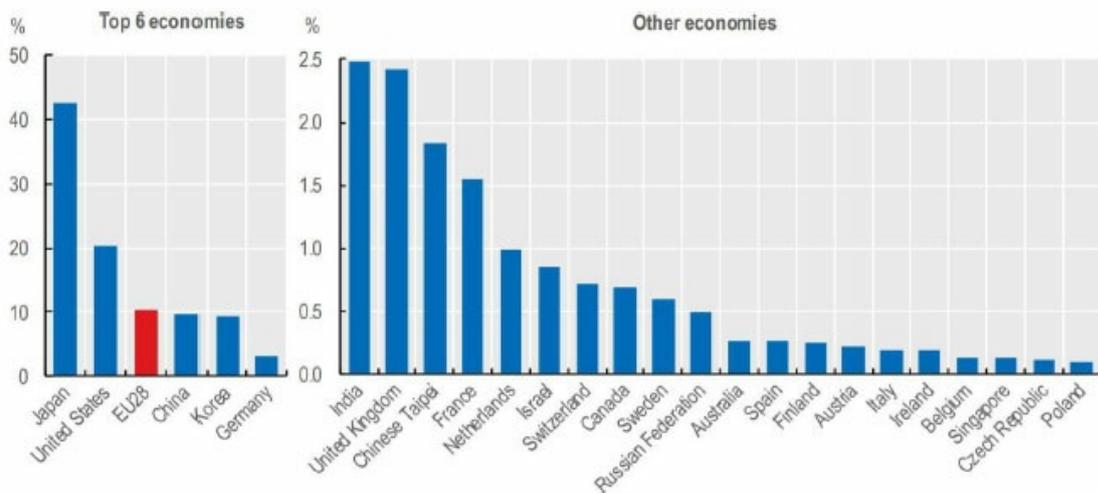
primarily driven by the massive investments of large technology groups such as Apple, Amazon, Google, Microsoft, and General Electric. The role of large companies like these is often so important to show up in aggregate statistics, with sectoral dynamics being often the

reflection of a handful of important firms (Gaubert and Itskhoki, 2020). In turn, this is due by the very characteristics of high-tech industries characterized by dynamic scale economies, which means that first-mover advantages can lead to long-lasting barriers to entry and imperfect competition (Dosi et al., 1990). Nevertheless, it is exactly the sectors characterized by this kind of dynamics that policymakers should target because they are those more innovative and that entail the highest learning opportunities in technological terms. The presence of dynamic scale economies is theoretically sufficient to justify policy interventions in high-tech sectors, to foster the emergence of national firms able to tackle the technological challenges we face (Mulatu, 2016).

In high-tech sectors, sheer firm size matters in more than one way. Investments in those fields are usually extremely risky, and firms need to have both the necessary technological capabilities and the financial resources required. Countries lacking enterprises of a sufficient critical mass to realize significant projects and deal with the international competition are shut out of an important part of the global market. The rapidly changing technological landscape magnifies these challenges, especially because losing ground on the key enabling technologies of Industry 4.0 would mean missing the best opportunities for growth (Teece, 2017). A clear national priority for Italy should be improving the level of competitiveness, namely the ability to engage and successfully compete in “high-value” international markets capable of granting national prosperity (Dosi and Tranchero, 2020). Hardly any new enterprises capable of competing in these sectors have emerged in Italy for years, while at the same time former world leaders such as Olivetti/Telecom Italia or Ilva have long lost their position. In Italy, the few large and technologically sophisticated firms are participated from the State and are usually the remaining heritage of IRI and the state capitalism of the 1960s-1970s. Companies like ENI, Enel,

STMicroelectronics, Leonardo, Fincantieri, and few others are the last hopes we have to stay on par with the tumultuous advancement of technology. At the same time, the issue should be addressed at the level of the European Union, too. Successful cases like Airbus should push the European Commission to change its stance on cross-border mergers in high-tech strategic sectors where scale is crucial to compete on a worldstage.

