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MONTHLY REVIEW OF ACADEMIC LITERATURE ON RESEARCH AND INNOVATION AS SOURCES OF GROWTH

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1. The future of productivity

Criscuolo C, Andrews D (2015). The future of productivity. OECD. Directorate for Science, Technology and Innovation.

- To sustain productivity growth: Foster innovation at the global frontier and facilitate the diffusion of new technologies to firms at the national frontier
- Create a market environment where the most productive firms are allowed to thrive, thereby facilitating the more widespread penetration of available technologies
- Reduce skill mismatches

Productivity growth slowed in many OECD countries even before the crisis, which amplified the phenomenon. The slowdown in knowledge-based capital accumulation and decline in business start-ups over this period also raises concerns of a structural slowing in productivity growth. Productivity growth at the global frontier has remained relatively robust in the 21st century, despite the slowdown in average productivity growth. However, firms at the global frontier have become older, which may foreshadow a slowdown in the arrival of radical innovations and productivity growth. The rising gap in productivity growth between the global frontier and other firms raises questions about: i) the ability of the most advanced firms nationally to adopt new technologies and knowledge developed at the global frontier; ii) diffusion of existing technologies and knowledge from national frontier firms to laggards; and iii) the rise of tacit knowledge as a source of competitive advantage for global frontier firms.

Policies to sustain productivity growth include (see also Table 1):

- Improvements in public funding and the organisation of basic research, which provide the right incentives for researchers
- Global mechanisms to co-ordinate investment in basic research and related policies, such as R&D tax incentives, corporate taxation and IPR regimes
- Productivity growth via the diffusion of innovations at the global frontier to national frontier firms is facilitated by trade openness, participation in global value chains (GVCs) and the international mobility of skilled workers.
- Well-functioning product, labour and risk capital markets as well as policies that do not trap resources in inefficient firms – including efficient judicial systems and bankruptcy laws that do not excessively penalize failure
- A competitive and open business environment that favours the adoption of superior managerial practices and does not give incentives for maintaining inefficient business structures (e.g. via inheritance tax exemptions for family-owned firms)
- Stronger competition enables the diffusion of existing technologies to laggards, which underpins their catch-up to the national frontier.
- Innovation policies, including R&D fiscal incentives, collaboration between firms and universities and IPR protection, should be designed to ensure that they do not excessively favour applied vs basic research and incumbents vs young firms.

- Framework policies that reduce barriers to firm entry and exit and improve the efficiency of matching in labour markets can improve productivity performance by reducing skill mismatch.
- Reforms to policies that restrict worker mobility and amplify skill mismatch – e.g. high transaction costs on buying property and stringent planning regulations – and funding for lifelong learning will become increasingly necessary, to combat slowing growth and rising inequality.

Table 1. Synoptic table on the channels through which policies shape aggregate productivity

Key dynamics to be promoted	Relevant policies	Channels	Outcomes	*Relevance to performance of various firms:* Global frontier (GF)	National frontier (NF)	The laggards
1. Experimentation with new knowledge and technologies	Innovation policies (e.g. basic research, R&D fiscal incentives, IPR)	Promoting an efficient balance between applied and basic research.	Pushing the global technological frontier via more radical innovation and knowledge absorption from the science base.	VV	V	
	International co-ordination of innovation policy	Compensating firms for market failures in the provision of innovative effort.		VV	V	
	Framework policies (e.g. PMR, EPL, Bankruptcy & Judicial Efficiency, Financing and Openness)	Competitive pressures and creative destruction.	More experimentation. Innovative entrants bring new ideas and pressures incumbents to innovate.	VV	V	
			Enhanced market size to raise the returns to innovation.	V	V	
		Efficient resource allocation (see 3).	Entry into global markets enables interactions with the GF	V	VV	
			Lower skill mismatch, which increases the effective pool of skills to supply innovation	V	VV	
2. Diffusion of existing knowledge and technologies	Framework policies (especially PMR)	Competitive pressures	Greater market discipline incentivises technology adoption		VV	VV
		Compensating firms for market failures in the provision of innovative effort.	Presence of complementary KBC assets to facilitate technological diffusion		VV	V
	Basic research		Knowledge externalities from public research leads to more applied innovation in the private sector		VV	
	R&D fiscal incentives				V	V
	R&D collaboration between firms and universities	Knowledge transfer and spillovers	Allows new entrants, experimenting at small scale, to access research facilities.		V	VV
3. Efficient resource allocation (capital, labour and skills) and supply of skills	Framework policies	Channelling scarce resources to the most productive and innovative firms; exit/downsizing of inefficient firms.	Higher returns to commercialisation and implementation of new ideas, leading to more experimentation (see 1)	VV	V	V
			Lower the cost of business failure and exit to encourage risk-taking and experimentation (see 1)	VV	V	V
			Facilitates up-scaling and entry into global markets (see 1)	V	VV	V
	Housing policies		Lower skill mismatch (particularly over-skilling), which increases the effective pool of skills to supply innovation (see 1)	V	VV	V

