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Universitat Autònoma
de Barcelona

DETERMINANTS AND GROWTH EFFECTS OF INNOVATION AND EXPORTING STRATEGIES

Department of Business

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Abstract

This doctoral dissertation contributes to the research on determinants and firm growth effects of innovation and exporting strategies. Based on dynamic capabilities approach and evolutionary theory, this dissertation analyzes, in the first place, the influence of the microfoundations of firms' dynamic capabilities on the innovation and exporting propensities. Then, it focuses on the concept of persistence in innovation and its relationship with exporting and firm growth based on a bibliometric analysis of the literature. Finally, it empirically tests the effects of persistence in both strategies on firm growth.

This dissertation uses panel data extracted from the Innovation Survey done by the Uruguayan National Agency of Research and Innovation (ANII) of manufacturing and services firms for the period 2010 to 2015. It also uses Scopus and Web of Science databases to analyze the persistence in innovation literature.

The methodologies used are, firstly, fixed effect, bivariate and multinomial probit models to estimate the propensity determinants. Secondly, a bibliometric analysis for the systematic literature review to study persistence in innovation literature. Thirdly, fixed effect models to estimate growth determinants.

The results show a positive relation between the microfoundations of dynamic capabilities and the innovation and exporting propensities, demonstrating the relevance of the dynamic capabilities to increase these propensities. In addition, the systematic review of the literature about persistence in innovation shows that the analysis of its effects on firm growth still have an incipient development. It is found a positive relationship between both variables in a variety of types of innovations and firm growth measures. However, there are not enough studies to confirm the relationship between them and the persistence in exporting. Besides, persistence in exporting and innovation strategies have in general the expected positive result on firm growth in the Uruguayan context.

All these findings have important implications for support policies and future research on persistence in innovation and exporting towards firm growth.

RESUMEN

Esta tesis doctoral contribuye a la investigación sobre los determinantes y los efectos de crecimiento empresarial de las estrategias de innovación y exportación. Basada en el enfoque de las capacidades dinámicas y la teoría evolutiva, esta tesis doctoral analiza, en primer lugar, la influencia de los microfundamentos de las capacidades dinámicas de las empresas sobre sus propensiones a la innovar y a exportar. Luego, se enfoca en el concepto de persistencia en la innovación y su relación con la exportación y el crecimiento empresarial a partir de un análisis bibliométrico de la literatura. Finalmente, prueba empíricamente los efectos de la persistencia en ambas estrategias sobre el crecimiento empresarial.

Esta disertación utiliza datos de panel extraídos de la Encuesta de Innovación realizada por la Agencia Nacional de Investigación e Innovación de Uruguay (ANII) a empresas manufactureras y de servicios para el período 2010 a 2015. También utiliza las bases de datos Scopus y Web of Science para analizar la literatura de persistencia en innovación.

Las metodologías utilizadas son, en primer lugar, modelos de efectos fijos, bivariado y multinomial probit para estimar los determinantes de la propensión. En segundo lugar, un análisis bibliométrico para la revisión sistemática de la literatura para estudiar la persistencia en la literatura de innovación. En tercer lugar, un modelo de efectos fijos para estimar los determinantes del crecimiento.

Los resultados muestran una relación positiva entre los microfundamentos de las capacidades dinámicas y las propensiones a la innovación y exportación, demostrando la relevancia de las capacidades dinámicas para incrementar estas propensiones. Además, la revisión sistemática de la literatura sobre la persistencia en la innovación muestra que el análisis de sus efectos sobre el crecimiento empresarial aún tiene un desarrollo incipiente. Se encuentra una relación positiva entre ambas variables en una variedad de tipos de innovaciones y medidas de crecimiento empresarial. Sin embargo, no hay suficientes estudios que confirmen la relación entre ellos y la persistencia en exportar. Además, la persistencia en las estrategias exportadoras y de innovación tienen, en general, el resultado positivo esperado sobre el crecimiento de las empresas en el contexto uruguayo.

Todos estos hallazgos tienen implicaciones importantes para las políticas de apoyo y la investigación futura sobre la persistencia en la innovación y la exportación hacia el crecimiento empresarial.

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The opinions and mistakes of the present dissertation are exclusively my responsibility.

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1. GENERAL OVERVIEW OF THE DISSERTATION

1.1 Problem statement

Around the world, public policies emphasize the relevance of innovation to generate added value and increase exports. In fact, several support programs have been created with the purpose of promoting innovation and exporting (e.g. Horizon 2020 in UE¹, PACC in Uruguay²). They support the realization of activities that create competitive products and services in the international market. In this way, firms can develop more sophisticated inputs for a global value chain or find better market prices with specialized products. In particular, in a small economy based on agro exports such as Uruguay, innovation is perceived as the route to increasing exports sophistication, helping to change the productive specialization matrix and to overcome external restrictions established by the two big regional partners (Argentina and Brazil).

These policies implicitly assume a complementary relationship between innovations and exporting (Bannò et al., 2013; Filippetti et al., 2009; Golovko and Valentini, 2011). Through “learning by exporting” or “self-selection” mechanisms, firms that export have incentive to invest in innovation and vice versa. The first mechanism is related to the experience generated in foreign markets that increases their business knowledge and inspires the firms to enhance innovation performance (Salomon and Shaver, 2005). Additionally, innovation helps to get into new and more demanding markets that enhance export performance, increasing foreign sales (Golovko and Valentini, 2011). The second one explains that the exporting firms tend to have higher productivity growth in relation to non-exporter (Araújo and Salerno, 2015; Bernard and Jensen, 1999). This argument states that firms innovate before exporting and the higher productivity is a cause of firms export behavior as the entrance to foreign markets is costly and only the most productive firms can self-select into exports (Bernard and Jensen, 1999; Roberts and Tybout, 1997). The global competition and continuous technological change make innovation increasingly important to achieve commercial and economic success (Cho and Pucik, 2005).

Although innovation and exporting show a desirable complementary relationship that tends to persist (Golovko and Valentini, 2011; Iandolo and Ferragina, 2019; Ito and Lechevalier, 2010), most of the analyzed literature treats the relationship between innovation and exporting persistence and firm performance separately. There are only a few studies that analyze the effects of such persistence on firm

¹ https://ec.europa.eu/info/funding-tenders/find-funding/eu-funding-programmes/horizon-europe_en

² https://otu.opp.gub.uy/sites/default/files/docsBiblioteca/memoria_pacc.pdf

growth, showing that persistence in both strategies has a better performance than doing only one or none (Löf et al., 2015; Iandolo and Ferragina, 2019). This dissertation adds new evidence from Uruguay to widen the empirical base about this relationship.

Persistence in innovation has been more widely studied than persistence in exporting (Bernini et al., 2016; Blum et al., 2013; Love and Máñez, 2019). The literature about persistence in innovation emphasizes on the accumulative process existence in innovation activities (Antonelli et al., 2012; Antonioli and Montresor, 2019; Costa et al., 2020; Ganter and Hecker, 2013; Le Bas and Scellato, 2014; Suárez, 2014; Tavassoli and Karlsson, 2015). The major interest in this literature is to understand the phenomenon and to find patterns of behavior. In that sense, from my point of view, if we concentrate on the cause of persistence, we lose the perspective of understanding the consequences they generate. And more importantly, if we do not analyze the effect of doing both strategies at the same time and persistently, we lose to estimate most of the potential that these activities have on firm growth.

In order to ensure continuous innovation in a changing and uncertain market, firms must develop dynamic capabilities (Eisenhardt and Martin, 2000; Teece et al., 1997). This action also involves the creation of operational capabilities to improve market position and get competitive advantage results (Eisenhardt and Martin, 2000; Peteraf and Maritan, 2007). Furthermore, some studies find that innovativeness and dynamic capabilities affect exporting performance (Miocevic, 2021; Monteiro et al., 2019; Ritam Garg, 2012; Vicente et al., 2015; Villar et al., 2014). For that reason, it is important to analyze how dynamic capabilities are created, and how they interplay with operational capabilities in order to generate firms' superior value (Vicente et al., 2015; Zahra, et al., 2006). Most of the recent studies on dynamic capabilities try to explain, in an empirical manner, how firms' dynamic capabilities lead to firm performance improvement and competitive advantage (Schilke et al., 2018). The operationalization of dynamic capacities contributes to the understanding of innovation capabilities and consequently, how they may collaborate to improve innovation level in the firm (Froehlich et al., 2017). Teece (2007) is the most frequently mentioned framework to DC approach (Kump et al., 2019; Schilke et al., 2018). It integrates the strategy and innovation literature and defines critical capabilities to sustain the business and management needs; hence, it gives information to decision makers about strategic considerations to enhance firm performance in global market competition. However, there is still an opportunity to contribute in the operationalization of dynamic capabilities and to understand how they support firm sustainable competitiveness (Karman and Savanevičienė, 2021; Kump et al., 2019). This dissertation aims to contribute to this ongoing discussion.

Methodologically, previous research tends to employ probit models to estimate innovation and export propensity (Bianchi et al., 2015; Cassoni and Ramada-Sarasola, 2010; Golovko and Valentini, 2011; Ito and Lechevalier, 2010). However, if both strategies are considered as interdependent decisions a multinomial probit specification should be used (Golovko and Valentini, 2011). Choosing the adequate

regression technique improves the estimation of the determinants of the strategies' propensities and guides more suitable interventions to enhance firm performance.

Another aspect of the methodology that should be considered when estimating the incidence of these two strategies on firm performance is how we measure them as an explicative variable. Most of the studies analyze the contribution of these activities measured in a year period, but they do not consider the effect of the cumulative knowledge process when these activities have been doing it continuously for several years. They consider the probability or intensity of doing these strategies once, the previous year, independently of what they had been doing before that period. Incorporating a variable that considers the strategy made for a longer period integrates the cumulative knowledge process done by the firm.

In an open agro exporter developing economy, with a small market, limited capital market and scarce qualified population, the innovation is perceived as a way to change its productive specialization matrix on the way to overcome the restrictions in the local market. Being innovative and exporter is the desirable condition although there may be alternative strategies for the firms because of restrictions like payback period or financial access difficulties (ANII, 2015; Horta Berro et al., 2021) or technical barriers to trade. In this context, as Teece (2019) suggests, the construction of dynamic managerial competencies to enhance the probabilities of success are very relevant. According to evolutionary theory, firm strategies and routines, based on their accumulated knowledge, experience and the interaction with the environment, are also important to connect with firm growth.

1.2 Purpose and research objectives

The general purpose of this dissertation is to examine the determinants and growth effects of innovation and exporting strategies. In addition, the specific objectives of the dissertation are:

- 1) Determine the influence of the microfoundations of dynamic capabilities in the propensity to innovate and export.
- 2) Analyze the temporal evolution of "persistence in innovation" literature and the relationship between persistence in innovation with exporting and firm growth to identify future research trends.
- 3) Investigate the individual and accumulative effects of the persistence in innovation and exporting on firm sales growth.

In connection with these objectives, this doctoral dissertation aims to address the following research questions, gathered into three groups:

The first group, related to the determinants of innovation and exporting, are:

- What influence do the microfoundations of sensing dynamic capabilities have in innovation and exporting propensity?
- What influence do the microfoundations of seizing dynamic capabilities have in innovation and exporting propensity?
- What influence do the microfoundations of configuration dynamic capabilities have in innovation and exporting propensity?

The second group, related to the systematic literature review about persistence in innovation, the questions are:

- Is there any particularity in the evolution of persistence in innovation literature?
- What is the relevance of the studies about firm growth and exporting in persistence in innovation literature?
- Which is the relationship between persistent innovation and firm growth?
- Which is the relationship between firm persistent innovation and export with growth?
- What are the factors that influence the mentioned relationships: type of innovation, growth measure and country?

Thirdly, related to the relationship between persistence in innovation, exporting and firm growth are

- What impact does persistence in exporting and innovation have on the growth of companies?
- What are the effects on firm growth if the firm only exports or innovates?

1.3 Theoretical background

The determinants and growth effects of innovation and exporting strategies are analyzed in three interconnected articles. The first one explores the determinants of innovation and export propensities. Evolutionary theory and dynamic capabilities approach are used to explain how the microfoundations of dynamic capabilities collaborate in the generation of innovation and exporting strategies to be everlasting. These theories and others are present in the systematic literature review of “persistence in innovation” to explain the mechanism that makes innovation persistent and affects firm performance. Due to the fact that in the first article it is demonstrated that persistence is a tendency for this sample, I

do this review to learn and understand the characteristics of the literature and the relationship between persistence in innovation, exporting and firm performance. Finally, in the last chapter, using the information I collected in the systematic literature review and based on the evolutionary theory framework, especially Nelson (1991), I estimate the effects on firm performance of persistence in innovation and exporting as different strategies.

This dissertation is based on two complementary perspectives: Evolutionary theory and Dynamic Capabilities (DC) approach. From the evolutionary (neoschumpeterian) theory of the firm this dissertation focuses on their conception of firms' innovation and growth process and the statement of firms' heterogeneity associated with differences in strategy, structure and core capabilities. From the DC approach, in turn, the dimensions of resources flexibility and adaptability to achieve the firms' goals through firms' capabilities and microfoundations are considered.

1.3.1 Evolutionary theory

The evolutionary theory explains the generation of innovation and the relationships between innovation and firm growth. This framework involves the three papers of this dissertation. From this point of view, knowledge, experience, and learning ability accumulate over time, meanwhile capabilities increase the innovation activities and the size of the firm (Nelson and Winter, 1982).

Cimoli and Dosi (1994) consider innovation as the production and transformation of symbolic and generic knowledge into specific knowledge to solve problems and improve the competitive market position of firms. The relevance of innovative activities is that they improve added value and quality through the incorporation of productive differentials to compete in the domestic market and internationally. Consequently, they contribute to growth, improving firms' capacities and conditions to sell their products abroad (Dosi, Pavitt and Soete, 1990).

“An Evolutionary Theory of Economic Change” (Nelson and Winter, 1982) establishes the basic notions and ideas regarding firm characteristics and behaviors. It defines firms as bundles of ‘organizational routines’. The routines are their regular activities based on the knowledge built on an accumulative learning process. They involve a conjunction of functions that determine what activities a firm does and ‘how productively’ (Nelson, 1995) in function of internal variables and external variables (market conditions). Hence, routines are the best a firm can do conditioned by its knowledge, evolutionary process and the surrounding context that has molded them. Managers must also build organizational capabilities for knowledge creation, typically generating a distinctive competence by doing so (Nelson, 1991). Firm-specific knowledge is the result of an accumulated experience of endogenous learning process, which makes firms structurally heterogeneous (Federico, 2016).

The knowledge generates an everlasting advantage, as it is accumulated in the workers of the organization and it is non-extinguishable (Costa et al., 2020). The learning processes and the environment will conduct firm innovation process adjustment (R. Nelson, 1991). In these processes there is feedback between past innovations, present investments and future innovations (R. R. Nelson and Winter, 1982). Hence, it is expected to achieve positive results in the future. The decision-making process that generates innovation is a standard behavior (routine) that is repeated in the case of success (Suárez, 2014). According to Nelson and Winter (1982) statement, firms invest because they easily repeat their “distinctive routinized ways of doing things” and the market shows that it is profitable to do it. This investment produces growth in capacity or in sales revenue.

