The SMEs Innovation in Europe

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Abstract: In this article we investigate the determinants of SMEs Innovation in Europe. We use data from the European Innovation Scoreboard of the European Commission in the period 2000-2019 for 36 countries. Data are analyzed through Panel Data with Fixed Effects, Random Effects, Dynamic Panel at 1 Stage and WLS. Results show that the presence of Innovators is positively associated with "*Enterprise births*", "*Government Procurement of Advanced Technology Products*", "*Firm Investments*", "*Intellectual Assets*", "*Sales Impacts*", "*Share High and Medium High-Tech Manufacturing*" and negatively associated to "*FDI Net Inflows*" and "*Population Density*".

1 INTRODUCTION

In this article we investigate the determinants of innovation in European SMEs. Specifically, we use data from the European Innovation Scoreboard of the European Commission for 36 countries[1] in the period 2000-2019. The role of innovation has an essential force to drive economic growth has been recognized especially in "*Schumpeterian Economics*", in the Solow's growth model and in the "*Endogenous Growth Theory*".

Schumpeterian Economics. In the context of the Schumpeterian economics the presence of innovation is an essential force to drive the economic growth. Schumpeterian economics is based on fourth main drivers that are "*Innovation and technological change*", "*Institutions*", and "*Entrepreneurs*" (Schumpeter, 1934). The main element in the theory of Schumpeter is the role of the entrepreneurship. Entrepreneurs can promote innovation and technological change. But in Schumpeterian economics it is also relevant the role of institutions, in fact institutions can promote the formation of the human capital either to create the conditions for the development of an entrepreneurial class able to generate economic value. A Schumpeterian related concept that has had a successful course in the history of the economic ideas is the concept of "*creative-destruction*" i.e. the idea that every innovation has a destructive power. The destructive power of innovation consists in the fact that it creates the conditions to make old products and services obsolete and by this way can induce many firms in failure. The creative-destruction is not only an interesting theoretical idea but it is also a true threat for many corporations and economic organizations that should defends themselves either by increasing the investment in Research and Development either by introducing a deeper strategical orientation in managerial choices.

Solow's Growth Theory. The role of innovation and Research and Development also is relevant in the Solow's Growth theory (Solow, 1956). In the theory of Solow, in the long run the investment in Research and Development is essential to promote technological change that is the main force able to promote the increasing in labour productivity. The investment in Research and Development, the increase in the level of knowledge and professional

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[1] Austria, Belgium, Bulgaria, Croatia, Cyprus, Czechia, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Israel, Italy, Latvia, Lithuania, Luxembourg, Malta, Montenegro, Netherlands, Norway, Poland, Portogallo, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey, Ukraine, UK.

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skills of human capital, and a deeper orientation to innovation and technological change in economic organizations are the main drivers that can promote economic growth in the long run. The role of innovation in the Solow's growth theory is considered strategically, and as a macroeconomic variable, and relates to the idea of knowledge and research and development in a context oriented to economic growth.

Endogenous Growth Theory. The role of innovation and Research and Development is also recognized in the Endogenous Growth Theory (Romer, 1994). The endogenous growth theory can explain the increasing in GDP in the short even if inputs are fixed. Innovation and Research and Development create the conditions to promote economic growth through the reorganization of the production function or firms and corporations. But in Endogenous Growht Theory innovation cannot be considered as an exogenous determinant of the economic growth, there are not external incentives that can promote the ability of firms to innovate through their investment in Research and Development. At the contrary, the investment in Research and Development as a tool to promote innovation is endogenous i.e. firms recognize the potential profits of innovation, for the fact that new products and services open new markets and give access to a greater number of customers, and then they invest in it. In a certain sense Endogenous Growht Theory indicates the inner determinants of a market structure that can promote the private investment in innovation without the intervention of government or policy makers. Firms and corporations, no matter if they are SMEs or large companies, have endogenous motivations to invest in innovation that are in their ability to increase productivity, sales, competitiveness and to acquire new markets and new customers. The investment in innovation and Research and Development can create the premise of an economic growth even in the presence of fixed inputs through the reorganization of the factors of productivity.