Figure 7: AI-related patents of the world's top R&D investors by inventor's location, 2014-16 (Share in AI- related IP5 patent families)



Source: Dernis et al., (2019) using data from JRC-OECD, COR&DIP© database v.2., 2019.

All these issues are even more pronounced if one focuses specifically on digital technologies. In areas like ICT, digitization, and digital platforms numerous large global market players have developed in the USA, and in China, both countries now leading the development of these technologies. However, only 15 percent of digital platform companies worth over a billion dollars were born European, compared to 46 percent in the United States and 35 percent in Asia (Evans and Gawer, 2016). With the only exceptions of SAP, Spotify, and Delivery Hero, this is depressing evidence that Europe lags much behind in the digital economy. To compete against large American and Chinese competitors, the European Commission needs to modernize their thinking and recognize that scale is a basic requirement for success in the digital economy and does not per se lead to harming consumers. However, the large gap in technologies such as

artificial intelligence (see Figure 7) suggest that more targeted direct measures could even be warranted to catch-up with the technological frontier.

Key points:

- Major environmental and technological challenges require corporate actors that can sustain the necessary investments in innovation and technological capabilities.

- Countries lack ingenter prises of a certain critical mass to invest in new technologies and deal with the international competition are shut out of an important part of the global market.

- A national priority for Italy (and Europe) should be improving the level of competitiveness, namely the ability to engage and successfully compete in “high-value” international markets capable of granting national prosperity.

Science policy is precondition of industrial and innovation policy, but not the same thing

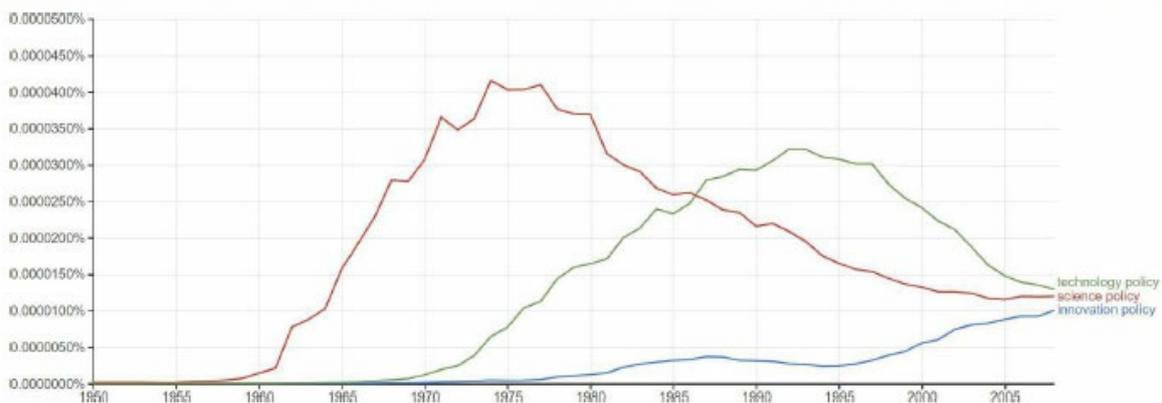
The COVID-19 pandemic has brought back attention to science and the need to propel scientific progress. Faced with the reality of rising deaths and lockdowns, the wider public seems now much more aware of the importance of funding scientific research in order to accumulate the scientific capabilities needed in times of crisis. At the same time, scientific governing bodies are struggling to find ways to adequately tackle this new challenge, as the recent resignation of Mauro Ferrari as head of the European Research Council (ERC) shows. His idea of setting up “top-down COVID-19 grants” was strongly resisted by the ERC organization, traditionally engaged in financing bottom-up research. The trade-off is clear: investigator-initiated research allows to pursue curiosity-driven questions, possibly leading to better science, but with the risk of neglecting key areas of inquiry where progress would benefit society the most. If society needs a vaccine against coronavirus, or new clean technologies to spur productivity and save the environment, why should we finance decentralized curiosity-driven research?