The persistence of routines influences the firm’s innovative features, either by guiding the innovative projects or by blocking them. Under an evolutionary model of Schumpeterian competition, successful innovative firms with their initial profit, via selection mechanism³, generate subsequent growth, which in turn will be re-invested again, producing additional profits, generating a virtuous circle and reinforcing the firms’ relative position. The development of past innovation enhances resources, capabilities and cost opportunities in the present, which increase the chances of the firm to perform future innovation projects, generating a path-dependence. The past investment in resources, within some particularities, generate sunk cost and establish the advantage for obtaining scale of economies, creating opportunity cost for new projects, which are considered in the moment of making decisions about new innovative processes (Suárez, 2014). As long as this process reinforces firms’ effective routines, firms do not have any incentive to behave in another way. The firm obtains quasi-monopoly rents and creates entry barriers, which improve their financial situation and generate above-normal profits to be reinvested in new innovations. Then, at the firm level, investment decisions and growth are closely related and reinforce the firm’s capabilities, increasing its size (R. R. Nelson and Winter, 1982).

In consequence, persistent asymmetries between firms’ learning trajectories and capabilities would exist and would be managed to persist dissimilarities in firm performance (Capasso et al., 2014). Until environmental change happens, routines would not change over time and a positive correlation with firm performance would be expected (Federico, 2016). According to Nelson (1991) heterogeneity may also arise through differences in strategy, structure and core capabilities, establishing the relevance of them.

Synthesizing, evolutionary theory of the firm states that the routines and knowledge, with its accumulative learning process, leads innovation to the firm’s growth, conditioned by the surrounding context. In addition, innovative activities increase added value to participate in the domestic market and

³ The most viable firms will survive and grow and unprofitable ones will contract (R. R. Nelson and Winter, 1982).

internationally, contributing to the firm's growth. The successful innovation generates a virtuous circle between innovation and growth, generating an innovation path dependence. Hence, it is expected to have a positive relationship between innovation, exporting and firm growth and a persistence behavior in innovation and exporting.

1.3.2 Dynamic Capabilities

Dynamic Capabilities (DC) approach establishes that firms' capabilities should be dynamic to gain competitive advantage in increasingly demanding environments and versatile markets (Eisenhardt and Martin, 2000; Rua et al., 2019; Teece, 2000; Teece, 2007; Teece et al., 1997). This framework aims to explain the determinants of firm competitive advantage and guide managers to have profit (Teece, 2007). For this approach, the firm is an adaptive entity conducted by rational strategists. Besides, in the short run, firms have low capacity for strategic reorientation (Rabetino et al., 2021).

In the literature there are different points of view about how firms' dynamic capabilities lead to firm performance improvement and competitive advantage. There is a debate about the mechanisms that operate (Zhou et al., 2019), as the conception of dynamic capabilities has constantly evolved (Helfat and Peteraf, 2009; Wenzel et al., 2020; Wilden et al., 2016; Zahra et al., 2006). At the beginning, the controversy concentrated on theoretical issues and did not discuss how practical activities of the organization contributed to the creation and development of them (Daly et al., 2004). However, more recently, research emphasizes on the operationalization and practical implications of dynamic capabilities (Daly et al., 2004; Froehlich et al., 2017; Karman and Savanevičienė, 2021; Kump et al., 2019; Schilke et al., 2018).

According to Di Stefano et al. (2014), DC are latent capacities, which can be perceived only once they are manifested in the routines, and their outcomes. Only through these routines, DC supports strategic renewal in a persistent and consistent way (Kump et al., 2019). Teece, Pisano and Shuen (1997) and Eisenhardt and Martin (2000) define DC as the firm processes to integrate, reconfigure, gain and build resources to match and create market change, in the pursuit of temporary advantages (opportunities). "Dynamic capabilities thus are the organizational and strategic routines by which firms achieve new resource configurations as markets emerge, collide, split, evolve, and die" (Eisenhardt and Martin, 2000: 1107). They are particular and distinguishable processes like product development, strategic decision making, and alliancing. (Eisenhardt and Martin, 2000).

Competitive advantage arises from technological and organizational capabilities (Harrison, 2003; Teece et al., 1997). The most innovative firms tend to overcome unstable situations, no matter which sort of innovation is adopted, as its organization determines the path to achieve competitive advantage and

promote firms' growth (Dess and Lumpkin, 2005; Rua, 2018). Firm's success depends on its resources, capabilities, and its ability to adapt itself to the industry and market contingencies. The firm assets form their DC and the evolutionary and co-evolutionary path shaped them (Rabetino et al., 2021). DC are key factors in an organization's innovativeness and competitiveness to support the environmental change adjustment (Eisenhardt and Martin, 2000; Giniuniene and Jurksiene, 2015; Teece et al., 1997). Otherwise, shareholder value would be destroyed (Bowman and Ambrosini, 2003).

DC are strengthened by organizational routines and managerial skills. The routines may be renewed as a consequence of changes in organizational conditions (Zahra et al., 2006) and managers must continuously renew skills and display the ability to take strategies in accordance with the business environment (Monteiro et al., 2017; Rua, 2018). The process of organizational learning develops managers' skills and improves firm's dynamic capability (Zollo and Winter, 2002).

Extending the DC approach, Efrat *et al.* (2018) and Miocevic (2021), define "Dynamic Export Capabilities" (DECs) as crucial routines through which exporting firms can transform knowledge into a source of customer value. These studies find that innovativeness is an important DECs to sustainable competitive advantage for firms that operate in foreign markets because they facilitate a quick response to the challenges imposed by unstable environments (Gölgeci et al., 2019). Furthermore, Miocevic (2021) finds that the firm's benefits from exporting depend on the DECs it generates. The DECs development condition their market (MD) and product diversification (PD) and vice versa. On one hand, the firm that innovate can obtain higher MD that contribute to increase sales revenues, capitalize on scale economies and obtain higher profitability of investing. On the other hand, when firms deploy their DECs, the innovativeness is benefited by a focused and narrow product portfolio to increase profitability in the case of SMEs.

In relation to dynamic capabilities, Teece (2018) describes two levels of capabilities. At the base level are operational and ordinary capabilities, related to routine activities, administration, and basic governance delineated in a given production program. In the second level operate the dynamic capabilities: "microfoundations" and higher-order capabilities (Teece, 2007). Microfoundations involve the adjustment and recombination of a firm's existing ordinary capabilities as well as the development of new ones. They are second-order dynamic capabilities and include new actions that involve astute managerial decisions. Teece (2007) defined them as "organizational and managerial processes, procedures, systems, and structures that undergird each class of capability" (Teece, 2007: 1321). They include distinct skills, decision rules, and disciplines. In the same level as microfoundations are the high-order dynamic capabilities that guide them. Using high-order dynamic capabilities, management, supported by organizational processes, senses future steps, plans business models to seize new or changed opportunities, and defines, in relation to the existing form and the plans, the best configuration for the organization. Teece (2007), for analytical purposes, classifies them as sense, seize and

reconfiguration capacities. They are the most relevant capabilities for the innovation and the selection of business models. They guarantee the enhancement, combination, protection and reconfiguration of intangible and tangible assets to maintain competitiveness. He recognizes that a collection of processes and routines provide particular microfoundations for dynamic capabilities like the ones defined by (Eisenhardt and Martin, 2000).

Summarizing, the interaction between the knowledge accumulation and the routines that use it within the firm, tend to create firms dynamic capabilities that support the systematic trust on innovation as a competitive tool (Antonelli et al., 2012). Only through these routines, DC supports strategic renewal of capacities in a persistent and consistent way (Kump et al., 2019). Therefore, based on the DC approach, it is expected that the enhancement of dynamic capabilities through the firm microfoundations increase the propensities of innovation and exporting (Teece, 2007) to make them persistent (Antonelli et al., 2012) towards a sustainable firm growth.

1.4 Research design

1.4.1 Conceptual model

The evolutionary theory and the dynamic capabilities approach are chosen as a theoretical framework because they are complementary in their vision of this dissertation subject.

The evolutionary theory explains the relationship between innovation and firm growth, based on firm knowledge, learning process, routines, and interaction with the environment.-This theory was chosen because it establishes the generation of innovation through routines that adjust according to the knowledge process and the environment, which in this research is also related to the generation of firms' dynamic capabilities that contribute to a sustainable behavior and competitive advantage. It also states the existence of path-dependence and a cumulative knowledge process that demonstrates the persistence in firm behavior and justifies the analysis of the effects of persistence in innovation.

According to Nelson (1991), differences in strategy define heterogeneity between firms. For that reason, this research aims to explore the most appropriate definition of strategies involving innovation and exporting to clarify and differentiate their results. I assume that each firm strategy has its own cumulative knowledge process that explains the firm heterogeneity (Nelson and Winter, 1991), because of this, I estimate the propensity of the combination of innovation and exporting strategies options, its persistence, and its effect on sales growth.

The dynamic capability (DC) approach analyzes how a firm develops resources and capabilities to adapt itself to the changing environmental conditions. It states that managers are rational and their objective is to develop dynamic capabilities as the source of firm sustainable competitive advantage, which are firm-specific, difficult to imitate, and replicate (Rabetino et al., 2021). These assumptions state the relevance of finding a clear definition of them to guide the managers in their functions. According to Teece (2007), a pool of processes and routines provides particular microfoundations for dynamic capabilities, therefore, it is assumed that they can be a suitable variable to represent microfoundations. Specifically, in this case, I relate DC with innovation and exporting considering that DC is latent capacities that are perceived only once they are manifested in the routines and their outcomes (Di Stefano et al., 2014).

It is assumed that the microfoundations of dynamic capabilities directly affect innovation and indirectly affect exporting through the effect of innovation to internationalization (Efrat et al., 2018; Miocevic, 2021; Teece, 2007). Because of their complementary relationship, improving innovation enhances exporting performance and makes them sustainable over time. The development of capabilities to sense and seize opportunities, and threats and reconfigure assets, facilitate the adaptation of the firm to the changing environmental conditions in overseas markets (Teece, 2007).

The conceptual map, represented in Figure 1, shows the relationship amongst dynamic capabilities, strategies, and impact. In this map, I represent the interaction between dynamic capabilities, growth-seeking strategies (innovation and internationalization), and performance. In the process, the firm's dynamic capabilities operate through their microfoundations to increase innovation and exporting strategies propensities (Teece, 2007). The sensing, seizing and reconfiguration capabilities guide the microfoundations and the base of all of them are the operational and ordinary capabilities, which are related to routines (Eisenhardt and Martin, 2000; Vicente et al., 2015). They are the vehicle of the dynamic capabilities to innovation and exporting strategies. This part of the conceptual map is considered in chapter 2 to analyze the relationship between microfoundations and innovation and exporting propensities.

Meanwhile, there is an interaction between both strategies, complementing each other through the learning by exporting (LBE) and self-selection (SS) hypothesis (Bernard and Jensen, 1999; Clerides et al., 1998). The innovation tends to behave persistently because of the existence of DC, sunk cost, success breath success or path dependence. This conceptual part is studied in chapter 3 through a systematic literature review of persistence in innovation, analyzing the characteristics of the literature and how it studies the relationships with exporting and firm growth.

In addition, the firm's innovation and internationalization process and routines, based on the accumulated knowledge in interaction with the context, contribute to growth, revenues and profit. The revenues and profit are reinvested, increasing capabilities and firm size, reinforcing innovation and

internationalization process, making these strategies long-lasting (R. R. Nelson and Winter, 1982). This relationship is studied in chapter 4.

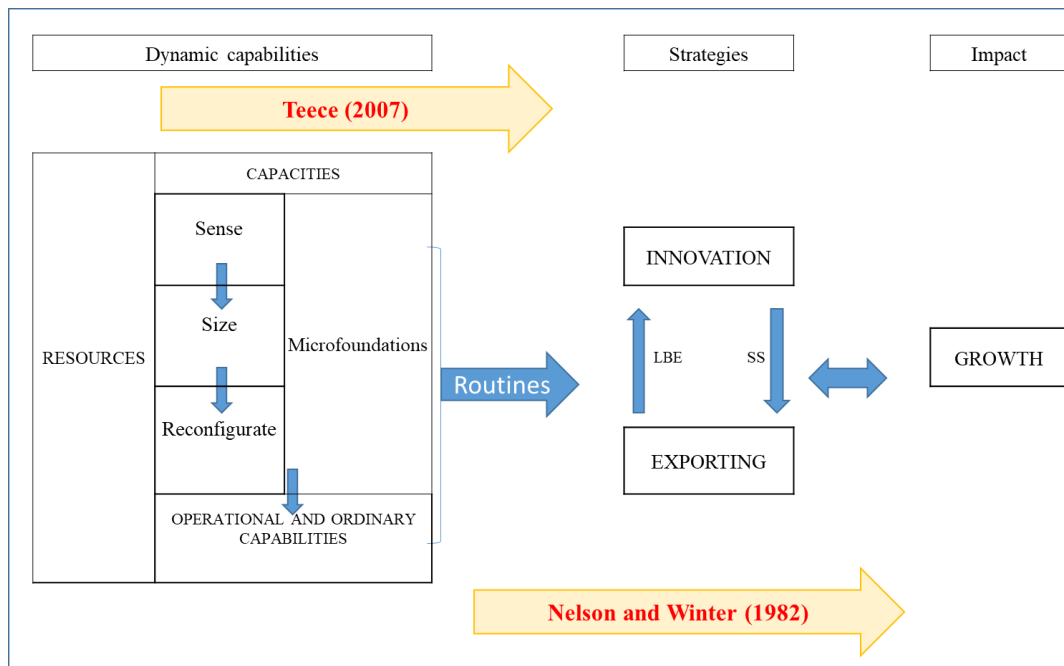


Figure 1.1 Conceptual map

1.4.2 Data collection and analysis

The database used for the second and the fourth chapter is the Innovation survey of manufacturing and services firms carried out by the National Agency for Innovation and Research (ANII). As for the third chapter the Scopus and Web of Science databases are considered because they are recommended by Paul and Rialp Criado (2020) and are used by the previous systematic literature review in this topic.

The innovation survey provides information on the main characteristics of the companies, its human resources, innovations, sales and exporting activities, focusing on innovation capacities and efforts, activities results, and its strategies. It involves industrial and selected service firms whose average employment in 2012 and 2013 was greater than or equal to 5 or their registered sales were greater than or equal to 60 million American dollars. The data is taken from two-wave survey (2010-2012 and 2013-2015). Its conceptual and methodological guidelines are based on the Bogotá Manual, which considers the Oslo Manual (OCDE) definitions, criteria, and classifications relevant for studies of industrial innovation and the integration of specific instruments and procedures suitable for Latin-American countries. The two-wave survey are selected because of firms' uniform selection criteria and compatible survey structure to merge them in one sample. In addition, in the moment of processing the information,

they were the most recent processed surveys. This consideration aims to identify the innovative behavior of the firms, its efforts, and results to define present challenges.

In chapter 2, the analysis of the microfoundations of dynamic capabilities as determinants of innovation and export propensities, the database includes 1836 and 1302 firms from each wave survey, and it was transformed into a six-year database of 16974 observations, containing manufacturing and service sectors. The extraction of the information forms a national standardized innovation survey, contributing to the standardization of this analysis for future studies. I assume that each firm's strategy has its own cumulative knowledge process that explains the firm's heterogeneity (Nelson and Winter, 1991). This should be revealed in the influence of the microfoundations on the propensities of doing both activities or doing only one. For that reason, I estimate the propensity of the choice of the combination of innovation and exporting strategies as an approach to the diversity of strategies taken by the firms. Because of a problem of multicollinearity, three strategy propensities are defined as dependent variables instead of four. The estimation of the no innovation and no exporting strategy was ignored. The three propensities are estimated using the investment in innovation activities and exports value data. The explicative variables used to represent each microfoundations are the most used routines or processes to improve firms' performance. They are clearly defined in the survey and easy to replicate in future analyses.