The Perspective of the Fourth Industrial Revolution. The fourth industrial revolution is based on innovation and research and development especially in the context of informatics and its applications to other field of knowledge such as for example medicine, finance, business management and transportation. The Fourth Industrial Revolution has been produced through the usage of algorithms in the context of Artificial Intelligence, Machine Learning and Big Data. The impact of the Fourth Industrial Revolution has changed the same idea of innovation in SMEs. In effect there a substantial identity between the application of the Artificial Intelligence-AI, Machine Learning-ML and Big Data-BD in SMEs and the ability of SMEs to innovate. But the Fourth Industrial Revolution has also created a mix of fears and expectations in respect to the ability of algorithm to improve productivity without reducing employment. The old threats of a zero sum game between technological innovation and employment has been revitalized in the context of the Fourth Industrial Revolution and some author (Harari, 2017) has also hypothesized the creation of a new useless class i.e. a class of workers without any possibility to contribute to the improvement of the economic system. Algorithms have a great ability to promote innovation and productivity and in the future they could certainly improve the level of output for worker. But there are many jobs that could be destroyed, in the sense of creative destruction, due to the introduction of AI, ML and BD especially in service sectors. Many professions such as doctors, engineers, accountants could be replaced, especially for routine task, from algorithms. But in the long run also creative jobs in the entertainment and media sectors could be replaced by algorithms. Finally also scientific jobs, such as researchers and knowledge based workers could be replaced by algorithms due to the fact that AI has potentially an infinite ability to acquire knowledge and produce while humans are limited in their ability to elaborate information.

Product Innovation and Process Innovation. But even if it is possible to distinguish tech-pessimists from tech-optimists it is also necessary to consider that the "*Compensation Effect*" seems to work especially in the case of product innovation (Costantiello & Leogrande, 2020). In effect while on one side process innovation is positively associated to rising unemployment, on the other side product innovation is positively associate to the reduction of unemployment. The difference between product innovation and process innovation is relevant since it can suggest to policy makers the ability to design new political economies that incentivize specifically product innovations in respect to process innovation boosting the investment in Research and Development. A relevant question is also associate to the finance-innovation nexus (Laureti, et al., 2020) i.e. the ability of SMEs to finance innovation. The efficiency of the finance-innovation nexus is an essential tool to boost productivity and economic growth.

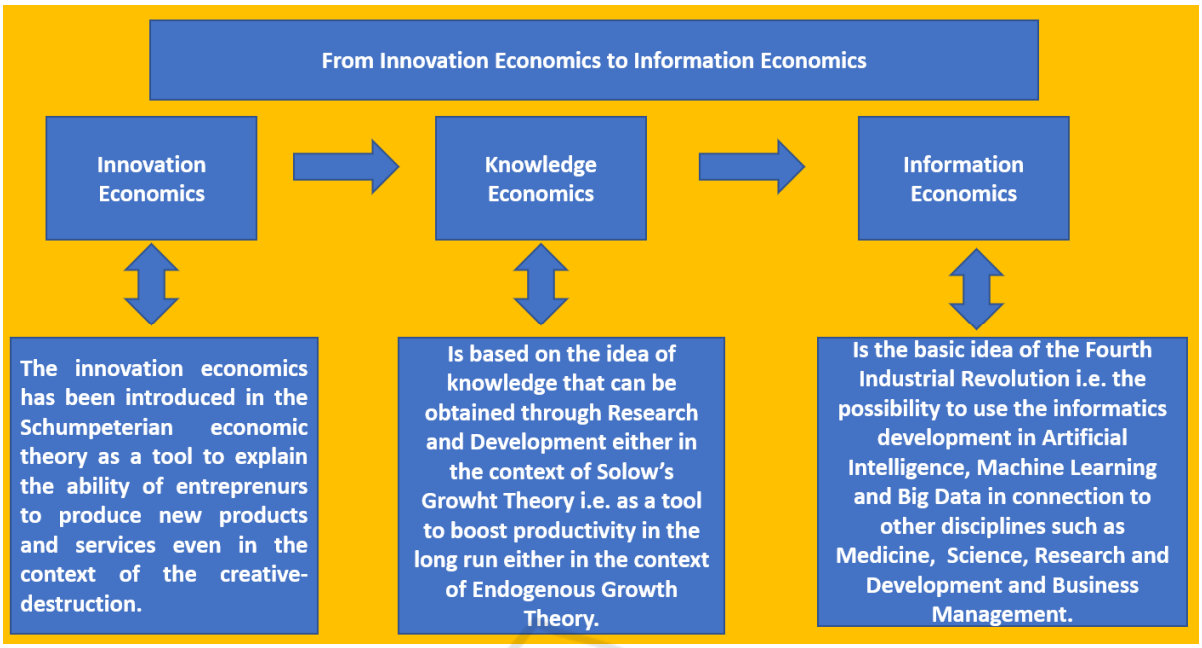

Figure 1: The passage from the Innovation Economics to Information Economics.