Source: OECD Secretariat.

Notes: In the final three columns, "V" denotes "relevant" and "VV" denotes "highly relevant" for the particular firm at hand.

2. Where are we headed? Perspectives on potential output

International Monetary Fund (2015). World Economic Outlook: Uneven Growth—Short- and Long-Term Factors. Washington (April). http://www.imf.org/external/pubs/ft/weo/2015/01/pdf/text.pdf

- Potential output growth has declined since the global financial crisis
- Decline reflects impact of aging; lower capital and productivity growth

- Policy action required to boost productivity, foster capital growth, and offset the effects of aging

Potential output growth across advanced and emerging market economies has declined in recent years. In advanced economies, this decline started as far back as the early 2000s and worsened with the global financial crisis. In emerging market economies, in contrast, it began only after the crisis. The analysis suggests that potential output growth in advanced economies is likely to increase slightly from current rates as some crisis-related effects wear off, but to remain below precrisis rates in the medium term. The main reasons are aging populations and the gradual increase in capital growth from current rates as output and investment recover from the crisis. In contrast, in emerging market economies, potential output growth is expected to decline further, owing to aging populations, weaker investment, and lower total factor productivity growth as these economies catch up to the technological frontier.

The reforms needed to increase potential output vary across countries. In advanced economies, continued demand support is needed to offset the effects of protracted weak demand on investment and capital growth as well as on unemployment. Structural reforms and greater support for research and development are key to increasing supply and innovation. In emerging market economies, higher infrastructure spending is needed to remove critical bottlenecks, and structural reforms must be directed at improving business conditions and product markets and fostering human capital accumulation.

3. How does information technology improve aggregate productivity? A new channel of productivity dispersion and reallocation

Chun H, Kimb J-W, Lee J (2015) How does information technology improve aggregate productivity? A new channel of productivity dispersion and reallocation. Research Policy 44(5):999-1016.

- IT affects aggregate productivity growth.
- The IT intensity within an industry increases productivity dispersion among firms.
- The effect of IT on long-run productivity growth is greater in industries with efficient input reallocation.
- The allocative efficiency explains about one third of the difference in 5-year productivity growth of industries with similar IT intensity.

Using U.S. firm-level data from 1971 to 2000, the paper quantifies the importance of production input reallocation in explaining the information technology (IT) driven productivity growth. The paper finds that cross-industry variation in input reallocation explains more than 30% of differences in the 5-year productivity growth rates of industries utilizing similar levels of IT. The findings of the paper illustrate a new channel through which IT affects the aggregate productive growth and are consistent with recent papers that emphasize the destructive nature of technology innovation and the importance of firm-level reallocation in explaining aggregate productivity growth. The paper implies that policy makers should focus not only on implementing IT but also on instituting policies aimed at improving reallocation efficiency to maximize the effect of IT on productivity growth.