The influence of microfoundations is estimated by three different models. The first one, the multinomial probit, considers the combination of exporting and innovating as four different strategy options that the firm decides to take. The other two models, frequently used, bivariate probit and fixed effects, are estimated to compare the results and validate the consideration of the combination of both strategies' propensities to have a more accurate prediction. In this sense, the bivariate probit considers that exporting and innovation decisions are jointly taken but estimates two probabilities. The fixed effect model assumes that they are independent decisions.

In chapter 3, Scopus and Web of Science databases are used to select articles related to the topic "persistence in innovation" (PI). The query extracted in April 2021 shows literature published from 1997 to 2021. I analyze the evolution of the literature and the relationship between PI with exporting and firm growth, through bibliometric and content analyses, following the protocols defined by PRISMA and PICOS tools to get easily replicated procedures and a refined sample from the databases. The selected documents after eliminating duplicate ones and those with non-related topics are 63.

In chapter 4, the analysis considers the accumulated knowledge effect of following a certain strategy therefore I estimate the effect of doing each strategy persistently to get its potential influence on firm growth. The database used is the same as in chapter 2. I elaborate on the persistence and the sales growth variables to estimate the regressions. The fixed effect is used to estimate four regressions that consider different measures of the firm strategies: persistence, intensity in $t-1$, and propensity in $t-1$. For the first

one, the continuity of the strategies from the year 2010 to year t is considered. The second one, according to Love and Máñez (2019), considers that previous experience supports export intensity (the ratio of exports to total sales). The third one represents one of the most used variables to estimate the influence of exporting or innovating (e.g. Golovko and Valentini, 2011). Considering these assumptions, I estimate the regressions of firm growth to compare these variable results with the persistence variable results. To check robustness, I estimate the same regressions for the labor growth and Haltinwagner index.

1.5 Structure and main contents of this dissertation

The first paper entitled “Determinants of innovation and exporting: a dynamic capabilities approach” deals with the first objective of this dissertation. It focuses on the effects of microfoundations of dynamic capabilities on exporting and innovating propensity. I also compare different estimations to demonstrate the relevance of considering the combination of exporting and innovating strategies as three different firm choices, defining them as dependent variables. This paper contributes to the operationalization of dynamic capabilities through microfoundations definitions to quantify their incidence in export and innovation propensity. I introduced multinomial models to resolve the determinants of the innovation and export propensities.

Data for this study and the fourth chapter are extracted from the Innovation and Research National Agency of Uruguay (ANII) survey from 2010 to 2015. Methodologically, I use three different models to study the determinants of being an exporter and an innovator, including the same explicative variables in all of them. The models are: Multinomial probit, bivariate probit and fixed-effect models as I explained before.

The multinomial model results show that all the coefficients associated with the microfoundations are significant and positively related to innovation and exporting strategy propensity. This result is in accordance with the theory of dynamic capabilities. Regarding only innovating and only exporting propensities, all the explicative variables significant are positively related, but not all of them are significant, demonstrating certain particularities in the relationship between the microfoundations and the strategies isolated.

The second paper is entitled “A Systematic Literature Review of Persistence in Innovation and the Relationship with Exporting and Firm Growth” and corresponds to the second objective of this dissertation. It studies the literature about persistence in innovation and its link with exports and firm performance. The information was extracted from Scopus and Web of Science databases, following

PRISMA statement and PICOS recommendations and protocol, as is described previously. The information is processed by bibliometric methodology and by content analysis. The first one allow the analysis of the main characteristics of the literature and its temporal evolution, meanwhile the second permits the analysis of the relationships between the variables of interest.

The persistence in innovation literature shows a particular evolution with a stagnant growth and two defined periods. The first one is characterized by few studies with high levels of citations, focusing on the analysis of the determinants of persistence in innovation. The second one studies the effect on firm performance more emphatically and few of them relate it to exporting; there are several authors with only one publication in the subject and articles not much cited, with scarce international collaborations.

Most papers show a positive relationship between persistence in innovation and firm performance, no matter which variable is used to define innovation or firm performance. Only one case finds no significance between them (Guarascio and Tamagni, 2019). The studies that explore this relationship demonstrate a diverse perspective. Only two articles relate persistence in innovation and persistence in exporting with firm performance.

The third paper refers to the third objective. It explores the relationship between the persistence in innovation and exporting propensities, and the firm sales growth. In this sense, the estimation is ought to demonstrate the accumulative process of doing exporting and innovating strategies continuously. The contributions of this paper are to increase empirical literature on persistence in innovation and firm growth; distinguishing different effects related to exporting and innovation variables on firm growth: considering the innovation effort in a wider concept and not only R&D classification, trying to create empirical evidence for exporting and innovating supporting policies; and presenting evidence for developing context, with restrictions to persist in innovation and persist in exporting in the same period.

I use the same database I employ in the first paper. The estimation is made by using a fixed effect model. I run four regressions to compare the effect of different measures of exporting and innovation on sales growth.

The results demonstrate that persistence in both strategies and in only exporting have positive significance on firm growth. Meanwhile, persistence in innovation has no significance on firm growth corroborating the results of Guarascio and Tamagni (2019). The results do not confirm that persistence in both strategies has a higher effect on firm growth in comparison to the others persistence.

Comparing all the regressions, the persistence variable is the one that reflects a positive effect of innovation and exporting strategy. The propensity of doing both and only exporting strategies with one year lag are negatively related to effects on firm growth. The variable exporting intensively the previous year without considering the preceding strategies is also negatively related. Meanwhile, innovation intensity in knowledge and technology is positively related to firm growth.

An earlier version of this paper was presented in ACEDE and has benefited from comments made by Teresa García Marco and two anonymous referees from ACEDE and one from EURAM.

In table 1 I present the structure and main contents of this dissertation showing the correspondence between objectives, theoretical backgrounds, methodology and results of each paper.

In the following sections I present the three papers of this dissertation and in the fifth section, the contributions, implications, limitations and further research agenda. The objective of this section is to present the main findings of each paper and highlight the implications of them. The implications are divided into political and practical implications. The limitations of these studies include future research agenda to advance in our understanding of this topic.

Table 1.1 Structure and main contents of the dissertation

	Objective/ focus	Main theoretical background	Sample	Methodology	Main result
Introduction	Summary of the main purposes, motivation, theoretical background, structure and contents of the dissertation				
Paper 1	Relationship between microfoundations and the propensities to innovate and export	Evolutionary theory, Dynamic Capabilites	Uruguayan firms, ANII Survey, 2010-2015	Fixed effect, Bivariate and Multinomial probit.	Positive relation of microfoundations in innovation and exporting propensities.
Paper 2	Temporal evolution of persistence in innovation (PI) literature and the relationship between PI with: * exporting and * firm growth. Identify future research trends.	Evolutionary theory, Dynamic Capabilites and others.	Scopus and Web of Science, 1997-2021, April,2021	PRISMA and PICOS, bibliometric and content analysis	Performance is a recent interest in this topic. Diverse studies in PI and growth. Most find positive relation between PI and growth. Few studies in PI and exporting.
Paper 3	Persistence in exporting and innovation effects on firm growth	Evolutionary theory	Uruguayan firms, ANII Survey, 2010-2015	Fixed effect	Persistence in both strategies and in only exporting (softer) is positive related to firm growth. Persistence in innovation has no significance.
Conclusions	Stylized summary of the main findings, theoretical and practical implications, limitations and future research agenda				

2 DETERMINANTS OF INNOVATION AND EXPORTING: A DYNAMIC CAPABILITIES APPROACH

2.1. Introduction

Exports and innovation are defined as the most frequent strategies used by firms to increase sales (Golovko and Valentini, 2011). They are also two strategies that have gained relevance in recent governmental programs and policies as enhancers of firm value added and growth (for example, Horizon 2020). Diverse research (Bernard and Jensen, 1999; Golovko and Valentini, 2011; Iandolo and Ferragina, 2019; Ito and Lechevalier, 2010) found there is a complementary relationship between both variables to increase firm performance. There is a virtuous circle through the mechanism of learning by exporting or self-selection hypothesis, that makes these firms to have a better performance than the ones that only does one strategy (Golovko and Valentini, 2011)

For the evolutionary vision, technology and innovation are the main determinants of firm growth in the long term. Innovative activities incorporate productive differentials that provide greater added value to compete in the domestic market and international markets. Consequently, they contribute to the firm's growth, improving its capacities and conditions to sell their products abroad (Dosi, Pavitt and Soete, 1990). They perceive firms as bundles of 'organizational routines', which are based on the knowledge build on an accumulative learning process. A routine is also the decision-making process that leads to innovation which, in case of success, will be repeated. The learning processes and the environment conduct firm innovation process adjustment (Nelson, 1991; Suárez, 2014). This investment produces growth in capacity or in sales revenue (R. R. Nelson and Winter, 1982).

In addition, the complementary effect between innovation and export that generates a virtuous circle by the mechanism of learning by exporting or self-selection hypothesis is also expected to improve the firm performance.

However, the firm's success also depends on its resources and capabilities, and its ability to adapt itself to the industry and market contingencies. Firms must display dynamic capabilities as key factors in the innovation and competitiveness of an organization (Eisenhardt and Martin, 2000; Giniuniene and

Jurksiene, 2015; Teece et al., 1997) to support the environmental change adjustment. Otherwise, shareholder value will be destroyed (Bowman and Ambrosini, 2003).

Teece (2019) suggests that less developed countries, apart from investing in technical efficiency, should consider market needs and the construction of dynamic managerial competencies to enhance the probabilities of success. In this research I analyze a developing country with an open and agro exporter economy, small market, qualified population and undeveloped capital market, where firms are obliged to innovate and export to increase their sales and improve their performance. Their lack of competitive cost because of the scale of production determines their focus on niche markets, incorporating innovation to access their standards. Then, it is important to analyze which are the determinants of firm export and innovation propensity as, in this context, this propensity is critical to have increasing performance.

In this research I aim to demonstrate, through a quantitative research method, the relevance of the microfoundations involved in the sense, seize and reconfiguration capacities (Teece, 2007) to generate firm's dynamic capabilities and to increase innovation and exports propensity.

In the literature there are different points of view about how firms' dynamic capabilities lead to firm performance improvement and competitive advantage. There is a debate about the mechanisms that operate (Zhou et al., 2019), as the conception of dynamic capabilities has constantly evolved (Helfat and Peteraf, 2009; Wenzel et al., 2020; Wilden et al., 2016; Zahra et al., 2006). At the beginning, the controversy was concentrated on theoretical issues and did not discuss how practical activities of the organization, such as training, contribute to the creation and development of them (Daly et al., 2004). However, more recently, research emphasized on the operationalization and practical implications of dynamic capabilities (Daly et al., 2004; Froehlich et al., 2017; Karman and Savanevičienė, 2021; Kump et al., 2019; Schilke et al., 2018). Nevertheless, there still are few quantitative studies that measure DC as dependent or independent variables and there are no standardized assumptions underlying this concept (Kump et al., 2019).

In this sense, I have found two gaps in this topic: first, the operationalization of dynamic capabilities and second, the methodology used to estimate the determinants of innovation and export propensity. Diverse articles study the determinants of innovation to identify specific behavior patterns. The operationalization of dynamic capacities framework may contribute to the understanding of innovation capability and consequently, it may collaborate to improve innovation level in the firm (Froehlich et al., 2017). Furthermore, some studies find that innovativeness and dynamic capabilities affect exporting performance (Miocevic, 2021; Monteiro et al., 2019; Ritam Garg, 2012; Vicente et al., 2015; Villar et al., 2014).

Teece (2007) formulates a practical framework that explains the relationship between the high order capacities and the firm microfoundations to implement organizational routine changes. He explores the

strategy and innovation literature and defines critical capabilities to sustain the business and management needs. These capabilities are classified into: sense, seize and reconfiguration. This gives information to decision makers about strategic considerations to enhance the firm performance in global market competition. Froehlich, Bitencourt and Bossle (2017) do an exhaustive analysis using Teece (2007) framework, studying a Brazilian innovative firm. Based on these two articles and complemented with Eisenhardt and Martin (2000) and Anand et al. (2009), I present the framework of this investigation. This framework is the most frequently mentioned to Dynamic Capability approach (Kump et al., 2019; Schilke et al., 2018)

In relation to the second gap, most of the previous studies tend to employ Probit models to estimate the export or innovation propensity (Bianchi et al., 2015; Cassoni and Ramada-Sarasola, 2010; Golovko and Valentini, 2011; Ito and Lechevalier, 2010). If we consider that the firm chooses to export or innovate as an interdependent decision, it should be used bivariate or multinomial probit. For instance, considering the choices of the combination of exporting and innovating as four different strategies (Golovko and Valentini, 2011; Iandolo and Ferragina, 2019; Lööf et al., 2015), multinomial probit model seems to be the appropriate estimation. In this sense, choosing the adequate regression improves the estimation of the determinants of innovation and export propensity and guides suitable interventions to enhance firm performance.

The research main objective is to determine the influence of the microfoundations of dynamic capabilities in the propensities to innovate and export. Assuming that Teece (2007) dynamic capabilities improve the development of innovation (Froehlich et al., 2017) and exporting capability (Miocevic, 2021) through its microfoundations. It is expected to find a positive relationship between the microfoundations and all the propensities. This analysis is very useful to improve the Uruguayan firm performance because of the relevance of doing both strategies to escape from domestic restrictions.

The questions that motivate this analysis are: 1) What influence do the microfoundations related to sense capabilities have in innovation and exporting propensity? 2) What influence do the microfoundations related to seize capabilities have in innovation and exporting propensity? and 3) What influence do the microfoundations related to configuration capabilities have in innovation and exporting propensity?

The contributions of this research are, first, the operationalization of dynamic capabilities through microfoundations definitions to quantify their incidence in export and innovation propensities. Second, the introduction of multinomial models to resolve the determinants of innovation and export propensity and compare its results with bivariate probit and fixed effect regression. Finally, to analyze a the case of a developing country.

2.2 Framework theory and hypothesis

2.2.1. Framework theory

This research is based on two different complementary perspectives: Evolutionary Theory and Dynamic Capabilities (DC) approach. It is considered an evolutionary vision of innovation (Neoshumpeterian) and the DC approach gives the dimension of asset flexibility and adaptability to achieve the firms' goals.

For the evolutionary vision, technology and innovation are the main determinants of the firms' growth in the long run. Cimoli and Dosi (1994) consider innovation as the production and transformation of symbolic and generic knowledge into specific knowledge to solve problems and improve the competitive market position of firms. The relevance of innovative activities is that they incorporate differentials in production that improve added value and quality to participate in the domestic and foreign markets. Consequently, they contribute to the firm growth, improving its capacities and conditions to sell their products domestically and abroad (Dosi et al., 1990).

