Introduction to the Special Issue PE/JEP *"Industrial policies in Europe and other advanced countries: scope, instruments, case studies and critical issues"*

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Foreword

As guest editors of this Special Issue of PE/JEP we have selected a small number of rather detailed assessment of contemporary history of domestic industrial policies in the international context. The four papers included in this Special Issue can be seen as three case studies of "sectoral" innovation policies (broad band, wind energy, biotechnology) with a strong emphasis on country institutional features and policy instruments, together with one "horizontal" case of industrial policy in a specific country context (innovative startups in Italy).

The heterogeneous theoretical background (industrial organization, evolutionary theory of the firm, economics of innovation, development) provides a somewhat unifying hidden thread of these case studies, without becoming a subject of analysis per se. This approach has been our intentional editorial choice and we are fully aware of its limitations.

After very short non-technical summaries of the four papers (Section 1) we try to present a rather synthetic assessment of our personal views (largely shared among us even with partial minor disagreements) about the increasingly hot debate on the nature, limitations and desirable perspectives of industrial policy today. We argue for a non-ideological forward-looking role of governments as active players in helping domestic entrepreneurial resources not only to fully exploit inherited comparative advantages but also to face structural uncertainties and discover own potential competitive advantages in a rapidly changing international context (Section 2).

1. Non-technical summaries of the four papers

The paper "Fiber to the people: the development of the Ultra-broadband network in Italy", by Michele Polo, Carlo Cambini and Antonio Sassano, after a brief overview of the fiber-optic technological solutions aimed at providing high-speed broadband services to consumers ("next generation network"), covers some empirical evidence on the role of regulations in infrastructure-based competition. Then it dwells on supply and demand for broadband access in Italy compared to the European Digital Agenda, finally coming to an evaluation of the Italian government Master Plan approved in March 2015. The Plan assigns almost 95.000 cells (mini-territorial areas) to different Clusters according to different existing and foreseeable private infrastructure and related need for public support, in order to reach targets of fast and ultra-fast access for different percentages of the residential population. Given the high degree of heterogeneity in terms of infrastructural endowment and degree of competition among existing private and public players, the optimum allocation of public subsidies coherent with rules of state aid discipline appears extremely complex. The paper provides an eloquent example of how difficult is to find the appropriate combination of private incentives and non distortionary public tools in a market-oriented perspective, in a sector characterized by fast technological development, entry barriers and spatial spillovers.

In his paper "The role of industrial policies in the development of a competitive wind energy industry: the Danish and Chinese sectoral innovation systems" Enrico Botta provides evidence about convergence of environmental (green growth) and industrial policy targets in the special case of an innovative sector (wind turbines), comparing two rather different country "sectoral systems of innovation". Denmark has enjoyed the first mover advantage of advanced wind

industry since 1979, going through the classical industry life cycle (infancy, early adopters, selection of dominant design and subsequent industry concentration, gradual shift from product to process innovation). Such an evolution along the industry-technology cycle has been fostered by a full range of industrial policy tools (demand and supply): from strong incentives to individual users and cooperatives to feed-in tariffs and price-setting mechanisms establishing a link to other electrical generation sources, publicly supported R&D through a National Laboratory for Sustainable Energy, strict grid connection regulations.
The Chinese sectoral innovation system for wind turbines has been based on a mix of demand-pull and technology-push (including knowledge generation) instruments: strong tariff incentives to domestic demand; investment incentives leading to overcapacity; licensing technologies from foreign sources soon evolving into multiplication of domestic R&D centres; increasing patenting activity ending in SOEs' acquisition of foreign licensors; national testing laboratories; generous concessional loans by China Development Bank to emerging markets wind farms favouring the Chinese foreign expansion.