Indeed, similar debates on the social function of science and how to best organize the scientific enterprise are not new. In 1939, John D. Bernal published an essay arguing against the ideal of “pure science” as something that should just be concerned with knowledge advancement irrespectively of societal needs. This contrasts with the classic statements of figures like Michael Polanyi and Vannevar Bush, who defended scientists’ right to be shielded by any undue

political pressure in their work. With the essay “Science-The Endless Frontier”, Bush outlined the creation of what is now the National Science Foundation(NSF).

Its basic principle is that the scientific community ought to self- organize itself, in the sense that the allocation of research grants is governed by a panel of experts on scientific merit only and without political oversight. This is indeed the same funding model of the ERC. Overall, it appears clear that the Bush’s vision emerged victoriously and set the basic blue print adopted by similar agencies through out the world.

Figure 8: evolution of the terms used in the public debate on science and innovation over time



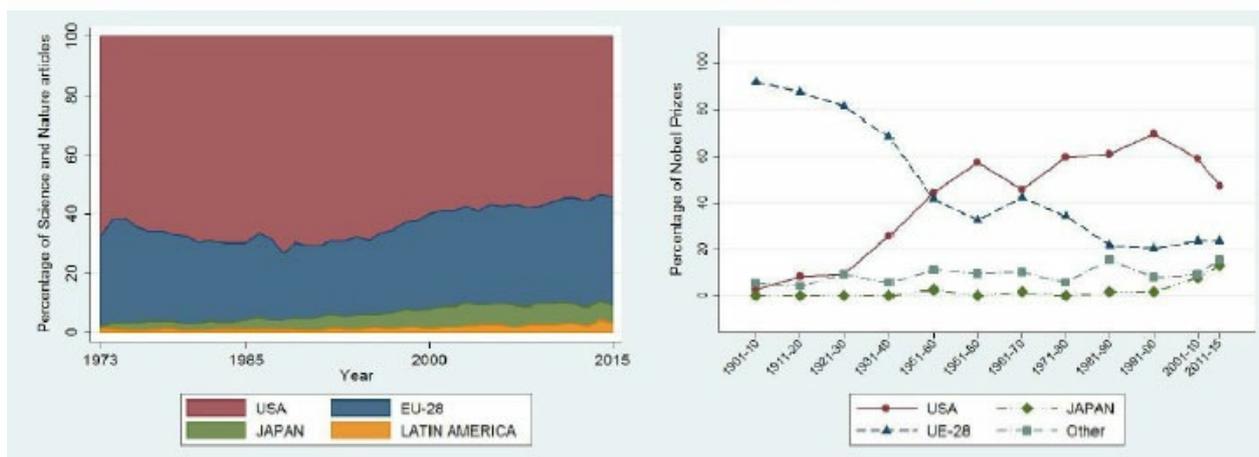
Source: own elaboration using Google N-Grams data

Still, the consensus on this principle for funding scientific research has been eroding even before the Covid- 19 pandemic. Over time, OECD countries have increasingly questioned the utility of investments in basic science, increasingly asking justification in economic terms for public spending in research. Gradually, scientific progress has lost its ability to justify itself, and it has become nothing more than any other government outlay that needs a cost-benefit analysis. As argued by Godin (2019), this has meant a gradual marginalization of basic research in the policy debate, increasingly focused on applied research. The new mantra is now financing science insofar this spurs innovation. Figure 8 shows the evolution of the public discourse on policies for

science and technology, showing how the concerns of policymakers have shifted toward applied settings. The last example of this trend is a recent bi-partisan bill discussed at the U.S. Senate, which plans to transform the NSF into the National Science and Technology Foundation (NSTF), which would have a new mandate much more focused toward technological development.