The article continues as follows: the second paragraph contains a brief literature review on the ability of SMEs to innovate; the third paragraph presents the econometric model and the discuss the results; the fourth paragraph concludes.

2 LITERATURE REVIEW

(Albassami, et al., 2019) affords the question of the ability of SMEs to perform knowledge management. The authors analyze SMEs in Pakistan. SMEs in Pakistan show a sustained growth. The results show the role of organization innovation and knowledge management in creating the premise for SMEs growth. (Hillemane, 2012) consider the fact that SMEs, for their organizational structure, have more abilities in implementing technological innovation. But, the fact that SMEs operate in an industrialized or underdeveloped country has a role in shaping the ability of small firms to innovate. The authors focalize their study on India. SMEs in India can boost either process either product innovation. SMEs can innovate with internal efforts or with external supports. SMEs that innovate with external support perform better in product and process innovation. (Nada, et al., 2012) afford the question of the innovation management in Turkish SMEs. The authors investigate the practices of innovation management in 25 SMEs countries. Specifically, the authors perform two different goals: on one hand they try to investigate the methodologies that Turkish SMEs apply in performing innovation management and on the other hand they give suggestion to perform an efficient political economics of innovation. The results show that Turkish SMEs have low efficiency in implementing innovation, due to lack of organizational and strategical planning. (Love & Roper, 2015) analyze the relationship between innovation, exportations, and growth in SMEs. The authors find the presence of a positive relationship among in innovation, exportations, and growth in SMEs. The greater the orientation of SMEs toward innovation, the greater the probability to export successfully. Specifically, the results show that SMEs that export growth faster and innovate better than non-exporting-SMEs.

(Mañez, et al., 2013) afford the question of the relationship between process innovation and total factor productivity in SMEs. The authors consider question if the most productive SMEs are those that perform process innovation in a sample of Spanish SMEs. Results show that most productive SMEs introduce process innovation, even if the extra-productivity gain induced by process innovation last in the short run.

(Thomä & Zimmermann, 2020) analyze the ability of SMEs in implementing innovation even in the case of low investments in Research and Development. The authors have analyzed different clusters of German SMEs based on their use of in-house Research and Development, their use of

external knowledge, and the implementation of interactive learning. The results show that even SMEs firm that have lower investment in Research and Development, i.e., firms that invest less in technological innovation, can improve their performance through internal and external interactive learning. Since learning is associated positively with the increase in productivity than it results that the increase in learning mode can improve the ability of SMEs to produce knowledge.

(Lesáková, et al., 2017) afford the question of the ability of SMEs to innovate and to eliminate innovation barriers. The authors focus their research on Slovak SMEs. Slovak SMEs are divided in three groups: innovation leaders, modest innovators, and non-innovators. Results shows that the presence of financial resources is main factor to boost innovation in SMEs. SMEs, in the sample analyzed, have identified three main barriers to innovation: bureaucracy, corruption and the lack of public policies oriented to innovation. The authors suggest to policy makers to implement political economies to improve innovation in SMEs based on the sequent elements: financial resources, high quality human resources, cooperation, networking, and the creation of deeper and more profitable relationship between institutions and SMEs.

(Nikolić, et al., 2015) analyze the presence of barriers to innovation in Serbian SMEs. The authors find that the main barriers to innovation are indicated as follows: lack of human capital open to innovation processes and products, the absence of a conscience of the role of innovation in boosting firms' performance, the lack of inadequate government strategy in supporting innovativeness, the insufficiency of capital, the presence of a market that has quantitative and qualitative limitations. Such social, institutional, financial, and organizational elements limit the ability of Serbian SMEs to promote innovation.

(Didonet & Diaz-Villavicencio, 2020) consider the role of market organization in shaping the ability of SMEs to innovate. The authors collect data from a sample of 169 Ecuadorian SMEs. The results show that SMEs that have a deeper market orientation have also greater probabilities to boost organizational innovation. SMEs' organizational structure is also relevant to improve learning. SMEs that are interested in augmenting the degree of innovation should implement an organizational structure that should be able to promote market orientation, creativity among the human capital and to promote technological improvements. Market orientation is the main force that can boost innovation in SMEs.