Luigi Orsenigo's paper "Industrial policies in Europe and other advanced countries: biotechnology" starts with a quick historical overview of American early start (Genentech 1976) and subsequent developments of an outstanding science-based technological industry, in which public R&D funding and availability of venture capital financing have jointly supported an overall growth of knowledge-intensive geographical clusters of science and industrial platforms. Genetic engineering and molecular biology quickly formed the knowledge base for production of large as well as small molecules with multiple technological trajectories, ranging from pharmaceucals to agrobusiness to industrial applications. In the US the three pillars of the so-called Silicon Valley Consensus (commercialization of scientific research, strong IPR regime, venture capital and private equity) have been reinforced by the Bayh-Dole Act (1980) which greatly encouraged university patenting and licensing. According to Orsenigo, the Silicon valley consensus was itself the outcome of rather clear policy decisions: so that biotechnology (as we know it) is largely the offspring of an explicit industrial policy.
Europe has been unable to generate a revised version of the Silicon Valley Consensus, mainly due to less massive and concentrated public funding of large scale-high quality research base (excessive national fragmentation despite EU-funded programs), sluggish spread of venture capital with long-term profitability perspectives, smaller average size of biotech firms, greater obstacles to intra-European skilled labour mobility, more cumbersome regulatory processes, weaker entrepreneurial propensity by traditional academic researchers. At the same time the role of a strong IPR regime is increasingly under scrutiny both in Europe and the US, to the extent that strategic use of patents may discourage new areas of research by potential competitors, whereas norms and rules of "open science" foster new possibilities of major technological advances in biomedical research.

Drawing data from a special register introduced in 2012 by an Italian law, the paper "The special features of innovative start-ups in Italy" by Bank of Italy's researchers Stefania De Mitri-Paolo Finaldi Russo-Silvia Magri and Cristina Rampazzi perform an exercise of propensity score matching between 1700 innovative start-ups (ISUPs) in 2013 and a control sample of other startups drawn from Cerved database of about 100.000 firms . Innovative startups are defined according to different features such as age, size and propensity to R&D expenditures.
ISUPs are characterized by smaller size in terms of total assets and turnover but higher propensity to invest, higher incidence of intangible assets (patents, brands), higher liquidity ratios, higher level of capitalization (especially those that have received more financial support by business angels and venture capital), lower debt/assets ratios, lower share of non-financial (trade) debt, lower share of bank loans and short-term debt. Lack of time series on these data prevent a dynamic analysis of performance and of structural characteristics.

2. Redesigning modern industrial policies in Europe

In the aftermath of the Great Recession European economies remain stuck. Growth is expected by the IMF to be just 1.8% across the European Union in 2016, and only 1.5% in the Euro Area.[1] In addition to the weakness of demand, is the weakness of business investment, which remains well below its 2008 trajectory.[2] And given that the objective is not just growth, but growth that is *smarter*, more *inclusive* and more *sustainable*[3]—falling levels of innovation, rising level of inequality, and green policies that remain weak, unequally distributed, and non-systematic are surely not good news for the future of Europe's Horizon 2020 agenda.

The problem is a lack of both public and private investment. EU governments are, in the name of needed 'austerity' to 'balance the books', pursuing pro-cyclical spending policies, while companies continue to cut back, hoarding cash on their balance sheets or returning it to shareholders through dividends or buy-backs[4]. Both hoarding and share buybacks are at record levels.

The problem is a lack of expectations on future opportunities: animal spirits. This is a key insight of Keynes.[5] The motivation for firms to enter new markets or make investments in existing ones is driven by expectations of future gains.[6] But why are those opportunities not there? When both the public and private sectors are not investing (one due to austerity, and the other due to perverse effects of financial liberalization)—we might get secular stagnation. This is not due to exogenous factors, but endogenous to the (lack of) investment.