But why would this change be an issue, if the final objective of achieving sustained economic growth does not change? In essence, the risk is that an increased focus on applied topics by government and universities could lead to an under-supply of fundamental scientific research, which by definition is the basis upon which applied work is built. Basic research is inherently high-risk and “open-ended”, both characteristics that make it unappealing to private firms seeking short term advancements. Evidence shows that firms are increasingly shifting away from performing basic research (Arora et al., 2019), despite its importance for corporate innovation activities (Cohen et al., 2002). Historically, there has been an implicit division of labor between firms and the public sector, with the latter providing the scientific common on which industrial innovation could happen (Azoulay et al., 2019). Changing this balance could prove extremely harmful to the innovation systems of advanced economies (Arora et al., 2020).

Figure 9: county shares of papers published on top-journals *Science* and *Nature* and of Nobel prize winners as proxies of high-quality scientific production



Source: own elaboration from ISI Web of Science and http://www.nobelprize.org/nobel_prizes/

In Europe, this debate took place when dealing with the purported “European Paradox”, namely the conjecture that despite playing a leading role in terms of scientific excellence, Europe lacks the capacity of the United States to transform its excellent scientific output into innovation and economic growth. In this perspective, the only thing that Europe would need to get back to a path of productivity growth would be fostering technology transfer from academia and spurring industrial exploitation of its scientific results. Unfortunately, the very premises of this seeming paradox are not even there, as discussed by Dosi et al. (2006). Beyond the surface, it appears that Europe is still lagging behind the US in most scientific areas: simply counting the scientific articles written in the EU without accounting for their quality is profoundly misleading. If one does this simple adjustment, for instance looking at top journals only or the reception of Nobel prizes, the United States still shows a clear leadership in high-quality science (Figure 9). Likewise, the industrial structure of Europe is still very skewed toward traditional sectors, and most attempts to establish high-tech clusters have been unsuccessful over time (Dosi et al.,2006).

Therefore, instead of insisting on creating more links between industry and

academia, the focus should be on having dynamic and competitive industrial and research systems; the latter being precisely the role of science policy. If there is one lesson that we should learn from the emergence of Silicon Valley, is that good science creates its own demand. The remarkable clustering of ICT and digital companies in the San Francisco Bay area has hardly anything to do with technology transfer offices but can be traced back to the excellent research (and training) carried out in the neighboring top-notch universities.

But how could Europe (and Italy) design science policies that both allow researchers freedom to excel in their chosen area of interest, while also channeling resources toward emergent technologies or societal needs? The first thing to acknowledge is that any serious scientific policy could not take place but on a European scale. The large costs and the major advantages of uniting talent across-borders naturally lead to adopting a European perspective on this issue. One idea could be reframing the mission-driven paradigm proposed by Mariana Mazzucato into a purely scientific endeavor. The challenge would be selecting several unexplored but promising areas and allocate funds in thematic calls that do not constrain investigators' ideas or approaches, as long as they loosely fall in the scope of the scientific mission. These missions should be centered on entirely unknown paradigms, not on emerging technologies that simply lack full development (e.g. nanotech). The time horizon for these programs would necessarily be very long as justified by their focus on basic research only. In a nutshell, policymakers should aim at creating a funding body that co-exists and complements existing European programs like ERC (investigator-initiated research) or the Framework Programs (the thematic applied research and development). These scientific missions should aim at advancing the frontier on fundamental scientific areas, adopting a portfolio approach: while the majority of these endeavors will likely fail, the chances that the next major technological paradigm is born in Europe outweighs the costs.

Key points:

- OECD countries have increasingly questioned the utility of investments in basic science, despite its role to propel technological innovation.
- This is particularly true in Europe, where policymakers directed their attention more on technology transfer activities than in nurturing the scientific common on the basis of the purported “European Paradox”.
- A workable approach could be designing “scientific missions” to tackle fundamental societal issues that require open-ended and risky research, which however could spurt major breakthroughs.