4. Small and medium-sized enterprises, intellectual property, and public policy

Nikzad R (2015). Small and medium-sized enterprises, intellectual property, and public policy. Science and Public Policy 42: 176-187

- SMEs do not use IP rights as effectively as large companies because of the low rate of innovation compared to large companies and the cost and complexity of the IP system
- Policy suggestions to support the use of IP by SMEs include:

- More active promotion of IP awareness and capacity building activities for SMEs
- Making, obtaining and enforcing IP rights should be less costly for SMEs
- Making IP (especially patents) a better tradable good

The paper studies the use of intellectual property (IP) rights by small and medium-sized enterprises (SMEs). It draws on different surveys and studies in selected countries, with an emphasis on Canadian SMEs, to compare the use and exploitation of IP by company size. The paper finds that despite the potential benefits of acquiring formal IP rights for SMEs, they use IP rights to a lesser degree than large companies due to several factors, mainly the low rate of innovation compared to large companies and the cost and complexity of the IP system. The paper also presents a framework to analyze whether there is a role for government to play in this area, and how the government could address this under-utilization of IP rights by SMEs.

5. Quality signals? The role of patents, alliances, and team experience in venture capital financing

Hoenig D, Henkel J (2015). Quality signals? The role of patents, alliances, and team experience in venture capital financing. Research Policy 44 (5): 1049–1064.

- Patents, alliances, and team experience help start-ups in attracting financing.
- They are potentially valued both as productive assets and as quality signals.
- VCs rely on research alliances as indicators of technological quality.
- Patents impact VC decisions as property rights, not as signals of technology quality.

Observable resources, particularly patents, alliances, and team experience, are known to affect a start-up's ability to attract venture capital financing. In this context they potentially fulfill a twofold function: as productive assets and, likely, as signals of characteristics of a venture that are not observable at the time of assessment. In particular, patents, alliances, and team experience may serve as signals of the unobservable quality of a venture's technology. Most existing studies based on firm-level transaction data cannot disentangle signaling from productive effects. Using a conjoint-based survey among 187 European and U.S. venture capitalists, the paper finds that venture capitalists rely on research alliances and, partly, on team experience as signals of technological quality. While patents affect the venture capitalists' decision making in their property rights function, the study finds no indication that they serve as technology quality signals.

6. Do the effects of R&D tax credits vary across industries? A meta-regression analysis

Fulvio Castellacci F, Mee Lie C (2015). Do the effects of R&D tax credits vary across industries? A meta-regression analysis. Research Policy 44(4):819-832.

- The study reviews the literature on the effects of R&D tax credits on firms' innovation: A meta-regression analysis (MRA) of a large number of recent studies.
- Estimated additionality effects are stronger for SMEs, service firms, and firms in low-tech sectors in countries with an incremental scheme.
- R&D tax credits seem to have stronger benefits for companies with low R&D intensity than for highly R&D intensive firms in technological advanced sectors.
- R&D tax credits favor the process of catching up of firms lagging behind the technological frontier rather than pushing the country's frontier further.

This paper presents a survey of the micro-econometric literature on the effects of R&D tax credits on firms' innovation activities. It focuses on one specific aspect, namely the sectoral dimension. The meta-regression analysis (MRA) sets up a new database collecting a large number of firm-level studies on the effects of R&D tax credits and investigates the factors that may explain differences in the estimated effects that are reported in the literature. The main result of the MRA analysis is that sectors matter. Specifically, the additionality effect of R&D tax credits is on average stronger

for SMEs, firms in the service sectors, and firms in low-tech sectors in countries with an incremental scheme. The paper proposes a framework to investigate why the innovation and economic effects of R&D tax credits vary across sectors and points out new directions and hypotheses for future research.

7. Internal and external effects of R&D subsidies and fiscal incentives

Montmartin B, Herrera M (2015). Internal and external effects of R&D subsidies and fiscal incentives: Empirical evidence using spatial dynamic panel models. Research Policy 44(5):1065-1079.

- The spatial and temporal dependence of private R&D investment is strong.
- Private R&D generates positive spatial spillovers.
- Direct subsidies and fiscal incentives are substitutes within a country.
- Fiscal incentives implemented by different countries are substitutes.
- According to their level of use, R&D policies have a non-linear (convex) effect on private R&D.