(Van de Vrande, et al., 2009) afford the question of the usage of the practice of open innovation in SMEs. The authors collect a database of 605 Dutch SMEs. Results shows that SMEs engage in open innovation persistently. Medium enterprises apply open innovation deeply in respect to small enterprises. SMEs perform open innovation to improve their market standing, to increase market share and to promote customer care, customer loyalty and customer retention. (Subrahmanya & Mathirajan, 2010) analyze the drivers of technological innovation in India SMEs. The authors also promote a comparison between the growth rates of innovative SMEs in respect to non-innovative SMEs in the sense of investment, employment, and sales. Results shows that innovation is relevant in improving SMEs growth.

(Radziwon & Bogers, 2019) afford the question of the tension between the necessity to participate in open innovation processes and the budget constraint connected to the management of internal sources dedicated in promoting firm's growth. SMEs need to operate in a multi-stakeholder environment to maximize the benefits of open innovation. Authors consider the role of regional ecosystem in shaping the collaboration between SMEs and the external environment. The results show the presence of an interdependence among SMEs necessity to innovate, multi-stakeholder analysis and environmental ecosystems.

(Nowacki & Staniewski, 2012) analyze the role of innovation in SMEs. Authors consider the essential role of innovation in shaping the competitiveness of SMEs in respect to large companies. Results of the analysis, based on a questioner of over than 600 Polish managers of SMES, show that a large amount of CEOs are aware of the great potential of innovation. But managers lack the ability to implement innovation in productive processes of in products and services. Authors find that neither the level of education of the manager neither the number of employees of the firm area able to predict the degree of innovation in SMEs. The lack of financial resources is a barrier to boost innovation in SMEs.

(Agostini & Nosella, 2017) consider the positive relationship between SMEs and innovation measured based on patents and intellectual propriety rights. Specifically, the authors analyze how internal and external knowledge impact of patents. The two variables of patent propensity and patent portfolio size are analyzed. Results show that: internal knowledge improve SMEs' patent propensity while external knowledge impact patent portfolio size.

(Anwar, 2018) consider the role of Business Model Innovation in creating the conditions to compete for SMEs. BMI is an essential tool for SMEs specially to survive in highly competitive markets. The authors analyze the role of Business Model Innovation in SMEs. The dataset used is based on 303 Pakistani SMEs. The results show the presence of a positive relationship between the adoption of BMI and SMEs performance.

(Subrahmanya, 2015) investigates 197 engineering SMEs in Bangalore city in India to verify the following two questions:

- The distinction between innovation and non-innovative SMEs;
- The economic and organizational determinants able to explain the differences between SMEs that perform high sales and SMEs that are characterized by low sales.

The author finds that SMEs that innovate successfully have adequate resources and capabilities and that younger SMEs have higher sales growth in respect to older SMEs.

(Bigliardi, 2013) consider the role of innovation in creating competitive advantage in SMEs with particular attention to their financial performance and firm size. Authors find that the increasing in innovation promote a better financial performance. But innovation is also relevant to meet customers' need and to increase competitiveness.

(Chereau, 2015) investigate the strategical role of innovation in SMEs. The authors find that different organization strategies are associated to different degree of innovation i.e. to gain high innovational performance in SMEs must to develop and implement specific strategies based on innovation. If SMEs are interested in promoting technological change persistently, they must strengthen the strategic-innovation nexus.

(Clark, 2010) analyzes the innovation processes in 95 New Zealand SME. The author shows that innovative SMEs are able to growth faster in respect to non-innovative SMEs and that are also well established i.e. they have a consolidated market share.

(Classen, et al., 2014) considers the role of innovation in either family and non-family firms. The authors analyze product innovation, process innovation, innovation outcomes and labor productivity. Data are collected from 2.087 German SMEs, the authors find that there are significant disparities between family and non-family SMEs in the sense of innovational processes. Specifically, family SMEs overperform in respect to non-family SMEs in the sense of process innovation. But family SMEs underperform in a confrontation with non-family SMEs in the sense of labor productivity.

(Clauss, et al., 2020) analyze the relationship between Business Model Innovation-BMI and Business Model Reconfiguration-BMR. The authors sustain that not all the BMR generate a BMI. Considering a study over 213 corporations the results show that firm can have a better performance in BMI in respect to BMR. In the case of BMI SMEs can maximize three relevant metrics in corporate performance i.e., value creation, value proposition and value capture.