“The Evolutionary Theory of Economic Change” (R. R. Nelson and Winter, 1982) define firms as bundles of ‘organizational routines’. The routines are their regular activities based on the knowledge built on an accumulative learning process. They involve a conjunction of functions that determine what activities a firm does and ‘how productively’ (R. R. Nelson, 1995) in function of internal variables and external variables (market conditions). Therefore, routines are the best a firm can do conditioned by its knowledge, evolutionary process and the surrounding environmental context that has molded them. Managers must also built organizational capabilities for knowledge creation, typically generating a distinctive competence by doing so (R. Nelson, 1991). Firm-specific knowledge is the result of an accumulated experience of an endogenous learning process, making firms structurally heterogeneous (Federico, 2016). The knowledge generates an everlasting advantage, as it is accumulated in the workers of the organization and it is non-extinguishable (Costa et al., 2020). The learning processes and the environment will conduct the firm innovation process adjustment (Nelson, 1991), through a path dependence (Suárez, 2014). In these processes there is feedback between past innovations, present investments and future innovations (R. Nelson, 1991; Suárez, 2014). Hence, it is expected to achieve positive results in the future (Suárez, 2014). The decision-making process that leads to innovate is a routine (a standard behavior) which, in the case of success, will be repeated. According to Nelson and Winter (1982) statement, firms invest because they easily repeat their “distinctive routinized ways of doing things” and the market shows that it is profitable to do it. This investment produces growth in capacity or in sales revenue (Federico, 2016).

In addition, firms must also display dynamic capabilities, their ability to integrate, build, and reconfigure internal competencies to a changing business environment (Teece, 2007; Teece et al., 1997). These capabilities are key factors in an organization's innovativeness and competitiveness (Eisenhardt and Martin, 2000; Giniuniene and Jurksiene, 2015; Teece et al., 1997). They are reinforced by organizational routines and managerial skills. The routines may be renewed as a consequence of changes in organizational conditions (Zahra et al., 2006) and managers must continuously renew skills and display the ability to take strategies in accordance with the business environment (Rua, 2018). The process of organizational learning develops managers' skills and improves firm dynamic capability (Zollo and Winter, 2002).

According to Dess and Lumpkin (2005), the most innovative firms tend to overcome unstable situations, no matter which sort of innovation is adopted, as the organization itself determines the path to achieve competitive advantage (Rua, 2018). Meanwhile, the organizational routines developed around exporting will help the firm to adjust its conditions to market and environment changes over time (Miller et al., 2012; Pentland et al., 2012) and make it long lasting (Love and Máñez, 2019).

In relation to dynamic capabilities, Teece (2018) describes two levels of capabilities. At the base level, there are operational and ordinary capabilities, related to routine activities, administration, and basic governance delineated in a given production program. In the second level operate the dynamic capabilities: "microfoundations" and higher-order capabilities (Teece, 2007).

Microfoundations involve the adjustment and recombination of a firm's existing ordinary capabilities as well as the development of new ones. They are second-order dynamic capabilities and include new actions that involve astute managerial decisions. Teece (2007) defined them as "organizational and managerial processes, procedures, systems, and structures that undergird each class of capability" (Teece, 2007: 1321). They include distinct skills, decision rules, and disciplines. According to Teece (2007), Eisenhardt and Martin (2000) recognize microfoundations provided by firm processes and routines. They do not denominated "microfoundations", but "Specific organizational and strategic processes". Particularly, they identify cross-functional R&D teams, new product development routines, quality control routines, technology and knowledge transfer routines, and performance measurement systems. All of them related to innovation firm strategies and indirectly to exporting strategies (Miocevic, 2021) as I will explain in the following sections.

In the same level as microfoundations there are the high-order dynamic capabilities that guide them. Using high-order dynamic capabilities, management, supported by organizational processes, senses future steps, plans business models to seize new or changed opportunities, and defines, in relation to the existing form and the plans, the best configuration for the organization. Teece (2007), for analytical purposes, classifies them as sense, seize and reconfiguration capacities. They are the most relevant capabilities for the innovation and the selection of business models. Hence, top management should be

principally focused on them as they define the problems and opportunities the firm is attempting to solve or exploit (Teece, 2018). They guarantee the enhancement, combination, protection and reconfiguration of intangible and tangible assets to maintain competitiveness. In foreign markets, firms are exposed to opportunities and threats of rapid technological change and must be creative to satisfy new customer needs. Additionally, in developed global markets there is space to exchange components and in poorly developed markets, exchange technological and managerial know-how is welcome. These market characteristics give space to develop sense, seize and reconfiguration capacities for new business abroad (Teece, 2007).

2.2.2. Hypotheses

In this section, based on Teece (2007) classification of high-order dynamic capabilities, I present the hypotheses explaining microfoundations associated with sensing, seizing and reconfiguration capabilities. They have been studied by different articles (Ali et al., 2020; Froehlich et al., 2017; Kump et al., 2019) and are expected to affect innovating and exporting propensity. I also present the hypothesis related to the proper estimation for innovation and exporting propensity.

Sensing capabilities is related to “Analytical Systems (and individual capacities) to Learn and to Sense, Filter, Shape, and Calibrate Opportunities” (Teece, 2007). They show the capacity to identify contexts and to recognize opportunities. It consists of filtering information from professional and social contacts to learn, interpret and project the likely evolution of technologies, customer desires, and marketplace reactions. Their mission involves knowledge acquisition, scanning and monitoring internal and external technological developments and evaluating signals emerging from changes in the firm activities (Karman and Savanevičienė, 2021). They estimate competitors, customers, and suppliers’ responses to changes, restrictions and rules imposed by regulatory mechanisms (Teece, 2007; 2012).

Sensing capabilities should be utilized to systematically link knowledge and information with the related organizational functions in various innovation activities (Karman and Savanevičienė, 2021). They are compromised in the internationalization process of exporting, as they became a path to take worldwide opportunities (Prange and Verdier, 2011). In this direction, exporting requires sensing and scanning capabilities to analyze foreign customers’ demands, competitors’ and suppliers’ actions, and networks to discover and exploit global opportunities (Ali et al., 2020).

Organizational processes inside the firm store new technical, customer and competitor information, tap developments in exogenous science and shape new products and processes opportunities. All these must be filtered by those capable of making sense of it. Discovering opportunities can also be settled in organizational processes, such as R&D activity (Teece, 2007). The ability to accumulate knowledge helps managers to make investment decisions towards R&D efforts (Karman and Savanevičienė, 2021).

The new possibilities may combine external inventions with complementary innovations to create adequate customer solutions for national or foreign markets. A business process that engages in a rigorous assembly of data and facts, synthesis and updating evidence, may assure a correct evaluation of market, technological developments and particular opportunities (Teece, 2007). Teece (2007) defined as the microfoundation “Process to direct Internal R&D and Select New Technologies”. On a strategic level, it is required the institutionalization of innovation processes to promote the alignment among the different areas and teams (Froehlich et al., 2017) and incorporate these activities in a systematic way to potentiate and take advantage of them (Harris et al., 2013). This process contributes to increase innovation and exporting propensity as it helps to define new opportunities of innovation and exporting.

H1.i) Process to direct Internal R&D and Select New Technologies is positively related to firm's innovation and exporting propensity.

Karman (2020) states that firms configuring relationship-learning activities, collecting information from external sources, are more likely to innovate. These relationships consist of ongoing joint activities between the firm and its customers, suppliers, academy or other institutions, sharing, understanding and integrating the acquired information. Therefore, new knowledge gained allows strategic synergy that enhances the development and sustainability practices. Collaborations and partnerships can be a vehicle for new organizational learning. Meanwhile, it may assist firms to visualize dysfunctional routines, and avoid strategic blind spots (Teece et al., 1997). In this direction, the firm's accumulated knowledge through network partners is also reflected in a lower ‘cost of foreignness’ in a new market entrant (Love and Máñez, 2019). Eisenhardt and Martin (2000) state that alliancing is a specific and identifiable process that contributes to the dynamic capabilities. They refer to interorganizational collaborations in which processes for accessing outside knowledge allow superior innovation performance. Those linkages can take varied forms including informal personal (Eisenhardt and Martin, 2000; Powell et al., 1996). However, there may exist routines through which networking know-how is articulated, codified, shared and internalized within the organization (Teece, 2007). Collaborations facilitate the ability to perceive and interpret the future and to innovate (Kyläheiko et al., 2011). Froehlich, Bitencourt and Bossle (2017) suggest naming this microfoundation (2007) as ‘processes to identify and establish partnerships to manage or complement organization's innovations’. International alliances are a mechanism for access to worldwide sources of knowledge. For the reasons explained above, it is expected that:

H1.ii) Alliancing process is positively related to firm's innovation and exporting propensity.

When opportunities are perceived, it is necessary to associate them with new models, processes, products or development of services. It is about planning and preparing the firm for changes across

multiple dimensions (Froehlich et al., 2017; D. J. Teece, 2016). Skills, technology, improvements in activities, and creation of strategies related to investment decisions are critical for the development of a successful new business model (Harris et al., 2013). Seizing also involves directing and incorporating opportunities (Froehlich et al., 2017) and it is related to the firm structures, procedures, designs and incentives (Teece, 2007). This capability is developed once sensing is consolidated. Sustaining and enhancing technological competencies and complementary assets are essential to address opportunities. Investment decisions require strategizing about the timing, relying on increasing return advantages, and selecting investment priorities. The alignment of processes and incentives with the physical technology is a relevant component of strategic management. Manager's ability to perceive dysfunctional characteristics of established decision rules and resource allocation processes is valuable; it may include fundamental changes in decision-making processes. Multiple functional areas are involved, so important coordination and management are necessary (Teece, 2007). An effective evaluation of international business potentiate competitive advantage, facilitating timely market-oriented decisions (Ali et al., 2020) and ahead the competitors (Eisenhardt and Martin, 2000).

Not only does seizing capability require determining the business model, but also considering resource needs, making decisions related to investing in resources and technology, and it leads to making the appropriate changes (Harris et al., 2013) to incorporate opportunities. Resources alignment and co-alignment issues are important in the context of innovation. The firm integration may be driven by the need to build capabilities when these are not available in the industry. This is about the microfoundation "Selecting enterprise boundaries" which involves calibrating asset specificity and controlling bottleneck assets to act in consequence to guarantee a successful innovation that will benefit the firm and not imitators (Teece, 2007). It will also facilitate exporting activities, access to capital and skilled human resources (Ali et al., 2020). Hence, it is expected that:

H2.i) Selecting Enterprise Boundaries is positively related to firm's innovation and exporting propensity.

Finally, reconfiguring capabilities maintains competitiveness through the renewal and orchestration of resources and competencies to match the requirements of the changing environment. These may include enhancing, combining, protecting or reconfiguring resources and competencies (D. J. Teece, 2007, 2012). The ability to recombine and reconfigure assets and organizational structures are crucial to sustain profitable growth, to manage threats and transformations (Froehlich et al., 2017). As markets and technologies change, reconfiguration is needed to maintain evolutionary fitness and avoid negative path dependencies. The success will conduct to a stable level of routine until there is another alteration in the environment (Teece, 2007).

Changing routines is costly and takes time. However, if the organizational culture is prepared to accept high levels of internal change, the cost and extent is reduced (Teece, 2007). In incremental innovations, routines and structures are adapted gradually. Meanwhile, radical innovation may establish entirely different sets of structures and procedures more difficult to implement in firms that tend to restrict their innovations investment according to the existing asset base, focusing on exploiting established technological and organizational assets (Teece, 2007).

Profitability sustained achievement involves “semi-continuous and/or continuous efforts to build, maintain, and adjust the complementarity of product offerings, systems, routines, and structures” (Teece, 2007: 1335). To minimize damages and maximize complementarities and constructive dialogue inside the firm, certain periodicity is required in business model redesign, asset orchestration and routine renewal. “Capability redeployment” may involve the sharing of capability between the old and the new model or the geographic transfer to another market (Helfat and Peteraf, 2003; Teece, 2007).

The concept of cospecialization operationalizes at least one dimension of the concept of organizational adaptation and adequacy. It involves seizing and reconfiguration. The realignment can be of one asset to another, or of strategy to structure or to process; to identify, develop and combine the specialized and cospecialized assets is a remarkable management’s ability. This is an important dynamic capability, which is sometimes absent in the firm settings. Innovation and reconfiguration need managers to combine cospecialized assets. Managers are required to sense the need or the opportunity and be able to effectuate the integration to be effective. When the assets cannot be procured outside the firm, it should be built internally, creating special value. The success depends on management’s entrepreneurial capacities in matching up and integrating relevant cospecialized assets (Teece, 2007). The effective management of cospecialization improves innovation and with it exports opportunities.

H3.i) Managing cospecialization is positively related to firm’s innovation and exporting propensity.

Continuous improvement is a systematic effort to search and execute new ways of doing work. Anand et al. (2009) define it as dynamic capability, considering Zollo and Winter (2002) conception⁴, as it is the organization that modifies its operating routines to improve its effectiveness. The continuous improvement capability is the ability to consistently learn and improve the current process (Ittner and Larcker, 1997; Anand et al., 2009). The firm challenge is to create an infrastructure to coordinate the projects which involves organizational learning, implies practices, tools and techniques to execute projects. The correct implementation of these procedures improves the organization’s ability to make consistent and rapid process changes to enhance work and introduce innovations. A coherent

⁴ “a learned and stable pattern of collective activity through which the organization systematically generates and modifies its operating routines in pursuit of improved effectiveness.” (Zollo and Winter, 2002, p. 340)

infrastructure is critical to produce and sustain dynamically changing operational capabilities (Eisenhardt and Martin, 2000). It is necessary to provide a planned and organized system for running continuous changes that require two broad areas to be sustainable: execution and coordination. The tasks require choosing and reviewing projects, maintaining lessons learned from projects, motivating and training employees to participate (Anand et al., 2009). Continuous improvement process introduces innovation and it is expected to, indirectly, enhance exports.

H3.ii) Continuous improvement processes is positively related to firm's innovation and exporting propensity.

Knowledge management microfoundation of dynamic capabilities is “the creation of learning, knowledge-sharing, and knowledge integrating procedures” (Teece, 2007:1339). Organizational learning involves creating new knowledge (exploration) and using existing knowledge (exploitation) (Crossan et al., 1999). The knowledge originates from outside, which implies ‘absorptive capacity’ (Zahra and George, 2002), or inside the firm through three learning process mechanisms that exist in operational routines: experience accumulation, knowledge articulation, and knowledge codification processes (Zollo and Winter, 2002). There are exploration activities that introduce new ideas and enhance innovation, and exploitation activities that involve the replication of existing methods and are expected to improve firm efficiency (Easterby-Smith and Prieto, 2008). Managers ought to encourage the appropriate climate to facilitate learning and creativity, using traditional learning tools, innovations and strategies to maximize organizational learning. Firms may display a semiautomatic increase of experience and thoughtful investments in knowledge articulation and codification activities. An effective articulation develops synergies, and the knowledge codification facilitates knowledge accumulation and the articulation. Once knowledge becomes institutionalized, it forms the basis for new organizational rules, procedures and routines that build dynamic capabilities. This process of individual and collective learning is the basis for the continuing evolution of organizational knowledge, implementations of innovations and improvement of exports (Villar et al., 2014). For that reason, it is expected that:

H3.iii) Knowledge management is positively related to firm's innovation and exporting propensity.