Most studies evaluating the macroeconomic effects of financial support policies on business-funded R&D use econometric methods that do not consider the existence of spatial effects, and generate biased estimates. This paper addresses and discusses this problem using spatial dynamic panel data methods. This provides new insights on the internal (in-country) and external (out-of-country) effects of both R&D subsidies and fiscal incentives. The paper uses a database of 25 OECD countries for the period 1990–2009. In relation to internal effects, for both instruments, it finds a non-linear relationship between their effect on private R&D and their level (suggesting the possibility of leveraging and crowding-out effects). The paper finds a substitution effect between the R&D subsidies and fiscal incentives implemented within a country. Concerning the spatial component, it finds evidence of positive spatial spillovers among private R&D investments. However, the results suggest the existence of competition/substitution effects between national R&D policies.

Table 1
Advantages and disadvantages of support.

Advantages	Disadvantages
Direct support	
• Adapted to target upon activities and projects where there is a significant gap between private and social returns to R&D.	• High administrative costs for both firms and public authorities.
• Theoretically, competition between firms ensures that public funds are used for the best R&D projects.	• Impossible to put into practice for a large number of projects.
• May be used to reduce the effects of economic cycles on firms' R&D investments.	• Causes distortions on the markets for the allocation of resources between different R&D fields and firms.
• May encourage cooperation and the transferal of technology thereby reinforcing knowledge externalities	• Project selection tends to reward lobbies. The pressure related to the result objectives of the established policies entails the risk of projects being selected due to their high success potential, i.e., projects with high private productivity carried out without any public funding.
• Allows the verification of costs entailed by measures.	
• May enhance the reputation of firms who have received financing thereby reducing their capital cost (SMEs).	• Numerous potential eviction sources, due to the fact that direct measures are targeted and affect returns to R&D.
Indirect support	
• Measures are more neutral as they encourage investment in R&D for all firms, particularly SMEs (although specific sectors may also be targeted).	• It is difficult to control the cost of financial measures.
• The firms themselves decide which projects they wish to invest in.	• The effects are limited for firms who do make sufficient profit or which invest heavily in R&D (large companies) because they do not reap the maximum benefit from the financial measures.
• Reduces the risk of public markets being rigged.	• Non-neglectable risk of eviction as these measures can reduce the cost of projects which would have been carried through anyway (particularly in the case of a large tax credit).
• Does not require a specific budget line as the cost is only expressed in terms of a loss of financial income.	• Financial incentives favor R&D projects with the highest short-term returns. Hence, projects with high social returns to R&D will not be favored by this type of measure.
• Implementation and management costs are relatively low.	
• Financial measures reduce the cost of R&D directly which theoretically reduces the potential eviction sources.	• Few knowledge externalities are generated as the firms choose the projects and cooperation is rarely a factor for eligibility.

Notes: Adapted of Carvalho (2011).

8. Education, training and skills in innovation policy

Borras S, Edquist C (2015). Education, training and skills in innovation policy. Science and Public Policy 42: 215-227.

- Competencies of firms are a crucial asset for their ability to innovate.
- General criteria for the (re)desing of innovation policy:
  - Creation, retention and attraction of competencies in a country or region (skill biased technological change)
  - The identification of the specific types of competencies that are needed in the present and in the future (instruments: statistics, survey analysis, foresight exercises)
  - Securing levels of absorptive capacity in firms and the innovation system as a whole (keeping a balance between internal and external competencies to avoid too much emphasis on internal sources of competences, but also too much dependency on external sources)

The main question of the paper is how governments are focusing (and must focus) on competence building (education, training and skills) when designing and implementing innovation policies. After a brief literature review, this paper suggests a typology of internal/external and individual/organizational sources of competences that are related to innovation activities. This serves to examine briefly the most common initiatives that governments are taking in this regard. The paper identifies three overall deficiencies and imbalances in innovation systems in terms of education, training and skills: the insufficient levels of competences in a system, the time lag between firms' short-term needs for specific competences and the long time required to develop them, and the imbalances between internal and external sources of competences in firms. From these, the paper elaborates a set of overall criteria for the (re)design of policy instruments addressing those imbalances.