(Olander, et al., 2011) consider the relationship between human capital and innovation in SMEs. Since innovation is a product of the knowledge of employees then it is economically relevant for the SMEs to minimize the risk of leaking and leaving. To reduce the risk of loss in human capital, the authors promote the adoption of a system of Human Resource Management-HRM that is more oriented to knowledge recognition and protection. The authors show that the development of a HRM-knowledge oriented can benefit the innovational capability of SMEs. HRM-related knowledge should be applied in different areas that are: recruitment, education, training, retaining employees, capturing and diffusion knowledge in-house and monitoring.

(Doh & Kim, 2014) analyze the relationship between innovation in SMEs and government support policies in South Korea. The authors consider the ability of SMEs to innovate as based on technological innovation that are patent, trademarks, and new design registrations. Results show the presence of a positive relationship between the investment of government in support of innovation and the number of design registration at a regional level attributable to SMEs. There is also a positive relationship between patent acquisition and new design registration of SMEs. Policy makers that are interested in boosting innovate-ion in SMEs should either promote a financial support for innovative firms and create the condition for a deeper networking between SMEs and universities.

(Rammer, et al., 2009) investigate the relationship among R&D, innovation management practices and innovation success in SMEs. The authors consider that investing in R&D for SMEs ca be considered a risky activity due to the presence of high fixed costs, high minimum investments, and financial constraints. SMEs prefer to reduce direct investment in R&D and to promote innovation management to increase productivity and competitiveness. But the authors find that to have success in innovation it is essential for SMEs to invest either in internal R&D either in external R&D. Successful SMEs in the sense of

innovation also can cooperate and create extended networks among external institutions and organizations able to produce knowledge and innovation. SMEs that do not invest in R&D con obtain similar results through the improving the quality of their human resources and with the implementation of team working.

(Baumann & Kritikos, 2016) analyze the relationship between R&D, innovation, and productivity in Micro, Small and Medium Enterprises-MSMEs. The authors focus on micro firms i.e. economic organizations with less than 10 employees. Data are collected from the German KfW SME panel. The results show the presence of a negative relationship between R&D intensity and the firm size. The greater the R&D intensity the grater the degree of innovation. Particularly R&D intensity tends to have a strict connection in respect to product innovations rather than to process innovations.

(Vasilescu, 2014) analyze the role of finance in relation with the ability of SMEs to innovate. There are many barriers that can reduce the financial capability of SMEs to create new products, services and processes such as limited market power, lack of management skills, absence of adequate accounting records, insufficient assets, transaction costs, lack of collateral. The authors suggest that to remove the financial obstacles that can reduce the ability of SMEs to innovate it is necessary to intervene at a political level to create more opportunity to give credit to firms.

(Henttonen & Lehtimäki, 2017) afford the question of how high-tech SMEs engage in open innovation. The authors use data from 13 technology intensive SMEs in forestry sector in Finland. The results show that in SMEs the open innovation is used for commercialization rather than for Research and Development. The creation of large cooperation with external firms and the outsourcing have partially compensated the internal weaknesses of SMEs.

3 THE MODEL

We estimate the sequent model using data from European Innovation Scoreboard for 36 countries in the period 2000-2019:

The estimated the value of Innovators that is constituted of three parts: "*SMEs with product or process innovations*", "*SMEs with marketing or organizational innovations*" and "*SMEs innovating in-house".* We found that the variable "*Innovators*" is:

- *Positively associated to "Enterprise births":* the increasing in "*Innovators*" has a positive effect on the birth of enterprise with more that 10 employees. This positive relationship can be explained with a condition of context in the sense that if an industrial or entrepreneurial environment is positively oriented to innovation, then it tends to be mode productive and successful. If SMEs are successful than it can be created an imitative process that can induce the formation of more SMEs. In effect firms tend to be more numerous in successful sectors and this phenomenon also create the economic specialization of areas and regions. But if SMEs fail in their ability to innovate and growth, then also the imitative behavior of other entrepreneurs could be limited, and the birth of new enterprise could stagnate.
- *Negatively associated to FDI net inflows:* the presence of FDI inflows reduce the ability of SMEs to innovate. This can be since innovation can be better explained in the context of endogenous growth theory i.e. firms invest in R&D to promote their competitiveness and productivity. In the case of FDI inflows SMEs are less incentives to promote inner growth of innovation, R&D, and knowledge. But it is also necessary to consider that generally FDI inflows tend to be used in highly profitable sector with a shortermist ability to generate revenues i.e. they have in a certain sense some "*speculative attitude*" while the investment in R&D for SMEs is risky and can be monetized only in a long run perspective. Probably if policy maker could create some incentive to give a longer run perspective to FDI inflows then the negative relationship between FDI inflows and "*Innovators*" could turn positive.
- *Negatively associated to "Population Density": "Population Density"* is defined as the number of inhabitants in squared kilometers. The