Product development routines are relevant microfoundations of dynamic capabilities (Eisenhardt and Martin, 2000). When a firm modifies product offerings, the ability to achieve asset ‘combinations’ and reconfiguration, must face business models, firm boundaries, and organizational structures. Threat management and reconfiguration of organizational structures are important to adapt technological and market changes. It is necessary for the firm to evaluate its activities and reformulate routines, realign

activities, and adapt its business units (Teece, 2007). This process involves cross-functional teams' participation with different sources of expertise. Sources of expertise are critical to develop a superior product in quality and related production. Their work is the information available and facilitates coordination to solve problems (Eisenhardt and Martin, 2000). It requires an effective knowledge creation process that links the firm with outside knowledge sources.

It is expected that in a changing and competitive environment, the firm will continuously develop new products to respond to the changing demand or to generate new one. Once the conditions are established for this process, the firm has incentive to repeat it. Through product development it is expected to increase consumers' approval, and it is predictable to an increase of the probability to export, apart from increasing innovation. Hence, it is expected that:

H3.iv) Product development routines are positively related to firm's innovation and exporting propensity.

2.3. Methodology

To analyze the effects of the microfoundations in innovation and export propensities, different models are used to compare the results. I use multinomial, bivariate probit and fixed-effect regressions, based on different assumptions. Before this, I introduce Uruguay's main characteristics and its particularities, which may influence the results. Later, I present the data and the variables used in the models.

2.3.1. Uruguayan context to firm's innovation and exporting propensities

Uruguay is a small developing country⁵ between the two biggest countries of South America: Argentina and Brazil. With these two states and Paraguay, Uruguay has been a member of the MERCOSUR, a commercial integration agreement since the mid-nineties. From the end of the 19th to the middle of the 20th century, it has grown by agro exports and migration. At that time, the exports of foodstuff to Europe brought high progress through technological innovations such as railways and steam boats (Bulmer-Thomas, 2003). Since the mid-1900s, public enterprises have been in charge of telecommunications, electricity, water supply and fuels⁶. Surrounded by monopoly regulations, these

⁵ It is nearly one third of the territory of Spain and it has 7% of its population (3.4 million people). Its GDP per capita was 14,380 Euros in 2017 and since 2013, it is considered a high rent country by the World Bank classification. With a very small birth rate since the 1960s, it has a high percentage of alphabets, 98.5% in 2014. In 2014, in the population between 25 to 59 years, 32.4% of women and 23.6 % in the case of men, having more than 13 years of education.

⁶ Energy and telecommunication, 1912, fuels, 1931, and water, 1952.

public firms have promoted important innovations such as the change in the energy matrix to renewable resources in the last decade.

The integration to MERCOSUR block started with important productive transformations, especially for the small firms. Some industries were affected by the increment of competitive imports, in some cases compensated by the increment of exports for the region, others paralyzed the production. The net balance was a stagnant industrial volume (Bittencourt, 2012). In 2002, this situation was aggravated with an economic and financial crisis that affected all MERCOSUR members. A high percentage of the industrial and commercial activity was affected because of the high dependence of the country on regional commerce. After that, there was a period of high growth for one decade, driven by the manufacturing industry and commercial activity.

The period analyzed in this research, 2010- 2015, is influenced by an abrupt decline after a prosperous economic stage for the Latin-American countries. In the 2000's, the agro industry expanded, driven by a booming demand for soy, grain, fruit, and other foodstuffs from emerging economies such as China (Aguilera et al., 2017). In particular, Argentina, Brazil, Chile, Peru, Paraguay, and Uruguay expanded the scale and sophistication of their agro production, investing in R&D for new seeds, machinery, and biotechnology (Brenes et al., 2016; Niosi and Bas, 2014). The global crisis of 2008 hit the region by a negative trade shock, falling commodity prices, increasing currency valuations and declining foreign direct investment inflows. However, the strong growth in exports to China maintained stability in the region, at least until 2015 (Vianna, 2016). An extraordinary capital flow was followed by a sharp drop in exports to China in 2015, affecting the most important economies of the region 2015 (Vianna, 2016). After a favorable scenario, some Uruguayan macro variables from 2010 to 2015 declined. Meanwhile GDP growth had an increasing trend, the exports decreased and FDI increased until 2013 and then decreased.

In 2010, after a decline of 10 per cent, Uruguayan exports increased up to 27%. Then, it decreased until 2015 by -11.2% annual variation (Uruguay XXI, Annual Report, 2016). From 2010 to 2014, the percentage of Uruguayan exports destined to South America was around 34% but in 2015, the percentage reduced to 28%. Meanwhile, Asia continuously increased its participation in Uruguayan exports from 18% to 31%. Consequently, the exporting firms decreased as Latin American countries were the principal destinations for those firms with lower exports percentage on sales (Grosse et al., 2013)⁷.

During this quinquennium, the promotion of firms' innovation has taken relevance. The creation of the National Research and Innovation Agency (ANII, for its Spanish acronym) improves Science,

⁷ <http://www.anii.org.uy/upcms/files/listado-documentos/documentos/encuesta-de-actividades-de-innovaci-n-en-la-industria-manufacturera-y-servicios-seleccionados-2010-2012.pdf>

Technology and Innovation financing programs. Meanwhile, the regulation of the Investment promotion law changed, demanding advanced technologies and other innovations to get higher tax exemption. Uruguay research and support institutions had had a traditional background about improving chain resources in productive sectors as cattle, forestry and agriculture. The agricultural sector had an outstanding technological dynamism in the principal agro exports products (Paolino et al., 2014). However, “most of the innovation capacities and efforts depend on the public enterprises, the behavior of private firms in highly regulated spaces” or dependent on regulations as the knowledge intensive sectors (Bittencourt, 2012). For example, in the two-wave survey (2010-2015), there is a low percentage of innovative firms, the 24 % (2010-2012) and the 27% of the firms surveyed (2013-2015), did at least one type of innovation (ANII, 2015).

2.3.2. Data and sample

The Innovation survey of manufacturing and services companies carried out by the National Agency for Innovation and Research (ANII) from 2010 to 2015 was used for this study. It provides information on the characteristics of the companies, its human resources, the innovation activities that performs, the type of innovation that is carried out, and the impact of it according to the valorization of the business sector, sales and exports activities.

It has the latest survey data processed. It is a representative and exhaustive database (Aboal et al., 2011; Bianchi et al., 2015; Cassoni and Ramada-Sarasola, 2010). The period covered by the survey captures the first part of the consolidation of recent transformations in the Uruguayan National Innovation System.

The surveys collect information about firms with five or more workers as the inferior stratum or which have declared sales for an equal and more than 5.85 million American dollars, as the superior stratum, associated with firms with more than 100 workers. Their economic activities are defined by the International Industry Uniform Classification fourth revision (CIIU. Rev. 4) and is selected in relation to its weight on the economy⁸. The samples are repeated observations taken in different moments to the same firms, taken as the initial period the survey of Innovation activities of 2009⁹.

⁸ <http://www.anii.org.uy/upcms/files/listado-documentos/documentos/encuesta-de-actividades-de-innovaci-n-en-la-industria-manufacturera-y-servicios-seleccionados-2010-2012.pdf>

⁹ “The base sample of the Innovation survey for the period 2010-2012 corresponds to the 2009 edition, which was selected based on the 2008 Permanent Register of Economic Activities (RPAE) under a systematic, R&om and stratified design. The stratum of the design recognizes two dimensions: 1) the main economic activity class of the company (at the activity division level) and, 2) the size of the activity in terms of workers and / or sales. Then, within each stratum, a sample was selected independently under a systematic design with R&om start, ordering the companies according to their activity to four digits (class) and their average employed personnel.”(ANII, 2015)

2.3.3. Variable and summary statistics

To test the hypotheses developed in the previous section I use three models related to innovation and export decision-making assumptions. Multinomial probit model assumes that the decision of exporting and innovating is taken at the same time and estimates the probability of adopting three different strategies of combinations of export and innovation choices. Bivariate probit assumes that both decisions are interrelated and fixed effect assumes that they are independent decisions.

It is used a wide concept of innovation (Sterlacchini, 1999) including propensity of innovation efforts on internal and external R&D, technology transfer (TT); acquisition of technology (software and capital goods), and different improvement in production or sales (organizational and management design, engineering and industrial design and training).

The control variables are: size, age, sectorial variables (agro industrial, chemistry, and technology) and years dummies (Bolívar-Ramos et al., 2020), ownership of capital (Golovko and Valentini, 2011) and labor productivity (Guarascio and Tamagni, 2019; Ito and Lechevalier, 2010), all lagged to reduce simultaneity. Size is measured as the logarithms of sales and labor productivity is estimated as the firm annual sales per employees. The sectors are chosen for being the most traditional (agro industry), the most innovative in the period 2010-2012 (ANII, 2015) and the “potentially innovative sector” (technology).

For the explicative variables, I adopt and integrate the microfoundations of dynamic capabilities analyzed in previous studies described in section 2.2.2. (Anand et al., 2009; Eisenhardt and Martin, 2000; Froehlich et al., 2017; Teece, 2007). The reference papers explore case studies and define the explicative variables from diverse manager answers about the firm activities and programs. Meanwhile, I choose representative variables from a structured survey, which uses general concepts. They are classified by the high order capabilities: Sense, seize and reconfiguration (Teece, 2007).

In the sense capability, the microfoundations “Process to direct Internal R&D and Select New Technologies” (Teece, 2007) and “Alliancing process” (Eisenhardt and Martin, 2000) are represented by the dummies existence of formal R&D unit and being part of a network, respectively. Having a formal unit is chosen because it reflects the existence of an infrastructure to create and direct internal R&D, and being part of a network is the result of alliancing process microfoundation. For the seizing capability, denominated as “Selecting Enterprise Boundaries” (Teece, 2007), I choose percentage of employees trained as a variable that explains the firm prioritization of the human resources and the potentiation of their capabilities to reduce possible boundaries and improve the firm performance. The

variables that explain the firm reconfiguration capabilities are five. Improving the use of employees' capabilities operationalizes the microfoundation "managing cospecialization" (Teece, 2007). It reflects the manager's ability to seize and reconfigure, identifying, realigning and combining the specialized and cospecialized assets. The variable having continuous improvement processes team is chosen to represent "continuous improvement processes" microfoundation (Anand et al., 2009). The measure of effective "knowledge management" ((Teece, 2007; Zollo and Winter, 2002) is certifications in product and process, representing the result of an effective implementation of these procedures. They are based on know-how transfer, exploiting existing knowledge to gain firm efficiency, but also implies internal learning process mechanism and absorptive capacity of the firm to implement it (Zahra and George, 2002). An effective knowledge management is able to implement any kind of certifications in product or process. To represent the "product development routines" (Eisenhardt and Martin, 2000) I select two representative variables as both are the firms' most used strategies between 2013 to 2015 and are two aspects of the same microfoundation. They expand product expand and improve product quality. All the explicative variables selected as microfoundations represent a three-year period strategy, according to the wave survey.

Table 1.1 shows the percentage of firms that in each wave survey have been involved in improving the firm performance. There is a notorious increment of the firms involved in these activities in the period 2013 to 2015. The most used strategies in the second period are: improving the use of employees' capabilities, improving product quality and expanding product range, which more than duplicate the first period percentage. In the second period, having a formal R&D unit and employees trained nearly duplicates the percentage. Continuous improvement groups and certifications in procedures and products have a moderate increase. Participating in agents' net percentage has equal percentage in both periods.

Table 2.1 Firms activities related to microfoundations (in percentage)

Microfoundations	2010-2012	2013-2015
Formal R+D unit	0.05	0.09
Participating in agents net	0.06	0.06
Percentage of employees trained	0.03	0.06
Improve use of employees capacities	0.11	0.27
Conitnuous improvement group	0.12	0.17
Certifications in Product & process	0.12	0.15
Expand product range	0.09	0.21
Improve product quality	0.11	0.26

Source: Own elaboration based on ANII survey

To analyze the influence of these activities in firm's propensities to innovate and export, according to Golovko and Valentini, (2011), I consider the combination of both strategies as four different strategies

options. In that sense, the strategies are: (1) exporting and innovating in year t (doing both); (2) only exporting in year t (only export); (3) only innovating in year t (only innovate) and (4) neither exporting nor innovating (None). In Table 2, based on Golovko and Valentini (2011) it is presented the transition probability matrix for this sample. It shows the probability for a firm strategy to happen, given the strategy it was followed in the previous year. The firm behavior related to innovation and export activities has not much variation over time and most of the firms tend to persist in their strategy as it is shown in the matrix. This table presents a higher persistence (from 74.6 to 83.3) than the one found in the study of reference (from 50.25 to 77.31). The highest persistence in this sample is in doing both (very close to “none”) and the lowest is in “only innovate”, meanwhile in the 2011 paper, the highest is doing neither activity, and the lowest is in only innovating. In table 2.2 it can be seen that, apart from the persistence, there is a higher transition probability from only innovator to no activities (19 per cent), being only exporter to doing both (13.9 per cent) and doing both to become only exporter (11.9), suggesting that innovation is the most unstable activity for some firms.

Table 2.2 -Transition probabilities matrix (in percentage)

Strategies t-1	Strategies t				Total
	None	Only innovation	Only exporting	Both activities	
None	83	8.9	1.3	0.3	3,820
Only innovation	19	74.6	1.2	3.3	1,260
Only exporting	4.9	1.5	77	13.9	1,076
Both activities	0	3.8	11.9	83.3	946
Missing	34.9	11.5	9.8	8.6	3,842
					10,491

Source: Own elaboration based on ANII survey

Table 2.3 -Summarize Statistics

Variables	Obs	Mean	Std. Dev.	Min	Max
Innovative	14145	.1563803	.3632284	0	1
Exporter	14145	.1749735	.3799579	0	1
Only innovation	14145	.963561	.2950936	0	1
Only exporting	14145	.1079533	.3103324	0	1
Both activities	14145	.593142	.2362203	0	1
Size	12845	3.676719	1.433133	0	9.309733
Productivity	12727	13.71762	1.434867	-5.925375	22.0403
Foreign capital	12924	.1346332	.3413446	0	1
Agro industrial sec.	14145	.1580064	.3647599	0	1
Chemistry ind.	14145	.0352775	.1844868	0	1
Technology sec.	14145	.030258	.1713026	0	1
Year 2011	16974	.1666667	.372689	0	1
Year 2013	16974	.1666667	.372689	0	1
Year 2015	16974	.1666667	.372689	0	1
Formal R+D unit	14145	.0683634	.2523774	0	1
Participating in agents net	14145	.1124072	.315878	0	1
Percentage of employees trained	10430	.0608709	.2001578	0	1.944444
Improve use of employees capacities	14145	.2043832	.4032644	0	1
Conitnuous improvement group	14145	.1853659	.3886078	0	1
Certifications in Product and process	14145	.1372923	.3441679	0	1
Expand product range	14145	.1485331	.3556402	0	1
Improve product quality	14145	.2012018	.4009127	0	1

2.3.4. Methodological approach

In this section three different models are used to study the determinants of being an exporter and doing innovation. First, I use the multinomial probit regression as it considers the combination of exporting and innovation strategies as three different options. Second, it is used bivariate probit regression considering the firm makes both decisions at the same time but gives only two probabilities. Third, I use fixed-effect models, which is commonly used to control for time invariant unobserved firm heterogeneity including the same explicative variables. This model tolerates the unobserved firm characteristics to be correlated with strategy choice and performance (export and innovation) variables.