So the big question is: how can the desire to invest (animal spirits) be induced via policy? The conventional policy approach, advocated by the IMF and others, is either through incentives (via different types of tax cuts or lightening regulation[7], or through basic spending on public infrastructure to address market failures in the provision of public goods which can crowd in private investments. While infrastructure spending is welcome (and a good idea when interest rates are so low: according to the IMF, they can also produce positive impacts on public finances, due to their effects – due to large multipliers – on gdp)[8], its impact on industrial transformation ~~it~~ is almost zero. The alternative to austerity must be more than tax incentives, better administrative regulations, building bridges and roads and so on. What businesses are lacking is a sense of where the future opportunities will lie. Through some sort of mission-oriented policy far-sighted states can do much more to provide the direction that is needed to unlock investment. Indeed, it is these types of investments that got us the IT revolution, the biotech revolution, the nanotech revolution and today are bringing us the greentech revolution (too slow)[9].

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[1] International Monetary Fund. 2016. *World Economic Outlook: Too Slow for Too Long*. Washington, April

[2] International Monetary Fund. 2015. *World Economic Outlook: Uneven Growth—Short- and Long-Term Factors.* Washington (April), p113

[3] EC Horizon 2020 strategy http://ec.europa.eu/europe2020/pdf/europe_2020_explained.pdf (accessed 20/5/2016)

[4] Lazonick, W. (2014). Profits without prosperity. *Harvard Business Review*, *92*(9), 46-55.

[5] Keynes, J.M., 1936. *The general theory of employment, interest and money*. New York: Harcourt, Brace and Company.

[6] Dosi, G. and Lovallo, D., 2007. 'Rational entrepreneurs or optimistic martyrs? Some considerations on technological regimes, corporate entries, and the evolutionary role of decision biases', in Garud et al., eds. *Technological Innovation: Oversights and Foresights.* Cambridge: Cambridge University Press, pp. 41–68.

[7] IMF, *Fiscal policies for innovation and growth*, in Fiscal Monitor, April 2016

[8] IMF, *World Economic Outlook,* October 2014

[9] Mazzucato, M., 2013. *The entrepreneurial state: Debunking the public vs. private myth in risk and innovation.* London: Anthem Press.

Market failure theory assigns only a limited role to the state – to 'fix' markets. Through the influence of mainstream public choice theory, it focuses on the risks of state action rather than potential role of market guidance. This approach can lead to incremental change. But while innovation has a rate, it also has a direction – and the blind direction chosen by the market's (more or less) invisible hand ~~is~~ may well often be sub-optimal. It is not the way that major breakthroughs happened in the past, and it is not the way we are likely to address the major challenges of the future. Examples from history show what is possible when governments act in visionary ways to design new futures, solve public problems and spur the creation of new markets in a business environment fraught with uncertainty. This is based on a very different understanding of the role of the state and of the relationship between the state and market actors in the wealth creating process.

From defense-related early computer development to Apollo missions that put a man on the moon, to huge investments that lay behind the creation of the Internet and entire new sectors like biotechnology, nanotechnology, and the emerging green technology revolution, government agencies have done much more than simply address market failures or only 'de-risk' an innovative private sector. In the US, but gradually in other countries such as Japan-Israel-Taiwan-Singapore-South Korea, they acted boldly, taking risks, to create a future environment that market actors could not have created alone. Public organisations in the United States from NASA to DARPA to the National Institutes of Health invested along the entire innovation chain, courageously defining new high-risk directions. Traditional cost-benefit analysis and market failure justifications used by conventional economic theory would very likely have halted these investments from the very start. Furthermore, all these transformational changes required active investments on both the supply and demand side.[10]

Indeed, innovation policy can learn a lot from these stories. Consequently there has been a call in recent years for a return to mission-oriented policies as a way to address grand societal challenges[11]. In the past, missions were often related to a well-defined outcome, such as putting a man on the moon, which entailed mostly technological challenges. Some researchers have claimed that modern missions are more complex because there are fewer clear technological challenges and outcomes are less clearly defined[12]. Contemporary missions aim to address broader challenges that require long-term commitment to the development of many technological solutions and "a continuing high rate of technical change *and* a set of institutional changes"[13]. One could add that these challenges also require changes at the societal/national systems level.