$$\begin{aligned}\boldsymbol{Innovators_{it}} &= \boldsymbol{a_1} + \boldsymbol{b_1}(\boldsymbol{EnterpriseBirth})_{it} + \boldsymbol{b_2}(\boldsymbol{FDINetInflows})_{it} \\ &+ \boldsymbol{b_3}(\boldsymbol{PopulationDensity})_{it} \\ &+ \boldsymbol{b_4}(\boldsymbol{GovernmentProcurementOfAdvancedTechnologyProducts})_{it} \\ &+ \boldsymbol{b_5}(\boldsymbol{ShareHighAndMediumHighTechManufacturing})_{it} \\ &+ \boldsymbol{b_6}(\boldsymbol{FirmInvestments})_{it} + \boldsymbol{b_7}(\boldsymbol{IntellectualAssets})_{it} \\ &+ \boldsymbol{b_8}(\boldsymbol{SalesImpacts})_{it}\end{aligned}$$

The Determinants of Innovators. Main Results								
	Fixed Effects		***Random Effects***		***Dynamic Panel***		***WLS***	
Variables	*Coefficient*	*p-value*	*Coefficient*	*p-value*	*Coefficient*	*p-value*	*Coefficient*	*p-value*
Const	2,21686		2,50112		-1,54372		0,492701	
Enterprise births	5,38678	***	5,3335	***	5,22991	*	6,78055	***
FDI net inflows	-0,426803	**	-0,41844	**	-0,303078	***	-0,500317	***
Population density	-0,0254478	***	-0,025665	***	-0,026688	*	-0,026458	***
Government procurement of advanced technology products	0,364894	***	0,369087	***	0,440566	***	0,357008	***
Firm investments	0,219975	***	0,220243	***	0,208012	***	0,299713	***
Intellectual assets	0,268219	***	0,260424	***	0,30007	**	0,18718	***
Sales impacts	0,507365	***	0,5104	***	0,569914	***	0,491619	***
Share High and Medium high-tech manufacturing	0,141498	*	0,145256	*	0,26605	***	0,10827	**
Innovators (-1)					0,0427401	***		

Figure 2: The determinants of Innovation in European SMEs. Main econometric results.

negative relationship between "Innovators" and "Population Density" means that generally innovative SMEs are not located in city centers or highly urbanized areas. The negative association can also be considered on a strictly economic point of view: in effect locating a SME in a city center can be very costly and can also reduce the possibility to acquire high skilled human capital. It can be easier and more profitable to locate a SMEs in less populated areas in connection with Universities and in places in which there is a higher level of well-being.

- *Positively associated to Government procurement of advanced technology products:* the countries in which Government invest more in sustain technological investment have also higher degree of innovative SMEs. This positive relationship between government investment in innovation and the presence of innovative SMEs is the proof of the efficiency and efficacy of political economics of innovation. Even if innovation is in the interest of SMEs, since through innovation SMEs can promote productivity and competitiveness, it also necessary the public intervention to improve the ability of economic organization to invest in risky assets such as that connected to Research and Development especially related to product innovation.
- *Positively associated to Share of Employment in High and Medium high-tech manufacturing:* the positive relationship between the presence of innovative SMEs and the level of employment in High and Medium High-Tech Manufacturing can be better understood because effectively innovative SMEs require high skilled human resources with specifical competencies in STEM discipline. High-tech innovative SMEs tend to employ engineers, scientists, physicists, and a workforce with postgraduate degrees such as Master of Science or Ph.Ds.
- *Positively associated to Firm investments:* the level of Firm Investment is based on three different variables that are "*R&D expenditure in the business sector*", "*Non-R&D innovation expenditures*", "*Enterprises providing training to develop or upgrade ICT skills of their personnel*". The positive relationship between the presence of Innovative SMEs and Firm Investments is the confirmation of the efficacy of the private sector expenditure in Research and Development and in the acquisition of ICT skills. In particular either the enrichment of human capital either the orientation towards knowledge as an intangible asset are the main drivers that can promote the persistence of a positive association between Firm Investment and the presence of Innovative SMEs.
- *Positively associated to Intellectual assets:* the variable "*Intellectual Assets*" is based on three different variables that are "*PCT patent applications*", "*Trademark applications*",

"Design Applications". Clearly, there are positive relationship between the variable "*Intellectual Assets*" and the presence of innovative SMEs. In effects one of the main outputs of innovative SMEs consist in the creation of patents and intellectual assets. This means that the greater the presence of innovative SME the greater the ability of that country to produce intellectual assets that are valuable as patents, trademarks, and intellectual property rights.