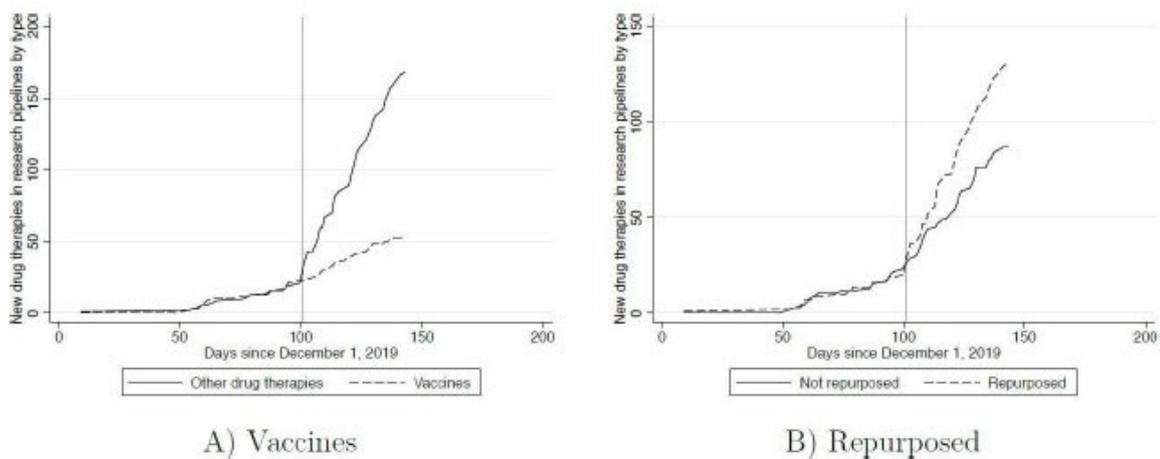
Thinking of new governance for innovation

Crafting and enacting effective innovation and industrial policies is a task that requires several years, and possibly decades. This is hardly conceivable in a country plagued by political instability, where governments rarely last over a year. The constant churn of ministers in charge of setting the agenda on industrial matters prevents any plan to be fully carried out and evaluated in its effects. Lessons are never learned, and the only measures that showed some stability over time are generic subsidies or lending programs (e.g. the “New Sabatini” law). The intrinsic dynamism of the industrial sector does indeed require policy flexibility and experimentation, but this is quite different from a radically changing course of direction every couple of years or focusing only on short-term measures whose effect can be seen before the next electoral cycle.

Designing new governance for innovation is probably the most challenging task of all, as it requires to balance well-crafted incentives with a bureaucratic apparatus that is flexible but accountable. An apparently simpler solution would be relying exclusively on tax-based support for research and development. Indirect and “technology- neutral” forms of support like R&D tax credits avoid bureaucratic hassles or arbitrariness in allocation, and they do indeed hold an important position in the innovation policy toolbox. Nevertheless, they are hardly enough in isolation, as a vivid example can help to clarify. Figure 10 shows the number of Covid-19 drug therapies in research pipelines, by drug classification (Bryant et al., 2020). The rate of Covid innovation appears very rapid, but competitive forces are pushing that research in a very short-term direction. Covid-19 research pipelines are skewed towards repurposed drugs and non-vaccines, both quicker and less costly to develop but less well-targeted.

Economic incentives are thus pushing pharmaceutical firms to race for finding a cure, with relative neglect of high social value innovations such as vaccines (Bryant et al., 2020). This exemplifies a particularly relevant instance where indirect R&D subsidies would fail in their goal since they would encourage firms to focus on areas with the highest private benefits but not necessarily the highest social ones.