The role of an active industrial policy can be clearly seen in all three case studies presented in this Special Issue (broad band, wind energy, biotech).

However, there is a clear difference between the American and the European situation. in the former case, research and industrial policies are performed at the federal level by the Federal Government (with state government playing a complementary role with reference to "local" industrial policies). In Europe there is a complex multilevel governance.

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[10] Mazzucato M. (2016) "From Market Fixing to Market-Creating: A new framework for innovation policy", Special Issue of *Industry and Innovation:* "Innovation Policy – can it make a difference?" Vol. 23(2).

[11] Mowery, D. C., Nelson, R. R. and Martin, B. R. (2010) 'Technology policy and global warming:
Why new policy models are needed (or why putting new wine in old bottles won't work)', *Research Policy,* 39(8), pp. 1011-1023

[12] Foray, D., Mowery, D. and Nelson, R. R. (2012) 'Public R&D and social challenges: What lessons from mission R&D programs?', *Research Policy,* 41(10), pp. 1697-1902.

[13] Freeman, C. (1996) 'The Greening of technology and models of innovation', *Technological Forecasting & Social Change,* 53(1), pp. 27-39. p. 34

At the European level, the EU budget, via the Horizon 2020 programme (corresponding, for the 2014-20 to the previous "Framework Programmes") promotes and finances some co-operative research and innovation projects. however, the size of the Horizon 2020 is limited (around 70 billion euros for the 7 years), not comparable with the financing of R&I in the United States (as well as in China or Japan). Morevoer, the EU Commission has a notable influence on the European industrial structure due to the state aid regulation and decisions. One has to keep in mind that state aid regulations were designed, and are implemented, with the goal of promoting market competition and access, with no consideration of the role that can be played by European firms in the international scenario.

At the national level, all European countries perform national industrial policies[14]. Their goals and instruments are markedly different, but they all share, even in the German case, a size of the "national innovation system" that is much smaller than the American, the Chinese and the Japanese ones. Finally, one should also add the role of regional authorities: in some case, notably germany and italy, their role if far from neglegible. The UE Commission itself promotes the role of regional government (e.g. in designing and implementing smart specialization strategies).

So, in a nutshell, what we can learn from the American economic history cannot be transported as such – as a policy implication – to Europe, given the completely different institutional settings. Orsenigo's paper discusses some of these issues concerning the US-EU comparison in the biotech case.

As it is well known, this calls for pan-European R&I initiatives, to reach scale and scope comparable to international competititors. EU initiatives, to be financed by a larger EU budget and managed by EU authorities, that appear to be hardly conceivable in the present, confused, European political scenario.

However, this is not at all to say that national technological and industrial policies cannot be successfully performed, in Europe, at the national level. Enrico Botta's paper provides a useful analysis concerning a case in which a small European country (Denmark) successfully managed to become a technological leader in the field of wind energy. The German experience provides both very interesting histories of technological/industrial policies and a strong commitment (the industry 4.0 plan) for the future.

A plausible mission oriented industrial policy is no longer today about financing a limited set of particular sectors (vertical policies), often subject to risks of "government failure" due to capture by private special interests and/or disguised political rent-seeking power. The bad Italian experience with degenerate State-owned system in steel and chemical sectors after the glorious early postwar period is a case in point.[15] Neither a modern industrial policy must be restricted to occasional response to specific firm crisis situations hitting specific territories and

[14] Naudè W. (2010) Industrial Policy: Old and New Issues, Working Paper 2010/106, United Nations University; OECD Development Centre (2013), Perspectives on Global Development 2013. Industrial Policies in a Changing World. Shifting up a Gear, OECD, Parigi; Wade R.H. (2012), Return of Industrial Policy?, International Review of Applied Economics, 26(2); Warwick K. (2013), Beyond Industrial Policy: Emerging Issues and New Trends, OECD Science, Technology and Industrial Policy Papers, n. 2; Onida F., Viesti G. (a cura di) (2016) Una nuova politica industriale in Italia. Investimenti, innovazione, trasferimento tecnologico, Passigli, Firenze