- *Positively associated to "Sales impacts":* "*Sales Impact*" is defined as the summation of three variables that are "*Medium and high-tech product exports*", "*Knowledge-intensive services exports"* and "*Sales of new-to-market and new-to-firm product innovation*". The greater the ability of SMEs to innovate the greater the ability of firms to exports medium and high-tech products, knowledge intensive services exports and to realize product innovation. This means that innovation in SMEs can boost either productivity either exportations. If policy makers are interested in promoting productivity and exportations, they should incentivize innovation among SMEs.

As we can see in the figure 2 the main relationship in the model is between the variable "*Enterprise Birth"* and "*Innovators*". The greater the number of new enterprises the greater the probability of an increase in innovative SMEs. At a minor level also the government intervention in the advancement of technology and the sales impact are significantly and positively associated to the presence of innovative enterprises. This means that on one hand government can have a significant role in boosting innovation in SMEs and on the other hand innovative SMEs are also able to boost sales. The econometric results show a clear indication for policy makers: if governments are interested in promoting the birth of new enterprises, or the improvement of sales especially in the sense of exportations, then they should invest more in the ability of SMEs to innovate.

4 CONCLUSIONS

In the sequent article we have investigated the determinants of the SMEs innovation in Europe. The role of innovation and Research and Development have been recognized as an essential driver for economic prosperity and technological change in Schumpeterian Economics, in Solow's Growht theory and in the Endogenous Growth Theory. The Fourth Industrial Revolution with AI-ML and BD has increased the ability of SMEs to innovate. But innovation is not neutral in the sense of employment, since it can produce more and better employment such as in the case of product innovation, or at the contrary can reduce the level of employment as in the