9. Does governmental venture capital spur invention and innovation? Evidence from young European biotech companies

Bertonia F, Tykvova T (2015). Does governmental venture capital spur invention and innovation? Evidence from young European biotech companies. Research Policy 44(4): 925-935.

- The paper investigates whether governmental capital investors spur invention and innovation, by focusing on young biotech firms in Europe.
- Stand-alone governmental capital investors have no effect on invention and innovation.
- Governmental capital investors increase patenting when syndicating with independent venture capital investors
- Development-oriented governmental venture capital investors have a positive effect on invention, while technology-oriented governmental venture capital investors have a positive effect on innovation.

The paper explores whether and how governmental venture capital investors (GVCs) spur invention and innovation in young biotech companies in Europe. To gauge invention the paper focuses on the simple patent stock at the company level, while innovation is proxied by the citation-weighted patent stock. The findings of the paper indicate that GVCs, as stand-alone investors, have no impact on invention and innovation. However, GVCs boost the impact of independent venture capital investors (IVCs) on both invention and innovation. The paper concludes that GVCs are an ineffective substitute, but an effective complement of IVCs. The paper also distinguishes between technology-oriented GVCs (TVCs) and development-oriented GVCs (DVCs). It finds that DVCs are better at increasing firm's inventions, and that TVCs, combined with IVCs, support innovations.

10. Scientific yield from collaboration with industry: The relevance of researchers' strategic approaches

Julie Callaerta, J, Landonib P, Van Looyc B, Vergantid R (2015). Scientific yield from collaboration with industry: The relevance of researchers' strategic approaches. Research Policy 44(4): 990-998.

- The paper analyze the relevance of academics' strategic approaches to collaborations.
- Scientific leverage is higher when academics pursue a more proactive strategy. Proactiveness' is measured as the proportion of projects initiated by the researcher, as opposed to projects initiated by the partnering firm.
- Scientific leverage is higher when academics are selective.'Selectiveness' is measured as the frequency with which the researcher has, in the past, refused proposals for research collaboration with industrial partners.
- This impact is influenced by the amount of financial resources obtained from industrial partners.

The study analyses the relevance of academics' strategic approaches to collaborative projects with industry. While recent research indicates that combining scientific and entrepreneurial activities at the level of academic scientists is feasible, the literature has remained muted on the dynamics behind such successful combinations. Little is known about how researchers avoid conflicts of commitment and conflicts of interest as well as the so-called 'skewing' of research agendas. Based on survey data collected from engineering professors at two European universities (Politecnico di Milano, Italy: n = 117; and KU Leuven, Belgium: n = 70), the paper analyzes whether the scientific yield from collaborative projects with industry depends on the degree of proactiveness, selectiveness and novelty of research topics. The paper finds that the scientific leverage of collaborating with industrial partners is higher when academics pursue a more proactive strategy and are selective. At the same time, the findings of the paper reveal that this impact is indirect: selectiveness and pro-activeness influence the amount of financial resources obtained from industrial partners, while the scientific yield itself is contingent on these resources.

11. Knowledge flows and the absorptive capacity of regions

Miguéleza E, Morenob R (2015). Knowledge flows and the absorptive capacity of regions. Research Policy 44(4):833-848.

- The paper studies how absorptive capacity mediates the role of external knowledge flows on regional innovation.
- It looks particularly at the interactions between regions' absorptive capacity and cross-regional mobility and networks.
- It finds large regional heterogeneity in mobility and networks returns to innovation.
- Regions' absorptive capacity critically enhances the impact of mobility and networks on innovation.
- Results are robust to the inclusion of region fixed effects as well as spatial effects.

The paper assesses the extent to which absorptive capacity determines knowledge flows' impact on regional innovation. In particular, it looks at how regions with large absorptive capacity make the most of external inflows of knowledge and information brought in by means of inventor mobility and networks, and fosters local innovation. The paper uses an unbalanced panel of 274 regions over 8 years to estimate a regional knowledge production function with fixed-effects. It finds evidence that inflows of inventors are critical for wealthier regions, while it has more nuanced effects for less developed areas. It also shows that regions' absorptive capacity critically adds a premium to tap into remote knowledge pools conveyed by mobility and networks.