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

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1. Economic growth, human capital and structural change: A dynamic panel data analysis

Teixeira A, Queirós A (2016). Economic growth, human capital and structural change: A dynamic panel data analysis. Research Policy 45(8):1636-1648.

- This paper assesses the effects of human capital on economic growth, including the interaction of human capital with the industrial specialisation of countries.
- Human capital, structural change, and their interaction matter to economic growth.
- Mismatches between structural change and human capital have a negative effect.
- The paper confirms the need for integrated, multifaceted policies, involving education-science-industry.

Using a growth model which integrates variables from both the supply side and demand side, this paper assesses the direct and indirect effects of human capital on economic growth, including the interaction of human capital with the industrial specialisation of countries. Based on dynamic panel data estimations, the authors found that human capital and the countries' productive specialisation dynamics are crucial factors for economic growth. Moreover, the interaction between human capital and structural change in high knowledge-intensive industries impacts significantly on economic growth. However, the sign of this effect depends on the type of country and the period of analysis. Specifically, over a longer time span (1960–2011) and for more highly developed (OECD) countries, the impact of the interaction between human capital and structural change is positive. When the authors also include transition and Mediterranean countries over a shorter time period (1990–2011), they find that human capital significantly and positively impacts on the countries' economic growth but the effect of human capital via specialisation in high-tech and knowledge-intensive activities is negative. The latter result indicates that the lack of industrial structures able to properly integrate highly educated individuals into the productive system leads countries to experience disappointing economic returns.

2. Inverted-U relationship between R&D intensity and survival: Evidence on scale and complementarity effects in UK data

Ugur M, Trushin E, Solomon E (2016). Inverted-U relationship between R&D intensity and survival: Evidence on scale and complementarity effects in UK data. Research Policy 45(8):1474-1492.

- This paper studies the effect of R&D intensity on survival of R&D-active UK firms.
- The relationship between R&D intensity and firm survival follows an inverted-U pattern that reflects diminishing scale effects.
- R&D-intensity and market concentration are complementary in that survival time at a given level of R&D intensity is longer when firms are located in concentrated industries.
- Creative destruction in the industry and business lending premium have a negative effect on firm survival.

- Firms that grow faster than the industry median for a sustained period before exit experience increased failure rates.

This paper examines the effect of R&D intensity on survival of R&D-active UK firms. Existing evidence on the relationship between R&D intensity and firm survival is varied and often conflicting. The authors argue that this may be due to overlooking R&D scale effects and complementarity between R&D intensity and market concentration. Drawing on Schumpeterian models of competition and innovation, the authors address these issues by developing a formal model of firm survival and using a panel dataset of 37,930 R&D-active UK firms over 1998–2012. The paper finds that the relationship between R&D intensity and survival is subject to diminishing scale effects: survival increases with R&D intensity at decreasing rates and eventually declines when R&D intensity is above an optimal level. Furthermore, it finds that R&D intensity and market concentration are complements in that R&D-active firms have longer survival time if they are in more concentrated industries. Creative destruction as proxied by median R&D intensity in the industry and the premium on business lending have negative effects on firm survival. Firm age, size, productivity and growth are correlated positively with survival; but there is an optimal level beyond which size reduces survival time. Firms that grow faster than the industry median for a sustained period before exit experience increased failure rates, possibly due to absence of growth management strategies commensurate with high-growth ambitions. The onset of a crisis and currency appreciation are found to reduce survival time.

3. EU corporate R&D intensity gap: What has changed over the last decade?

Moncada-Paternò-Castello P. (2016). EU corporate R&D intensity gap: What has changed over the last decade? European Commission, Joint Research Centre, Seville, Spain.

- This paper provides insights into the evolution of corporate R&D and shows how and why business R&D intensity differs in different regions of the world.
- The results confirm the structural nature of the EU-US R&D intensity gap, which has widened in the last decade.
- The study shows a high concentration - sustained over time - of R&D investment in a few countries, sectors and firms.
- In the EU there are fewer smaller top R&D firms that invest more intensively in R&D.