Figure 10: Number of Covid-19 drug therapies in research pipelines, by drug classification



Source: Bryan et al., (2020)

Government-directed grants could easily target the development of solutions to specific problems. Such as vaccines for Coronavirus. Despite having a bad reputation, well-crafted targeted subsidies could complement measures like automatic tax credits. Having both automatic R&D subsidies and direct funding of risky or exploratory projects seems like the best option to exploit complementarities among those two kinds of policies (Pless, 2019). In certain areas, the nature of high-value inventions is often widely known and there is less ambiguity on the allocation of targeted subsidies. In this vein, direct government R&D grants can in principle focus on high- spillover R&D that creates benefits that are more public. Recent empirical findings document how military R&D spending (Moretti et al., 2019) and grants aimed at small businesses (Howell, 2017) have positive impacts on firms' revenues, growth, and patenting.

Administering this kind of policy would need the creation of an ad-hoc specialized agency. Ideally, such an agency would receive a clear mandate with verifiable objectives, as well as a guaranteed pluriannual budget. The latter would be very important to allow careful planning and to avoid funding uncertainty in the case of ministerial turnover. This agency should be led by experienced policymakers, have a relatively bi-partisan profile, and be entrusted with the operative management of the many programs now executed by the Ministry for Economic Development. A key advantage over the latter, though, would be its intrinsic long-term horizon, shielded by political turbulences. The well-known cases of DARPA and similar agencies (Azoulay et al., 2019) provide a natural starting point, even though replicating anything similar in Italy would require a complete change of the paradigm currently used to design state bureaucracies. For instance, DARPA enjoys incredible flexibility to experiment and risk-taking, both crucial elements to “think outside the box”, but antithetic to the cumbersome hiring practices and vertical structures of the Italian public sector. A second challenge pertains to the choice of topic to fund with targeted subsidies. In the absence of a silver bullet, this would ultimately remain a political decision where the consultation of a panel of science and industry experts could be of great help.

Key points:

- Extreme political instability prevents design and enactment of long-term policies, a problem particularly relevant in science and innovation realms where the horizon is necessarily long.

- Italy would benefit from the creation of an ad-hoc specialized agency, possibly following the well-known best practices introduced by DARPA and similar endeavors.

- The key objective should be financing early stage and risky projects with targeted grants that however fit into a broader national innovation strategy.

Conclusions: let's start the debate for the next decades

The objective of this policy essay has been outlining a number of principles that should inform the design of a comprehensive industrial and innovation policy for Italy. This has been done by bridging the gap between academic research and the policy arena. Recent research in economics and management has greatly enhanced our understanding of innovation dynamics, and what kind of policies can or cannot spur innovation-led growth. All too often laws and policy measures are informed by preconceived assumptions that are outdated or simply wrong for Italy.

As an example, consider the so-called “patent box”, a measure to lower taxation on revenues derived from intellectual property rights. Despite enthusiastic adoption across many OECD countries, recent evidence has found it has no effect on the rate and quality of innovation (Gaessler et al., 2020). Patent box policies are based on theoretical hypotheses that are simply not supported by the available data. Indeed, there is no conclusive evidence that patents themselves are useful to encourage innovation, and historical examples abound of countries that did not enforce intellectual property rights but managed to achieve sustained innovation. Still, an excessive emphasis on patent strengthening and patent policies is quite common in OECD countries. For instance, among the many useful measures of Industry 4.0, one part of the policy was specifically aimed at the introduction of a patent box regime in Italy. The measure has since then been renewed and even reinforced by subsequent governments, with no attempt to evaluate its effects or discuss its costs and use. This strikes to me as the effect of a lack of evidence-based policy discussion, an

unfortunate classic in our country. The kind of policy discussion spurred by this first policy paper should aim at preventing similar measures from being uncritically adopted again in the future.

For too long a misguided rhetoric of “small is beautiful” and “we don’t need industrial and innovation policies” has blocked discussion and enactment of policies that could arrest Italy’s decline. This paper should constitute just the beginning of a fruitful debate that goes beyond the sweet illusions of received common sense. As such, it has not to be taken as embodying truths set in stone; rather, it hopes to be a provocative (albeit thoughtful) essay that will spark a policy debate capable of designing a better future for Italy.

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