First, to be more exhaustive, it is presented a multinomial probit, which avoids the independence of irrelevant alternatives assumption, unlike multinomial logit, and assumes that the errors can be correlated across choices. This regression models the probabilities of the three strategies that relate exporting and innovating activities, considering that each strategy has a different cumulative knowledge process that defines its performance.

The bivariate probit model allows the estimation of the probabilities of the two activities, with correlated disturbances. It is equal to the sum of the log likelihoods of the two univariate probit models that consider the decision of exporting and innovating separately.

The fixed effect models place an unrestricted distribution of the heterogeneity, so that the errors and the explicative variables may be correlated. They have an incidental parameters problem that reduces the maximum likelihood estimator inconsistent. The estimators are not consistent (because they do not converge at all). This is the incidental parameters problem. It does not require an assumption of orthogonality of the independent variables and the heterogeneity (Greene, 2003, p.697).

2.4. Results

Three different regression models are estimated to corroborate the relation between the microfoundations of dynamic capabilities and the propensity to export and innovate. As it was described previously, each regression considers different assumptions.

By analyzing the multinomial probit estimation, we can affirm that all the hypotheses are verified. All the microfoundations of dynamic capabilities have a positive relation with the propensity to export and innovate. Most of them, with exception of knowledge management, are positively related to only innovation propensity and half of them are positively related to only exporting (process to direct internal R&D and select new technologies, alliancing process, knowledge management and product development routines with the expand product range explicative variable).

The sensing capabilities variables are positively related to exporting and innovating propensity. The process to direct internal R&D and select new technologies is positively related to the firm innovation and exporting propensity. The explicative variable used to test the hypotheses is to have a formal unit of R&D. This variable has the biggest significant coefficient associated with the microfoundations of dynamic capabilities. This variable is positively related to all the propensities estimated with exception of exporting propensity in fix effect regression. Alliancing process is positively related to export and innovation propensity. The explicative variable used to test the hypothesis is to be engaged in a network and is positively related to all the propensities, with exception of the fixed effect estimation, which is not significant for any propensity.

The seizing capability variable is positively related to being an exporter and innovator at the same time. The seizing capability is represented by the microfoundation selecting enterprise boundaries (Teece, 2007). The explicative variable is the percentage of employees trained, demonstrative of the firm

preparation for changes across multiple dimensions and its investment priorities, calibrating asset specificity to guarantee a successful innovation. This variable is explicative of the propensity of doing both and only innovating for the multinomial probit regression and for innovating propensity in the other two regressions.

The reconfiguration capabilities variables are positively related to being an exporter and innovator in the same period for all the microfoundations. The explicative variable used to represent the microfoundation managing cospecialization is improving the use of employees' capabilities. In this case, these variables are positively related to doing both and only innovating propensities in the case of multinomial probit. Meanwhile it is only positively related to innovation propensity for the bivariate probit and fixed effect regressions.

Continuous improvement processes are positively related to innovation and exporting propensity. Having a continuous improvement team is the explicative variable selected to represent the microfoundation. In this case, the variable is positively related to doing both and only innovating propensities in the multinomial probit regression and for innovating and exporting propensities in the bivariate probit and negatively related to exporting propensity in the fixed effect regression. The results between the regressions are contradictory.

Knowledge management is positively related to exporting propensities. The certification in product and process coefficient is significant and positive in the multinomial probit for doing both and only exporting propensities, meanwhile the other models are for innovation and exporting propensities. In the multinomial regression, the significant coefficient is larger than the other regressions.

Product development routines are positively related to innovation and exporting propensity. The variables that expand product range and improve product quality have a significant and positive coefficient associated with all the propensities of multinomial and bivariate probit regression, and only for innovation propensity in fixed effect regression. Improving product quality is positively related to all the propensities that involve innovation in all the regressions, but not significant for exporting propensities in all the models.

Not only do the results verify that all the explicative variables selected increase the probability of being an exporter and innovator, but the incidence of these variables on the propensity is higher if the firm does both activities than if it only innovates or only exports. The only cases that these variables have a higher effect in the propensity to only innovate are percentage of employees trained, improve use of employees' capacities and improve product quality. All of them are variables that are insignificant in the propensity of being only exporter. These last results also appear in the bivariate probit and fixed effect regressions for exporting propensity. There are particular higher significant coefficients in only innovation propensity for both regressions in comparison to the other variables. The values of the bivariate probit coefficients in innovating are similar to the multinomial and the fixed effect regression

are very low. Meanwhile Certifications in product and process do not influence only innovating propensity but do influence being only exporter and influence all the propensities in the others regressions.

Summarizing, the significant coefficients associated with each variable are generally higher in the multinomial case except for improve the use of employees' capacities, which has a larger significant coefficient for innovation propensity in bivariate probit regression. This result clearly shows that the multinomial regression explains the relationship between the explicative variables and the propensities better. The microfoundations associated with the explicative variables reinforce the dynamic capabilities that increase the propensity to innovate and export together more than any other, with the exception of three variables that have more influence on only innovating propensity.

The results put some light on the influence of the variables selected to the propensity to export and innovate, through the generation of dynamic capabilities. The "sense" activities (Having R&D formal unit and being part of a net) and expand product range have a positive effect on the three propensities for the multinomial estimation. This shows the relevance of these activities in generating dynamic capabilities to increase the propensity to do any of these strategies. The variable that has higher positive influence on the propensities is having a formal R&D unit. The second best is the percentage of employees trained except for only exporting propensity. Certifications in product and process are the activity that has more incidences in only exporting propensity.

Table 2.4, Multinomial Probit, Bivariate Probit and Fixed Effect Models Results

Variables	Multinomial Probit			Bivariate probit		Fixed effects	
	Both	Only	Only	Innovation	Export	Innovation	Export
Size t-1	0.268*** (10.69)	0.249*** (12.34)	0.244*** (13.22)	0.181*** (13.53)	0.139*** (11.67)	0.0526** (4.43)	0.0323** (4.71)
Productivity t-1	0.301*** (11.25)	0.0751*** (3.37)	0.309*** (17.04)	0.0805** (5.89)	0.219*** (18.21)	0.00434 (0.61)	0.0224** (5.47)
Foreign capital t-1	0.572*** (6.65)	-0.245** (-2.72)	0.921*** (14.14)	-0.152** (-2.86)	0.701*** (16.53)	0.0628* (2.05)	0.00190 (0.11)
Agro industrial t-1	0.897*** (11.54)	0.183** (2.62)	0.873*** (16.01)	0.0852* (1.98)	0.650*** (17.95)	0.356 (0.97)	0.0674 (0.32)
Chemistry ind. t-1	1.163*** (9.40)	0.352** (2.75)	0.584*** (5.32)	0.232** (2.86)	0.578*** (8.79)	0.139 (0.54)	0.0143 (0.10)
Technology sec. t-1	0.548*** (3.58)	0.374** (2.83)	0.613*** (5.27)	0.0505 (0.57)	0.359*** (4.79)	-0.00437 (-0.03)	-0.00777 (-0.09)
Year 2011	0.459*** (5.28)	0.389*** (5.43)	0.0627 (0.92)	-0.192*** (-3.80)	0.0603 (1.39)	-0.359*** (-4.79)	0.00309 (0.64)
Year 2013	-0.350*** (-3.54)	-0.562*** (-6.49)	0.0143 (0.21)	-0.00658 (-0.13)	0.0463 (1.01)	-0.0133 (-1.49)	-0.00322 (-0.62)
Year 2015	-0.574*** (-6.52)	-0.514*** (-7.21)	-0.0503 (-0.84)	0.128** (2.86)	-0.0487 (-1.24)	0.0269** (3.64)	-0.00348 (-0.81)
Formal R+D unit	1.571*** (16.91)	1.217*** (13.81)	0.285** (2.63)	0.740*** (10.87)	0.333*** (6.30)	0.0860** (4.26)	0.0158 (1.35)
Participating in agents net	0.395*** (4.96)	0.290*** (4.14)	0.243*** (3.64)	0.105* (2.19)	0.139*** (3.32)	-0.0183 (-1.16)	0.0154 (1.70)
Percentage of employees trained	0.934*** (6.96)	1.107*** (8.98)	0.0149 (0.10)	0.950*** (9.52)	-0.0441 (-0.57)	0.138*** (4.81)	0.0178 (1.08)
Improve use of Employees	0.630*** (7.49)	0.693*** (9.73)	-0.0154 (-0.20)	0.930*** (20.66)	0.00464 (0.10)	0.204*** (13.08)	0.00722 (0.80)
Continuous process team	0.294*** (4.11)	0.186** (2.97)	0.107 (1.83)	0.160*** (3.83)	0.0924* (2.48)	0.0151 (1.10)	-0.0208** (-2.63)
Certifications in Product and	0.513*** (6.86)	0.103 (1.50)	0.351*** (5.23)	0.232*** (4.94)	0.298*** (7.21)	0.0425** (2.99)	0.0281** (3.41)
Expand product range	0.682*** (7.65)	0.437*** (5.75)	0.216* (2.47)	0.482*** (9.05)	0.235*** (4.48)	0.0599** (3.34)	0.00558 (0.54)
Improve product quality	0.612*** (6.37)	0.967*** (12.03)	0.0187 (0.21)	0.844*** (16.33)	-0.0917 (-1.67)	0.216*** (12.13)	-0.0109 (-1.06)
Constant	-8.524*** (-21.09)	-4.315*** (-13.55)	-6.950*** (-25.38)	-3.218*** (-16.10)	-4.844*** (-26.87)	-0.176 (-1.18)	-0.215* (-2.48)
Athrho					-0.00902 (-0.35)		
Observations	9989			9989		9989	9989

The hypothesis results are illustrated in Table 2.5. The hypothesis is accepted when the dynamic capability microfoundation is positively related to doing both strategies for multinomial probit regression or to both exporting propensity and innovating propensity in the case of bivariate probit and fixed effect. Is not accepted when the microfoundation is positively related to only one strategy, is negatively related or has no significance to one or both strategies estimated by bivariate probit or fixed effect.

Table 2.5 Hypotheses results

	Multinomial Probit	Bivariate probit	Fixed effects	
H1.i) Process to direct internal R&D and select new technologies is positively related to firm's innovation and exporting propensity.	Supported	Supported	Not Supported	
H1.ii) Alliancing process is positively related to firm's innovation and exporting propensity.	Supported	Supported	Not Supported	
H2.i) Selecting Enterprise Boundaries is positively related to firm's innovation and exporting propensity.	Supported	Not Supported	Not Supported	
H3.i) Managing cospecialization is positively related to firm's innovation and exporting propensity.	Supported	Not Supported	Not Supported	
H3.ii) Continuous improvement processes is positively related to firm's innovation and exporting propensity.	Supported	Supported	Not Supported	
H3.iii) Knowledge management is positively related to firm's innovation and exporting propensity.	Accepted Supported	Supported	Supported	
H3.iv) Product development routines are positively related to firm's innovation and exporting propensity.	A) To expand product range.	Supported	Supported	Not Supported
	B) To improve product quality.	Supported	Not Supported	Not Supported

2.5. Conclusions

2.5.1 Discussion

Innovation and exporting are complementary strategies (Bernard and Jensen, 1999; Golovko and Valentini, 2011; Iandolo and Ferragina, 2019; Ito and Lechevalier, 2010) frequently used by firm to increase their performance (Bolívar-Ramos et al., 2020; Golovko and Valentini, 2011). For the evolutionary vision, innovation is the main determinant of firm growth in the long term. Innovative activities incorporate productive differentials to increase added value and quality to be competitive in any market. Consequently, they promote firm growth, improving its capacities and conditions to sell their products overseas (Dosi, Pavitt and Soete, 1990). The learning processes and the environment conduct firm innovation process adjustment. The decision-making process of the routines leads to innovation and, in case of success, to its replication (Nelson, 1991; Suárez, 2014) and persistence. This innovation investment produces growth in capacity or in sales revenue (R. R. Nelson and Winter, 1982). However, firms' performance also depends on its resources and capabilities, its ability to adapt itself to the industry and market contingencies. They need to display dynamic capabilities in order to improve

organization's innovativeness and competitiveness (Eisenhardt and Martin, 2000; Giniuniene and Jurksiene, 2015; Teece et al., 1997). According to Teece (2019), developing countries firms should especially consider the construction of dynamic managerial competencies to enhance the probabilities of success, apart from investing in technological efficiency and considering market necessities. In the case of Uruguay, as a small and agro exporter economy that depends on the foreign market to grow sales and an innovative behavior to access these demanding markets, the dynamic capabilities are critical to improve innovation and exporting propensity and assure sustainable firm performance.

Integrating the innovation and strategy literature, Teece (2007) describes the most relevant capabilities management needs to sustain the evolutionary and entrepreneurial business. I use his classification of sense, seize and reconfiguration capabilities, connecting them with their microfoundations of sustainable firm performance. I present the hypotheses, describing the microfoundation of dynamic capabilities involved in each higher order capability and the expected incidence in innovating and exporting propensity. To operationalize the dynamic capabilities, I use for the explicative variables representing each microfoundation, the most relevant firm's strategies in accordance with data obtained from Uruguayan innovation survey (2010 – 2015).

This research aims to reduce the gap between dynamic capabilities and its operationalization. I analyze the microfoundations of dynamic capabilities' effects on innovation and exporting propensity, based on Teece (2007) classification. I integrate microfoundation defined by other studies (Anand et al., 2009; Eisenhardt and Martin, 2000; Froehlich et al., 2017). This demonstrates the relevance of managers' strategies to increase innovation and exports propensity. In addition, presenting a methodological gap, I discuss the appropriate estimation of innovation and exporting propensity, analyzing the results of multinomial probit, bivariate probit and fixed effect models.

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The results shed some light on the relation between the microfoundations and their influence on the propensity to innovate and export. They demonstrate that all the microfoundations selected have a positive relationship with the propensity to innovating and exporting together. The estimations show the incidence of each microfoundation to increase the innovation and exporting propensity, and the no

signification of some variables to determinate the only innovating propensity (certifications in product and process) or only exporting propensity (percentage of employees trained, improve use of employees' capacities and improve product quality). Having a formal unit of R&D has the highest incidence in the propensity of the three strategies, however, this sense capability, with employees training strategy, is one of the least used by Uruguayan firms. This result is in accordance to Silveira et al. (2021) findings that demonstrate the relevance of firms R&D formalization to increase the innovation propensity but also Horta et al. (2020) prove that this activity is relevant to increase exporting propensity. The variable associated with seize capability is the second highest influencer to innovation propensities in multinomial regressions. Meanwhile, the most used strategies, improving the use of employees' capabilities and improving product quality (used by 27 and 26 percent of the firms in 2012-2015, respectively), have higher coefficient in only innovating in comparison to doing both strategies and are the fourth and fifth variable more influential to both strategy propensity.

2.5.2 Implications, further research agenda and limitations

The results of this dissertation have practical implications as they show that innovation and exporting propensity performance can be improved if the firm invests in the variables that have more positive incidence in this propensity, which are the least used by firms. The estimations also give information about the most influential variables to increase only innovation and only exporting propensities.

There are policy implications that give information for the promotion of certain activities to stimulate the development of exporting and innovating activities. The estimations demonstrate that the process to direct internal R&D and select new technologies, associated with sensing capabilities, is the most influential to increase innovation and exporting propensity but it is the least used. This leaves space for policies and programs actions promoting the generation and formalization of R&D inside the firm. In addition, the second most influential variable is employees training and is one of the least used, although programs that promote and finance them have been increasing. It seems to be that these programs are not effective, so it calls for a revision of their characteristics.