This paper explores corporate R&D intensity decomposition by examining the effects of several parameters on R&D intensity and investigating its comparative distribution among top R&D firms, sectors and world regions/countries. It draws on a longitudinal company-level micro dataset for the period 2005-2013 and uses both descriptive statistics and decomposition computation methods. The paper confirms that differences in the structural composition of economies play a major role in the R&D intensity gap and finds that the structural effect even outweighs the positive effect of EU corporate R&D investment effort (intrinsic effect) in comparison with all regions/countries considered, except Switzerland. The study also confirms that the bulk of global private R&D investment is concentrated in high and medium-high sector groups (especially the pharmaceutical and biotechnology, technology hardware and equipment, and automobiles and parts sectors, and software and computer services), in a few countries/regions (especially the USA, the EU and Japan) and in a few companies. US companies with high cumulative R&D intensity, as is typical of high-tech sectors (i.e. R&D intensity above 5 %), dominate the full range of R&D investments. The bulk of the smaller top US R&D investors improved their cumulative R&D intensity in 2013 with respect to 2005. In contrast, the cumulative R&D intensity of the smaller top EU R&D investors remained largely unchanged. The paper concludes that there have been more dynamic changes in the structure of the US economy than in the EU economy in the last two decades. The economy in the USA moved in favour of higher-R&D-intensity sectors, in particular in ICT-related sectors, to a larger extent than in the EU, and this, in turn, was a major contributor in the difference in overall R&D intensity. The study shows that EU companies have only a weak presence, in terms of market share, in the high-tech sectors compared with their most direct competitors. Most of these sectors have been created in the last few decades (e.g. biotech, software, internet) by new firms. Younger and smaller US companies are more present – and show a greater capacity to grow – in high-R&D intensity sectors than similar companies in the EU. Such companies, if numerous and if they prosper in the (new) high-R&D intensity sectors, are able to drive the shift in the economic structure of a given country, hence reinforcing its technology base. Therefore, policy-makers

should consider tailored policies that address the barriers to the creation of new (high risk and oriented to solve societal problems) R&D and innovation-intensive sectors and companies (favouring new/young entrants).

4. Young Firms and Industry Dynamics in Belgium

Dumont M, Kegels C (2016). Federal Planning Bureau. Economic analyses and forecasts. http://www.plan.be/admin/uploaded/201606240814370.WP_1606.pdf

- Recent studies reveal the importance of entrants and young firms for job creation, productivity and economic growth.
- The declining entry of new firms, can explain, to a certain extent, the productivity slowdown witnessed in most OECD countries.
- Belgium appears to stand out unfavourably from other countries in its very low start-up rate.
- Access to finance is found to be the major barrier for entrants and young firms in Belgium, more important than bankruptcy regulation, contract enforcement, and product market regulation.

Recent studies reveal the importance of entrants and young firms for job creation, industry-level productivity growth and economic growth. There is growing concern that the declining entry of new firms could help explain, to a certain extent, the productivity slowdown witnessed in many OECD countries. Belgium stands out unfavourably from other OECD countries, in its low entry of new firms. Over the period 2001-2011, the entry rate and the share of young firms decreased. In view of the evidence that young firms – rather than small firms – are crucial for industry dynamics, economic growth would be achieved more efficiently by targeting tax support on young firms instead of favouring size-contingent tax benefits. Considering the position of Belgium in rankings on factors that seem to explain cross-country differences in the entry of new firms, such as bankruptcy regulation, contract enforcement, access to finance and product market regulation, it seems that access to finance is the major barrier for entrants and young firms in Belgium. A recent survey indicates that start-ups in Belgium face vital problems in obtaining financing by banks. Banks motivate their rejection of demands for loans by the lack of collateral or equity of start-ups. Venture capitalists seem to have also become more averse to finance risky early-stage investment. The specific tax benefit for young innovative companies, introduced by the Belgian federal government in 2006, and the Start-up Plan that was initiated in 2015, seem to be a good practice in targeting tax incentives on young firms as it minimises the budgetary cost and the tendency to favour less dynamic incumbents at the expense of dynamic young firms. Policy should however not be restricted to transactional support (grants, subsidies and tax benefits), but should also consider 'relational support' to the 'entrepreneurial ecosystem' of firms, universities, science parks, incubators and venture capitalists that are instrumental in generating knowledge spillovers, academic spinoffs and the formation of highly specialised human and social capital.

5. Do Tax Incentives for Research Increase Firm Innovation? An RD Design for R&D

Dechezleprêtre A, Einiö E, Martin R, Nguyen K-T, Van Reenen J. (2016). Do Tax Incentives for Research Increase Firm Innovation? An RD Design for R&D. CEP Discussion Paper No 1413 Revised June 2016 (Replaced March 2016 version).