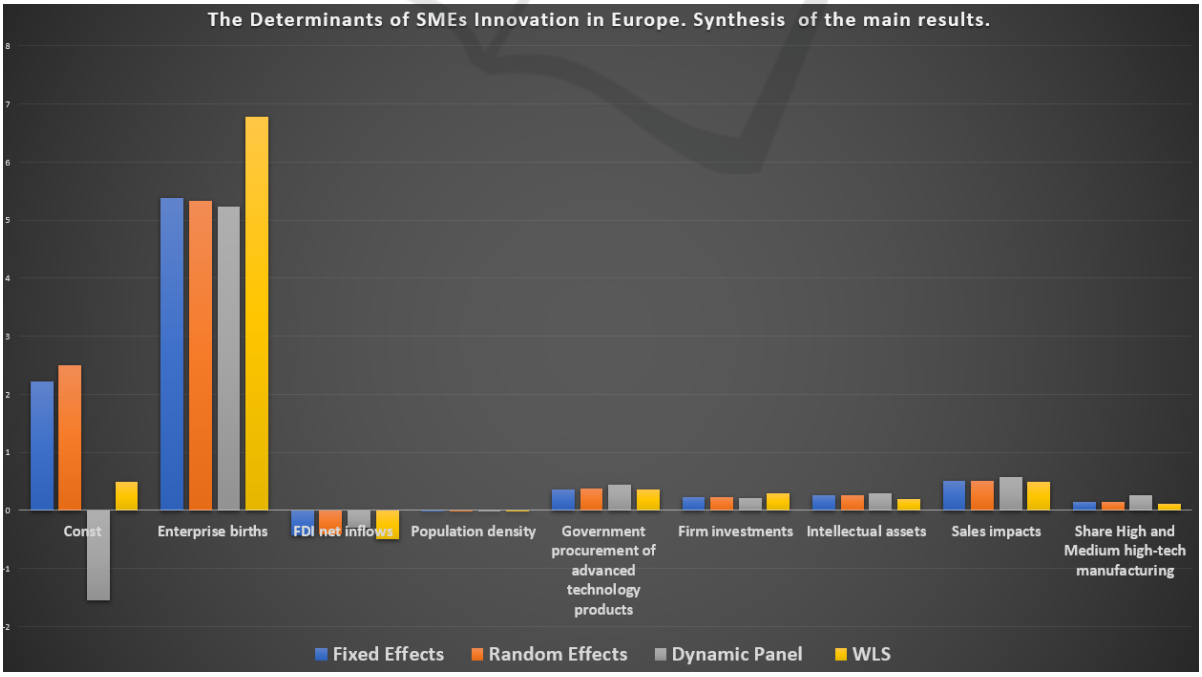

Figure 3: The determinant of SMEs Innovation in Europe. Synthesis of the main results.

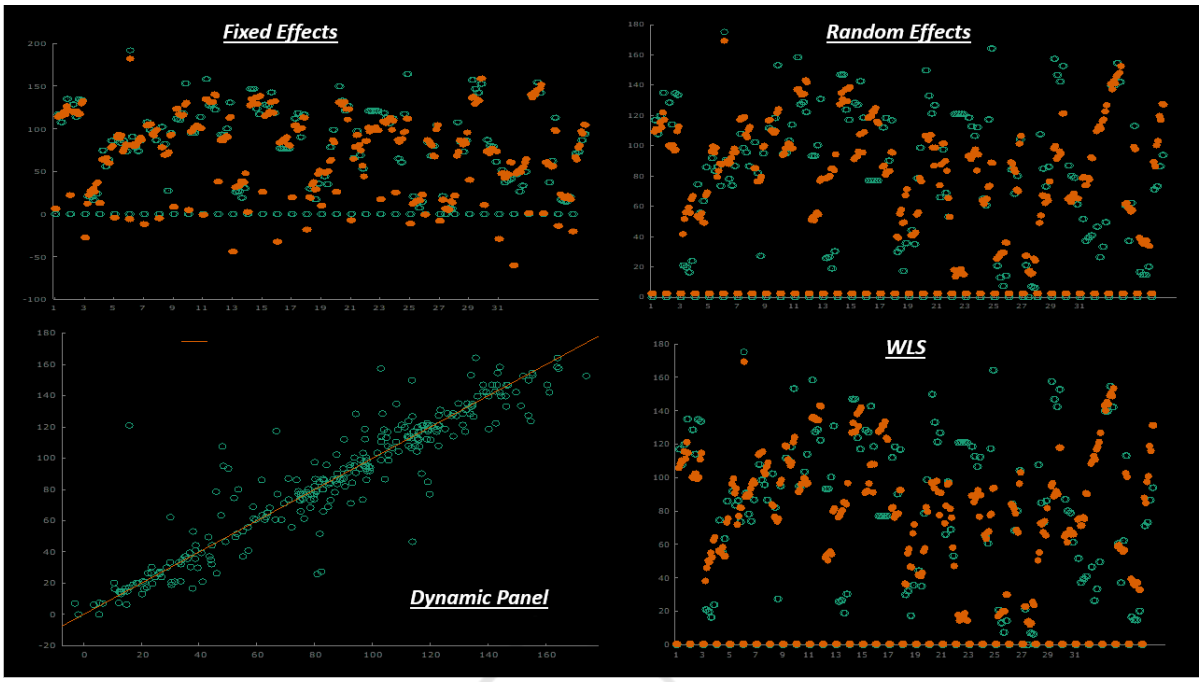

Figure 4: The predictive ability of the econometric models.

case of process innovation. The great risk with AI is that it could operate as a process innovation (Ng, 2017). Innovative SMEs can have many positive impacts valuable at a macroeconomic level and even in the sense of political economy. To evaluate the impact of innovative SMEs we use data from the European Innovation Scoreboard of the European Union for 36 countries in the period 2000-2019. As showed in the econometric model discussed in the third paragraph, the presence of Innovative SMEs is positively associated to "*Enterprise births*", "*Government Procurement of Advanced Technology Products*", "*Firm Investments*", "*Intellectual Assets*", "*Sales Impacts*", "*Share High and Medium High-Tech Manufacturing*". But data also shows the presence of a negative relationship between Innovative SMEs "*FDI Net Inflows*" and "*Population Density*". Our analysis suggest that if policy makers are interested in boosting firm natality, in augmenting private investments, intellectual assets, in sustaining the ability of firm to export, then they should incentivize innovative SMEs.

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