One of the most important results in this dissertation is the demonstration that the estimation of the propensities to export and innovating as four different strategies as correlated binary outcomes, using the multinomial probit model is the accurate model. This estimation demonstrates to be a better predictor as it has the highest significant coefficients in comparison to bivariate probit and fixed effect regressions.

In the future, managerial capabilities may be explored to analyze if their contribution to the propensities are associated with the theoretical framework presented here. For example, most of the

microfoundations analyzed previously, require certain dynamic managerial capacities as: managerial cognition, managerial social capital, and managerial human capital (Helfat and Martin, 2014), conditional to which strategy will be taken, for example, managerial social capital enhances the creation of networks.

In this sample, there are two-wave survey from 2010 to 2015. Expanding the period sample may enable us to verify if the results are constant or if it depends on the period analyzed.

3. A SYSTEMATIC LITERATURE REVIEW OF THE RELATIONSHIP OF PERSISTENCE IN INNOVATION WITH EXPORTING AND FIRM GROWTH

3.1 Introduction

In the previous chapter, analyzing the determinants of innovation and exporting persistence, I show that, the Uruguayan sample as well as the Spanish sample (Golovko and Valentini, 2011), tend to persist in their strategies: doing both activities, only exporting, only innovating or none of them. From the investigation, I find that diverse microfoundations of dynamic capabilities contribute positively to the propensity of the different strategies that involve innovation and exporting, reinforcing the idea of persistence in all these strategies. However, in the literature, the most analyzed persistence is in innovation, which is still reduced.

The principal subtopics studied in the literature about “persistence in innovation” are its determinants and behavior. The mechanisms that operate for persistence are explained by different perspectives. Schumpeterian analysis explains through the existence of monopolistic and oligopolistic markets and the strategy to defend their market share. The knowledge accumulation hypothesis (Geroski et al., 1997; Le Bas et al., 2015; Le Bas and Scellato, 2014) assert that the learning-by-doing effects with the emergence of dynamic capabilities (Antonelli et al., 2013; Matvejeva, 2014), reinforce the cumulative

and incremental nature of innovation. The success-breed-success hypothesis states that those firms that reach above-the-average profits through a successful innovation, accumulate the resources needed to innovate further and have an incentive to keep on innovating (Cefis and Ciccarelli, 2005). On the other side, sunk costs of performing R&D activities also explains innovation persistence, as firms find that once they invest, it is better to keep on investing and developing technological competitiveness strategies rather than to stop (Ganter and Hecker, 2013). This decision is based on the cost of internal capabilities and past knowledge accumulation (Antonelli et al., 2013).

Empirical evidence confirms that there is a virtuous circle between innovative inputs, outputs, and economic performance (Bogliacino et al., 2017). The positive effect of a persistent strategy on firm performance is greater than a discontinuous one (Bartoloni, 2012; Lööf et al., 2015; Lööf and Johansson, 2014; Lööf and Nabavi, 2015). This occurs because there is an cumulative knowledge process that increases capabilities, affects performance and contributes to the stability of innovation (Malerba and Orsenigo, 1999).

Recent studies such as Iandolo and Ferragina (2019), Golovko and Valentini (2011) and Ito and Lechevalier (2011) demonstrate that innovation and exporting are complementary. They “positively reinforce each other in a dynamic virtuous circle” and find that “the positive effect of innovation activity on firms’ growth rate is higher for firms that also engage in exports, and vice versa” (Golovko and Valentini, 2011, p.362). The cumulative knowledge process of firm’s persistence in exporting and innovating influences the scope of learning effects and intensifies progressively, as experience is accumulated (Andersson et al., 2012). The interaction of exporting and innovating generates permanent differences in performance among firms as these are two ways to accumulate knowledge and improve firms’ capabilities (Ito and Lechevalier, 2010).

To my knowledge, there is only one Systematic Literature Review that analyzes this topic. Arenas et al. (2020) purpose to identify the common factors that positively influence the process of persisting in innovation. However, it does not review whether there are studies that analyze the effects or consequences of this persistence, particularly, it does not consider persistence in innovation effect on firm performance. This topic is critical for policymakers and managers. Understanding the relationship between these two variables contributes to the evaluation of innovation policies’ effectiveness and helps managers to make decisions about innovation and the continuity of the process.

The universe examined by Arenas et al. (2020) was 34 papers. Interesting findings of this article support what I analyze in the previous chapter: the interaction between dynamic capabilities, procedures and routines facilitate the persistence in innovation. Company’s capabilities (including knowledge management and human resources) are often mentioned as common elements that influence persistence in innovation. The role of leaders is highlighted for encouraging innovation or keeping knowledge updated to continue innovating. Product innovation and R&D are found as important links for

continuous innovations in processes or products. Meanwhile, R&D enables the company to generate radical innovation constantly. In general, studies use data analysis techniques to determine the most influential elements in innovation persistence. In most cases, a Probit or logistic regression model was used. Community Innovation Surveys—Eurostat—is the main database, especially the case of Spain. In the case of South America, these types of studies are scarce.

My systematic literature review goes further and aims to systematize all the literature written about “persistence in innovation” to shed some light on the relationship between this variable, firm growth and exporting, analyzing common elements in the explanation of these relationships. Specifically, I am interested in the evolution of the topic and the types of innovation used to define persistence in innovation and the measure used to consider firm performance, if these have an incidence on the estimation results. I consider that the relationship with firm performance is what makes persistence in innovation a critical factor to be studied deeply. I also pretend to help researchers to identify future investigation trends.

In this study, I examine the dynamics of global research in the last 25 years (from 1997 to 2021). In relation to the previous systematic literature review in this topic (Arenas et al., 2020), mine does not restrict the database by the date published and nearly triplicates the articles examined. The final database has 63 articles. In addition, instead of focusing on the causes, I concentrate on the consequences of innovation persistence. To be clear and transparent in the presentation of the systematic literature review, I follow PICOS approach and PRISMA statement (Arenas et al., 2020; Liberati et al., 2009). The research questions that motivate this systematic literature review are: a) Is there any particularity in the evolution of persistence in innovation literature?, b) What is the relevance of the studies about firm growth and exporting in this literature?, c) Which is the relationship between persistent innovation and firm growth?, d) Which is the relationship between firm persistent innovation and export? And e) What are the factors that influence the mentioned relationships: type of innovation, growth measure and country?

The contributions of this study are: 1) Analyze the temporal evolution of persistence in innovation literature, 2) Analyze common elements in the relationship between persistent innovation and exporting in this literature, and 3) suggest future research challenges.

In the next section, I explain the procedure of this research, the protocols used, manipulation of the database, the bibliometric methodology and the analysis of the data. Subsequently, the results of the bibliometric and the content analysis are exposed and analyzed. Finally, a summary is presented to introduce the discussion, implications and research recommendations.

3.2 Methods

This systematic literature review is based on Preferred Reporting Items for Systematic reviews and Meta-Analyses (PRISMA) statement (Liberati et al., 2009) to ensure the clarity and transparency of the process. For them, the key characteristics of a systematic review are: a) objectives clearly stated with an explicit methodology, easily reproducible; b) systematic search to find all studies that comply with the eligibility criteria; c) valuation of the validity of the findings; and d) systematic presentation and synthesis of the characteristics and findings of the included studies (Arenas et al., 2020; Liberati et al., 2009). This statement defines in each section of the review, items to consider and explain the required characteristics. In addition, the structure of the research questions considers PICOS five elements: participants, interventions, control, outcomes, and study design (PICOS). Both guidelines are elaborated to help authors report systematic literature reviews related to health care intervention. In this document, I elaborate an interpretation of the guideline made for health care interventions research, to suit the topic of this research, which is related to economy and management.

This paper follows five steps: (1) definition of the field of study (Table 3.1), (2) database selection (Figure 3.1), (3) research criteria adjustment, (4) information process, and (5) analysis of the information. The specifications of each step are detailed below. The definition of the field of study includes 3 planning activities defined in Kitchenham et al. (2009) and followed by Arenas et al. (2020): 1) identification of the need for research, 2) preparation of research questions, and 3) development of review protocols.

1) Identification of the need.

The persistence of innovation is a desired strategy because it is considered an important variable to generate an everlasting advantage. Former innovations with success, reinforce the possibility of persistence in innovation, which increase credibility and profitability towards external sources and enhance financial availability to keep on innovating (Costa et al., 2020).

This has motivated constant investigations since 1997. For evolutionary theory, there is a virtuous circle between innovation, investment and profit that positively influence firm growth level (R. R. Nelson and Winter, 1982). The investment in capabilities is involved in the decision-making process that leads innovation to be a routine, which in the case of success, will be repeated (Suárez, 2014). Their investment may produce growth in capacity and also sales revenue. The relevance of the innovation activities is that it increases firm's competitiveness and growth. The empirical evidence corroborates a positive relation between persistence in innovation and firm growth (Cefis and Ciccarelli, 2005; Deschryvere, 2014; Lööf and Johansson, 2014).

Most of the literature is focused to determine factors that influence persistence (Arenas et al., 2020). Meanwhile, the number of studies about its relationship with firm performance is reduced, using a variety of measures in growth and innovation. Its relation to exporting is not much studied, although this variable is considered as innovation's complementary strategy towards firm growth as it is established in the mechanism of learning by exporting and self-selection (Clerides et al., 1998).

The self-selection definition explains that sunk costs and firm heterogeneity encourage firms to innovate to get sufficiently high profits to cover the sunk costs and become the most productive firm to, consequently, export. Once a firm has entered export markets, productivity growth may receive a further boost (Greenaway and Kneller, 2007). Conversely, learning by exporting explains the innovation due to the learning process of selling in an unknown foreign market that stimulates firms' innovation. They "positively reinforce each other in a dynamic virtuous circle" and find that "the positive effect of innovation activity on firms' growth rate is higher for firms that also engage in exports, and vice versa" (Golovko and Valentini, 2011, p.362). The interaction of exporting and innovating generates permanent differences in performance among firms as these are two ways to accumulate knowledge and improve firms' capabilities (Ito and Lechevalier, 2011).

Because of the relevance of the interaction of innovation and exporting explained above and the empirical evidence that corroborates a positive relation between persistence in innovation and firm growth, the objective of the literature review is to identify common elements that relate innovation persistence with firm performance and exports.

2) Preparation of the questions.

The questions that are expected to be answered with this study are:

1. Is there any particularity in the evolution of persistence in innovation literature?
2. What is the relevance of the studies about firm growth and exporting in persistence in innovation literature?
3. Which is the relationship between persistence in innovation and firm growth?
4. Which is the relationship between persistence in innovation and exporting, and firm growth?
5. What are the factors that influence the mentioned relationships: type of innovation, growth measure and country?

These questions are elaborated using PICOS as a structured approach for framing questions, which elements are detailed in Table 3.1.

Table 3.1 PICOS

Element	Description
P- Population	Manufacturing and service firms
I-Intervention	Persistence in innovation, Export and Growth
C-Comparison	None
O-Outcome	Relationship between variables, Type of Innovation, growth measures, country.
S- Study type	Case study, analysis, quantitative studies.

Source: Own elaboration based on interpretation of Liberati et al. (2009)

The population should define a group of participants in detail, Intervention or exposures under consideration may be transparently reported, Comparison define a Comparator group intervention used for control, explicitly define Outcome of the intervention measured, required to interpret the validity and generalizability of the systematic review's results and the Study design of the articles included in the review.

3) Development of review protocols.

The following items are defined to reduce research bias and have quality research:

a. Primary Investigations: only articles from journals or articles in English, as primary sources are selected.

b. Database selection. The documents to be analyzed are selected from the most used databases: Web of Science by Clarivate Analytics, and Scopus by Elsevier (Agramunt et al., 2020; Paul and Rialp Criado, 2020). Both databases are appropriate to analyze by biblioshiny of R studio and VOSViewer package (analysis tools freely accessible for academic nonprofit use). A previous pilot search was done including the ProQuest database, but all of its documents were included in the other two databases.

c. Extraction strategy. The query for each database was generic and with the same parameters. The aim was to capture the vast compilation of documents that include the persistence in innovation concept in their topic, using similar restrictions.

Following PICOS defined structure of the research questions, it is considered all kinds of studies (Case study, quantitative research, analysis) that are related to firm level innovation. As this topic is of recent interest, there is no restriction about publication date. This review was limited to technological (product or service), patent, R&D, organizational, input innovation or any other type of innovation at firm level. The last search was run in April 2021.

4) Research criteria adjustment:

I chose some specificities and restrictions to arrive at quality information related to innovation persistence from the Scopus and Web of Science databases.

The electronic search strategy for Scopus database was to look for the strategic words in documents' abstracts, article title and keywords. Boolean operators were used to get an accurate search with wide capture:

```
TITLE-ABS-KEY ( ( "innovat*persist*" OR "persist* innovat*" OR "persist* R&D" OR "persist* R and D" OR "*persist* innovat*" OR "*persist* technol*" ) )
```

The restrictions defined were only articles in English and the subject areas were: Business, Management and Accounting and Economics, Econometrics and Finance. The application of these restrictions reduce the sample from 211 to 76 articles.

Meanwhile for Web of Science (WOS) the words I applied to look for the topic were the same as for Scopus:

```
TOPIC: (("innovat* persist*" OR "persist* innovat*" OR "persist* R&D" OR "persist* R and D" OR "*persist* innovat*" OR "*persist*technol*"))
```

The constraint used was: English articles from WOS Core Collection data base, related to research domains of Social Science and Business Economics research area with no year restriction. These limitations reduce the sample from 177 to 78 articles.

5) Information process:

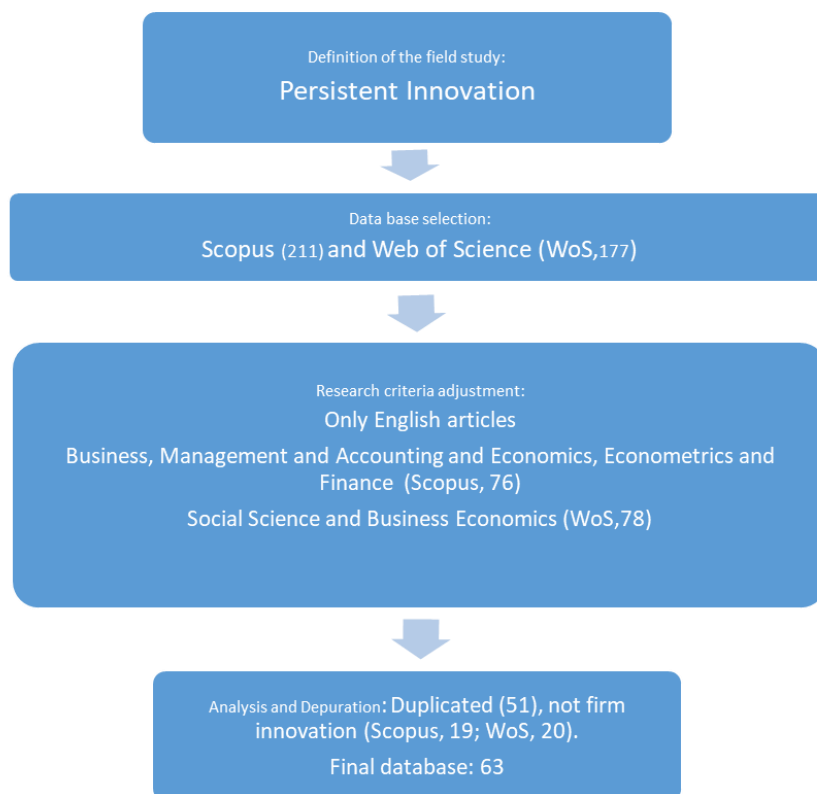
It was necessary to combine results from Scopus (76 documents) and Web of Science (78) database to have a unique database. Documents that were not related to innovations at firm-level (20 articles from each database) and duplicate publications were excluded, remaining 63 articles (for details, see Annex A.3). The final databases have 51 documents that were in both databases and 5 and 7 exclusives from each database.