- This paper studies the impact of R&D tax incentives in UK firms.
- It finds statistically and economically significant effects on both R&D and patenting.
- The effect is much stronger for younger and smaller firms than for older firms.
- Aggregate business R&D is found to be 10% lower in the absence of the tax relief scheme.
- R&D generated by the tax policy is found to create positive spillovers on the innovations of technologically related firms.

The paper presents evidence of a causal impact of research and development (R&D) tax incentives on innovation. The authors exploit a change in the asset-based size thresholds for eligibility for R&D tax subsidies and implement a Regression Discontinuity Design using administrative tax data on the population of UK firms. They find statistically and economically significant effects of the tax

change on both R&D and patenting (even when quality-adjusted). The estimated R&D tax-price elasticity is found to be much larger for younger and smaller firms (about 2.6) than for older firms. The authors do not find pre-policy manipulation of assets around the thresholds that could undermine their design. Over the 2006-11 period aggregate business R&D is found to be around 10% lower in the absence of the tax relief scheme. The paper also finds that the R&D generated by the tax policy creates positive spillovers on the innovations of technologically related firms.

6. Incentives and barriers for R&D-based SMEs to participate in European research programs: An empirical assessment for the Netherlands

Faber J, van Dijk J, Rijnsoever F (2016). Incentives and barriers for R&D-based SMEs to participate in European research programs: An empirical assessment for the Netherlands. Science and Public Policy 43(3):414-428.

- This study investigates the motives of R&D-based SMEs for (non)participation in European research collaboration programs.
- The authors formulate a set of hypotheses about incentives and barriers that influence the likelihood of participation by SMEs and tests them empirically using a survey of 247 Dutch R&D-based SMEs.
- The paper finds that European collaborative research programs attract the participation of rather limited numbers of especially science-based SMEs having prior experience with international collaboration.

As participation by small and medium-sized enterprises (SMEs) in European collaboration research programs is less than has been striven for, this study investigates the motives of R&D-based SMEs for (non)participation in these programs. The authors formulate a set of hypotheses about incentives and barriers that influence the likelihood of participation by SMEs. These hypotheses are empirically tested using a survey of 247 Dutch R&D-based SMEs. The authors find that European collaborative research programs attract the participation of rather limited numbers of especially science-based SMEs having prior experience with international collaboration, based on the incentives of cost sharing and knowledge sharing and the barrier formed by the costs of participating in these programs. Policy measures are derived that might improve the participation of SMEs in European collaborative research programs. However, whether or not the stimulation of SME participation in EU collaborative research programs also results in more commercialisation of research results produced remains an issue of concern.

7. How venture capitalists decide which new medical technologies come to exist

Lehoux P, Miller FA, Daudelin G, Urbach D R (2016). How venture capitalists decide which new medical technologies come to exist. Science and Public Policy 43(3):375-385.

- This study explores why capital investors choose to invest in certain health technology-based ventures and how they influence the innovation process.
- Capital investors use market-oriented valuations when they pick and 'coach' technology entrepreneurs. Then they act to transform and protect their investments and exert their authority along the technology development process.
- Current innovation policies should be carefully examined to steer which health technologies make their way into healthcare systems.

To encourage the commercial translation of biomedical discoveries, public policies increasingly seek to stimulate the venture capital industry. Very little is known, however, about the way venture capitalists assess the likely benefits new technologies may bring to clinical practice and healthcare systems. Drawing on a five-year fieldwork conducted in Quebec (Canada), including in-depth interviews and document analysis, the authors explore why capital investors choose to invest in certain health technology-based ventures and how they influence the innovation process. The findings clarify how capital investors: first, use market-oriented valuations when they pick and 'coach' technology entrepreneurs; second, act to transform and protect their investments; and

finally, exert their authority along the technology development process. Current innovation policies should be carefully examined because capital investors' understanding of the world in which they operate largely determines which health technologies make their way into healthcare systems and which may never come into existence.

8. Openness and innovation in the US: Collaboration form, idea generation and implementation

Walsh J P, Lee Y-N, Nagaoka S (2016). Openness and innovation in the US: Collaboration form, idea generation and implementation. Research Policy 45(8):1660-1671.

- This paper examines the relationship between collaboration and innovation.
- About 10% of inventions in the US involve an external co-inventor; about 25% involve external (non-co-inventor) collaboration.
- Heterogeneous collaboration, university-industry and vertical collaboration are associated with higher invention quality.
- The impact of different forms of collaborative innovation may vary depending on the stage of the innovation process.