[15] An analysis of successes and failures of national industrial policies in Europe is in Owen G. (2012) Industrial policy in Europe since the Second World War: what has been learnt?, ECIPE Occasional Paper 1, The European Centre for International Political Economy, Bruxelles.

challenging the available resources of the welfare State. Nor these policies can only focus on horizontal framework policies.

It's more about coming up with large (mission oriented) public programs of pre-competitive R&D cutting through different sectors, using general purpose technologies to foster productivity increases across the economy, and setting up collaborations among individual firms and between the public and private sector in new ways. Fundamentally it requires patient finance from the public sector to invest in long run, high risk capital intensive areas—where risk averse firms are too fearful to tread. Only such a patient financing may support the entrepreneurial "self-discovery" of own potential comparative advantages in directions that the private sector is unwilling to explore, due to basic outcome uncertainty and too long time horizons for reasonable profitability. There is ample room for information externalities and related public-private "strategic coordination" in presence of scale economies. Essential conditions for this type of virtuous role of the State as catalyser of innovation are a strict surveillance on risks of corruption and rent-seeking, as well as the ability to "pick the loser" whenever a given program reveals itself unable to deliver the expected results in due time. As Dani Rodrik puts it "the right way of thinking of industrial policy is a discovery process – one where firms and the government learn about underlying costs and opportunities and engage in strategic coordination (…) It is the information externalities generated by ignorance in the private sector that creates a useful public role" [16]

There is an increasing awareness among institutions such as OECD and the European Commission[17], as well among some private business observatories,[18] that a return to decent rate of growth of total factor productivity in Europe and elsewhere must target greater interconnectivity among firms as well as between firms (large, medium, small) and public research institutions. The same holds for a greater degree of international integration.[19]

Even the liberal-oriented Monti report for Barroso in its chapter "Why state aid and control matters" comes to say "There is also a consensus that an EU action should have some vertical elements, helping national policies to focus on selected highly promising sectors, such as energy, innovative industries and clean vehicles, without forgetting the needs of manufacturing industries. The EU should move ahead to formulate its new conception of an active industrial policy to complement the relaunch of the single market"[20]

Historically, when the public sector leads as a bold, market-creating risk-taker, private sector investment follows. In his desire to get innovation going for green as it did for IT, Bill Gates recently said: government must lead, only then will the private sector follow **(I'LL ADD TWO**

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16 Rodrik, D., Industrial policy for the twenty-first century, in Rodrik D., (2007), *One economics, many recipes: globalization, institutions, and economic growth,* Princeton University Press, ch. 4. It draws heavily from the seminal paper by HausmannR. And Rodrik D., (2003) Economic development as self-discovery, *Journal of Development Economics, 72: 603-33.* See also Aghion P.,Boulanger E. and Cohen S. (2011), Rethinking industrial policy, Bruegel Policy Briefs, June.

17 Warwick K. (2013), Beyond industrial policy. Merging issues and new trends, OECD Science Technology and Industry Policy Papers, 2; Craft N. and Hughes A., (2013)Industrial policy for the medium to long-term, CBR Working Paper, n. 455; Stiglitz J.E. and J. Lin Y. eds. (2013), The industrial policy revolutionI. The role of government beyond ideology, New York, Palgrave MacMillan,; Dutz M.A., Kuznetsov Y., Lasagabaster E. and Piklat D,, eds., (2014)Making innovation policy work. Learning from experimentation, OECD-World Bank (2014); EC Commission, For a European industrial Renaissance, COM (2014), 14 Final; EC Commission (2014), A vision for the internal market for industrial products (and related Staff Working Documents); European Parliament (2015), EU industrial policy. Assessment of recent developments and recommendations for future policies. Study for the ITRE Committee.