Much current work in management of innovation argues that it is becoming increasingly necessary for inventors and their firms to exploit information and capabilities outside the firm in order to combine one's own resources with resources from the external environment. Building on this work, this paper examines the relationship between collaboration and innovation. Using detailed information on a sample of triadic patents, with over 1900 responses in the US, the authors report on the rates of collaboration of various forms, and test the effects of collaboration. The results suggest that just over 10% of inventions involve an external co-inventor and about 23% involve external (non-co-inventor) collaborators. The authors find evidence that heterogeneous collaboration and university-industry collaboration in inventing drive higher invention quality. However, vertical collaboration at the inventing stage is relatively more critical to commercialisation at the implementation stage than is university-industry collaboration. These results suggest that the impact of different forms of collaborative innovation may vary depending on the stage of the innovation process.

9. Too big to innovate? Exploring organizational size and innovation processes in scientific research

Mote J, Jordan G, Hage J, Hadden W, Clark A (2016). Too big to innovate? Exploring organizational size and innovation processes in scientific research. Science and Public Policy 43(3):332-337.

- This paper explores the impact of organisational size on organisational processes related to the pursuit of innovation.
- It found that the organizational size had a negative impact on three categories of innovation processes:
  - the amount of time spent in research and professional activities
  - how research time is spent
  - and exchanges of technical knowledge
- Some potential advantages of larger size, such as: greater research resources, better perceived managerial quality or a visionary strategy, were not found to be significant.

This paper explores the impact of organisational size in six federally funded research organisations on a range of organisational processes related to the pursuit of innovation. The data utilised consisted of 266 scientists drawn from 64 research projects across five programmatic research areas: alternative energies, biology, chemistry, geophysical sciences, and material sciences. A sixth project category was added to accommodate the highly interdisciplinary character of a handful of projects. The authors found that organisational size had a negative impact on three categories of innovation processes: 1) the amount of time spent in research and professional activities, 2) how research time is spent, and 3) exchanges of technical knowledge. In addition, some potential advantages of larger size, such as: greater research resources, better perceived managerial quality or a visionary strategy, were not found to be significant.

10. R&D profitability: the role of risk and Knightian uncertainty

Amoroso S, Moncada-Paterno-Castello P, Vezzani A (2016). R&D profitability: the role of risk and Knightian uncertainty. Small Business Economics. An Entrepreneurship Journal. DOI 10.1007/s11187-016-9776-z

- This paper provides an empirical attempt at linking firms' profits with investments in R&D following Knight's distinction between uncertainty and risk.
- Apart from the risky profit-maximising scenario, identifying a second, offsetting, unpredictable bias that leads to heterogeneous returns to R&D investments is found to be a crucial driver of corporate profits.
- Consistently with the Knightian theory that relates risk to profitability, the authors model the impact of risk and uncertainty on profits and provide an empirical attempt at modelling the effect of ambiguity, a particular type of uncertainty, on R&D returns.

This paper examines the returns to R&D investment when companies face a risky and ambiguous environment. First, consistently with the Knightian theory that relates risk to profitability, the authors model the impact of risk and uncertainty on profits. The word 'risk' is used to describe the "measurable uncertainty", where the possible outcomes are known and they can be classified in groups and assigned probabilities. The 'true' uncertainty, on the other hand, applies to situations where no probability can be computed, as agents do not have the information necessary to assign a probability measure "because the situation dealt with is in a high degree unique". For Knight, such uncertainty is the essence of entrepreneurial activity, without which there could be no profits in a (perfectly) competitive setting, since the probabilistically predictable extra margins profits would be eliminated. The authors find a positive effect of risk on companies' earnings, in line with the so-called "risk-premium" hypothesis. Moreover, they show that the premium is increasing with the size of the company, suggesting that larger firms are not only better placed to hedge against the risk of falling profits, but they also enjoy a higher return to risk than their medium or small counterparts. Second, the authors provide the first empirical attempt to model the effect of uncertainty on R&D returns. Asset returns is expressed as a sum of a risk premium and an ambiguity premium. On the one hand, the paper finds that ambiguity lowers the company's profits as a consequence of a more cautious innovative investment decision. On the other hand, when facing an ambiguous scenario, the R&D effort yields an additional premium to the investing companies. This ambiguity premium is mediated by the innovative effort of companies. R&D investment is crucial when uncertainty and turbulence are high. In this context, R&D policies could be particularly effective by preventing firms to lower their R&D efforts (as a consequence of ambiguity).