18 Confindustria Centro Studi, Scenari industriali, giugno 2014: "Si tratta di interventi di politica industriale per loro stessa natura selettivi, vista la scarsità delle risorse a disposizione dello Stato, dove però la selettività non ha come obiettivo singoli sub-settori dell'economia o singole imprese (i cosiddetti campioni nazionali), ma riguarda innanzi tutto le traiettorie di cambiamento, sia nei bisogni dei consumatori sia nelle tecnologie disponibili, che si intende intercettare orientando lo sviluppo del sistema produttivo e identificando a cascata le filiere produttive interessate,le loro potenziali interconnessioni e i problemi tecnici, organizzativi e normativi che ostacolano la creazione e la diffusione di nuove idee e prodotti".

19 OECD (2013), , Interconnected economies. Benefiting from global value chains; McKinsey Global Institute (2012), Manufacturing the future: the next era of global growth and innovation, November.

20 A new strategy for the Single Market at the service of Europe's economy and society, Bruxelles, 9 May 2010.

REFS LATER.) And just as direction provided by mission-oriented policy characterises the innovation process, so the deployment of innovation requires clear direction if it is to unlock investment. Given the right encouragement, the 'green' direction can provide the impetus for investment in the full deployment of ICT.[21]

The challenge for states then becomes:

- To create sufficiently credible, stable and enduring commitments in a given direction to channel investment, and provide any necessary complementary assets needed for private sector investment – laying down the tramlines for the deployment of new ideas.
- To ensure the availability of patient committed finance through public funding, such as state investment banks or public venture capital funds, but also from stimulating sources of patient *private* sector finance; and
- To set rules of the game which encourage close responsible interactions between economic actors, reward firms which take a longer-term offering a broader perspective on the value they create, and supplying a fair balance of risk and reward to different actors.

The horizontal dimension of an active industrial policy must not overlook two fundamental ingredients that specifically apply to the European context of highly fragmented institutions and territories.

First, special care must be given to the design and implementation of suitable channels for transfer of scientific and technological knowledge (Universities, public research centres) to business firms' innovative activity. Much of the "European paradox" (lot of scientific excellence not enough reflected in business leadership and industrial competitiveness) has to do with the relative weakness of government-backed institutions equipped for supplying fluent pervasive mechanisms of "technology transfer" to medium and low size firms. The German tradition of complementary action by Max Planck institutes and Fraunhofer societies are a good benchmark in this respect. Similar examples may be found in the Dutch TNO and the newly designed British "Catapult Cenrtres".

Second, the more or less rich battery of public horizontal fiscal and financial incentives to business investment and employment should aim at encouraging networks of interconnected firms, each of them often well endowed with human capital, but too small in size for achieving a critical mass in global competition. Again, governments can draw some lessons from more or less successful experiences of "Technology clusters" which manage to attract innovative firms of different size, as well as institutions and individual talents. As it is well known, even in a digital age geographical proximity keeps playing a crucial role in fostering spillovers of ideas, knowledge and managerial skills.[22]

[21] Perez, C. 'Capitalism, Technology and a Green Global Golden Age: the role of history in helping shape the future', in Mazzucato, M. and Jacobs, M., eds. *Rethinking Capitalism* (forthcoming)**;** and ……

Mazzucato, M. and Perez, C. (2015), "Innovation as Growth Policy," in *The Triple Challenge: Europe in a New Age*. Fagerberg J., Laestadius S., and Martin B. (eds.) Oxford University Press: Oxford

[22] Patel P. (1995), The localized production of global technology, in "Cambridge Journal of Economics", 19 (I), 141-53; Moretti E. (2012), New geography of jobs, Houghton Mifflin Harcourt.