It is worth mentioning that both databases have 81 per cent of the documents in common. To create tables, graphics and networking is used biblioshiny and VOSviewer. I used only the Scopus database to generate networking maps. The difference with the whole database is only 7 articles because of the 51 articles in common. None of these latter articles are part of the literature that relates persistence in innovation with firm performance or exporting activities, so I think this base is representative.

6) Analysis of the information:

Besides the bibliometric analysis, to do an additional study, information was extracted from each abstract¹⁰, to define data clustering. The groups are: objectives, country, database and how persistent innovation term was used. I did another data clustering with words related to my research questions as: export (and commerce), type of innovation studied, and growth measures (sales growth, profitability, TFP, performance and productivity)¹¹. In this sense, I elaborated new statistics to answer my questions.

Figure 3.1 Bibliometric methodology flowchart



Source: Own elaboration with Web of Science and Scopus database (2021)

¹⁰ Although Kanter (1982) Cabagnols, (2006) and Barge-Gil *et al.* (2018) abstracts are not available in the Web of Science database, this information was found in Google scholar web. As the first and the third document do not mention persistent innovation at firm level, they are also excluded. However, the second one is included. This information is given the following PRISMA statement.

¹¹ These words were not used as key words to limit the database as I wanted to weight the percentage of the documents related to export and growth in the whole database. For details, see Annex A.3.

3.3. Results

The results are exposed by descriptive analysis and content analysis. In both analyses I use biblioshiny and VOSviewer as complementary tools. First, the descriptive analysis shows Summary data (table 3.2), Annual scientific production (figure 3.2). Table and Figure 3.3 present the number of publications per country and top authors' production over time, respectively. For these figures and tables Biblioshiny software was used with Scopus database and I elaborated by my own a summary of the whole database main information, using excel program (Scopus and Web of Science). After that, using VOSviewer software, I present in Graphic 3.4 the co-occurrence map based on the Scopus database.

3.3.1 Bibliometric analysis

To answer the first question about the evolution of persistence in innovation literature and its particularities, I do several analyses about the characteristics considering its temporal evolution. In the following table 3.2, we can observe the summary of 25 years of "Persistence in innovation" literature. Although some documents have been widely cited, we can see the number of authors and documents involved in this topic is reduced and with relatively stagnant evolution in comparison to other topics. According to Clausen et al. (2012), I confirm the scarce attention given by researchers, even though the literature recognizes the empirical relevance of innovation persistence.

Thirty-five journals have publications in this topic. Economics of Innovation and New Technology and Research Policy concentrate eleven and ten publications respectively. In the first journal, the publications are from 2005 to 2021, with an important variety of authors and context studies (Vietnam, Italy, UK, Germany, France, Rusia, Uruguay). The second Journal has been published from 1997 to 2019. There is a country comparative study, but all the studies are concentrated in developed countries.

Table 3.2 Summary of data

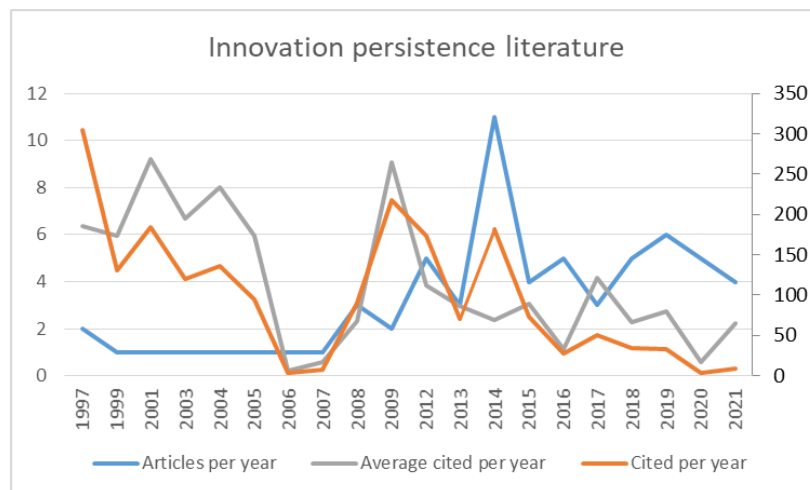
Description	Results
Timespan	1997 : 2021
Sources (Journals)	35
Documents	63
Total citations	2137
Number of authors	115
Average years from publication	7.3
Average citations per documents	30.8
Average citations per year per doc	3.1
Single-authored documents	9
Average author per document	2.4

Source: Own elaboration with Web of Science and Scopus database (2021)

In figure 3.2 there is a graph of the temporal evolution of the literature published and its citations. If we look at the graph of articles per year, we can realize that there are some years in the middle of the period that have few authors interested in writing about this topic.

Source (Journals) statistics per year are the same as articles per year. There is not a specialized Journal on this topic. The literature in the beginnings (before 2005) and the middle (2009) of the period are the most cited. The year 2014 is the most productive. There is a slow increase in the number of articles published. However, there is an important decreasing number of citations per article. This is explained because the first papers published are a very important reference for this topic, with very prolific authors such as Geroski, Van Reenen and Walters (1997). Other important references are Malerba, Orsenigo and Peretto (1997), Suzuki and Kodama (2004) and Peters (2009).

Figure 3.2 Annual scientific production



Source: own elaboration with Web of Science and Scopus data bib65(2021). Total number of articles published per year; Number of article citations per year; Average article citations per year.

The oldest and most cited article of the database selected is “How persistently do firms innovate?” by Geroski et al. (1997). This study searches for evidence to prove that firms that innovate, usually do it persistently, but it finds that very few innovative firms are persistently innovative. Meanwhile, Malerba et al. (1997) finds that persistence and asymmetries strongly affect the patterns of innovative activities across countries and sectors, and persistent innovators are associated with international technological specialization. Hence, controversial results have been found in this literature since the beginning. The other articles more cited are: Suzuki and Kodama (2004), which is about two case studies of large Japanese firms and Peters (2009) that excel for writing about stylized facts of persistence in innovation.

There is a clear evolution in the concern related to persistence innovation. At the beginning of the period, they focus on examining patterns and determinants of the persistence in innovation, trying to understand the mechanism that operates and its behavior. Meanwhile in the second period, there emerge

studies explaining its effect on firm performance. This latter literature is concentrated in the last six years (2014-2020).

We can observe that the publications are mainly from European countries. Italy is the most prolific country, which articles concentrated in the last eight years. The most important authors are Antonelli, Crespi and Scellato (2012, 2013) with two publications that have more than 50 citations. In Sweden, for example, Lööf is involved in all the articles (2014-2015 and 2019). The Asian countries are involved in the last two-year publications. In general, authors are not involved in more than two articles on this topic. It is worth mentioning that research collaborations are mainly intra-country. In the last five years, authors from different countries, which are not very well known, write about this topic only once. All these factors may explain the low level of production and citations.

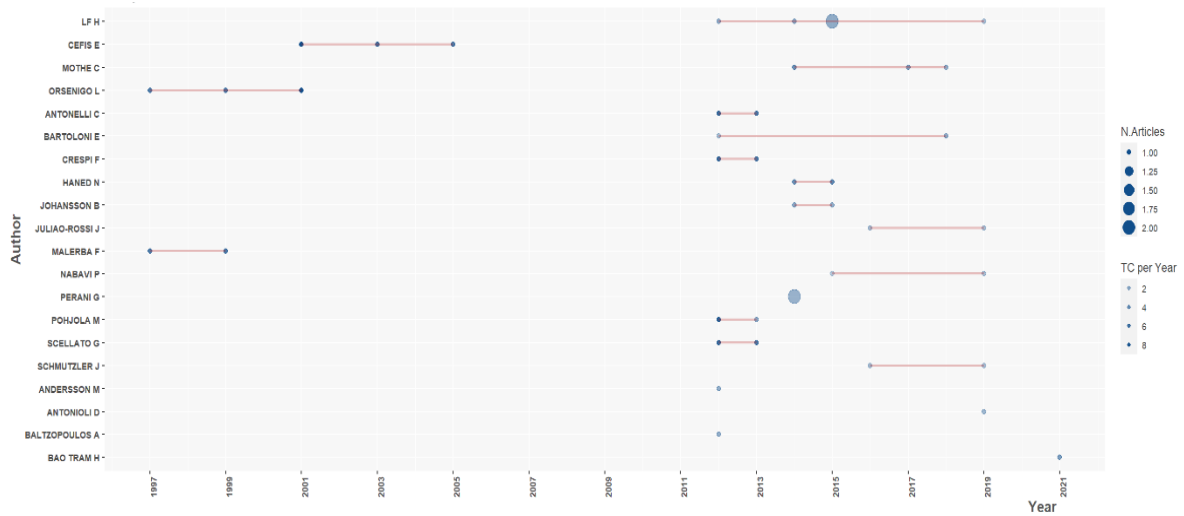
Table 3.3 Number of publications per country.

Country	Articles	Freq	SCP	MCP	MCP_Ratio
ITALY	13	0.2955	10	3	0.231
CHINA	5	0.1136	5	0	0
SWEDEN	4	0.0909	3	1	0.25
UNITED KINGDOM	4	0.0909	3	1	0.25
FRANCE	3	0.0682	2	1	0.333
COLOMBIA	2	0.0455	1	1	0.5
FINLAND	2	0.0455	1	1	0.5
LUXEMBOURG	2	0.0455	0	2	1
CANADA	1	0.0227	1	0	0
JAPAN	1	0.0227	1	0	0
NEW ZEALAND	1	0.0227	0	1	1
NORWAY	1	0.0227	0	1	1
PERU	1	0.0227	1	0	0
PORTUGAL	1	0.0227	1	0	0
SPAIN	1	0.0227	1	0	0
URUGUAY	1	0.0227	0	1	1
USA	1	0.0227	1	0	0

Source: own elaboration using Biblioshiny software with Scopus data (2021). Intra country (SCP) and inter-country (MCP) collaboration indices

In figure 3.3 it is shown the distribution per year of publication by author. In this image, we can clearly observe two stages of publications. The first one, from 1997 to 2011, is concentrated on few articles with high levels of citations, and the second one, from 2012 to 2021, is characterized by several not very well-known authors. This figure also shows the author's publication perseverance. It shows that this topic does not kept authors publishing for long periods

Figure 3.3 Top authors' production over time

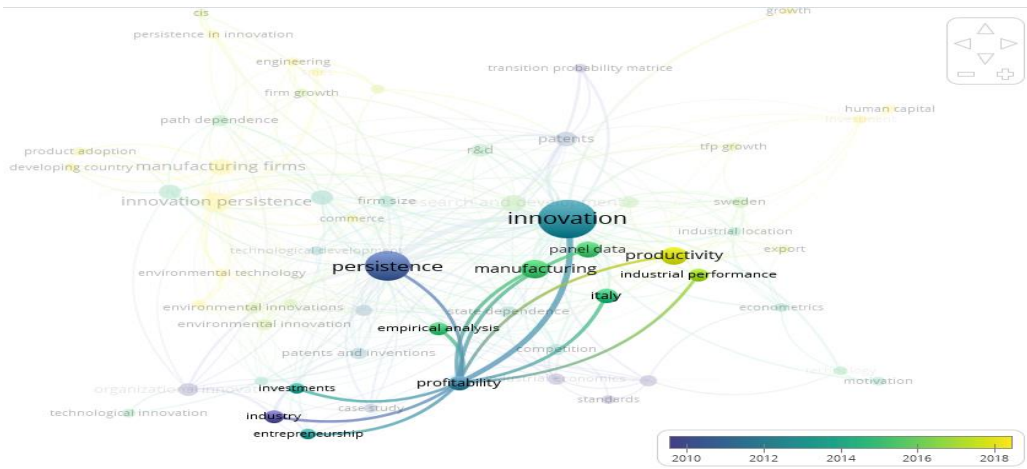


Source: own elaboration with Scopus data (2020) processed with Biblioshiny software.

To answer the second question about the relevance of our interest in the whole database of “Innovation persistence”, I present the Co-occurrence graph connecting keywords that appear in the title, abstract and author keywords list. I found this bibliometric method very illustrative as it uses the content of abstract and title documents to establish relationships and build a conceptual structure of the domain. It is assumed that the concepts behind those words are closely related. I found that this bibliometric method fits better with the objective of this research. Neither bibliographic coupling nor co-citations will help to illuminate my research questions, as both methods connect older publications with no reference with literature associated with firm performance and export. In my case, I am interested in the relevance of the relationships analyzed in recent literature. Next figures associate each word with an average year of publication, given the idea of concepts evolution in the literature. It was considered binary counting, so the number connected to each term indicates the number of documents in which the word appears at least once.

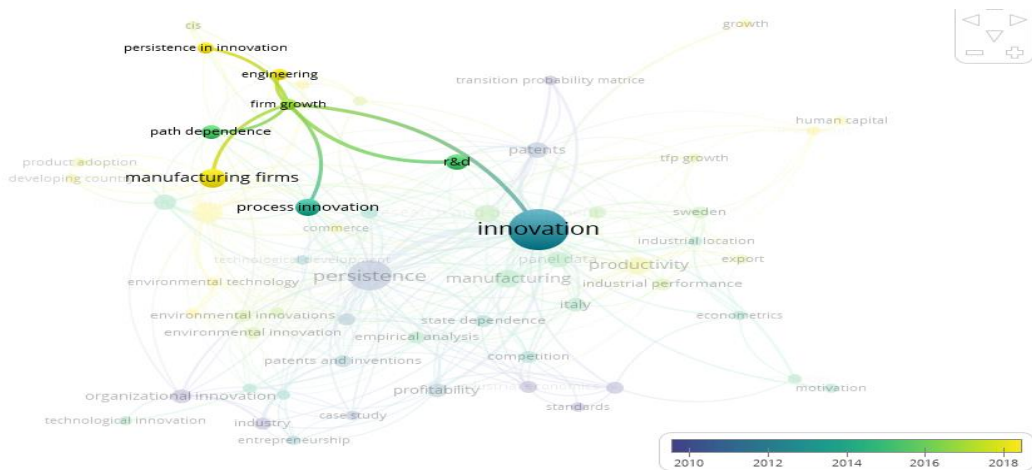
In Figure 3.4, it is shown the Co-occurrence graph with all the keywords with a minimum of 2 occurrences of a keyword, which is a low number because of the size of the database and the relevance of the keywords of my interest in the whole database. In the figure we can associate by the color, the word with the publication year (blue are oldest and yellow are latest) and with the size of the word circle, the relevance of the word in the database keywords. This figure illustrates the conceptual space changes over time.

Figure 3.4.a Profitability, Co-word in Cluster 2, average year publication (ayp) 2012



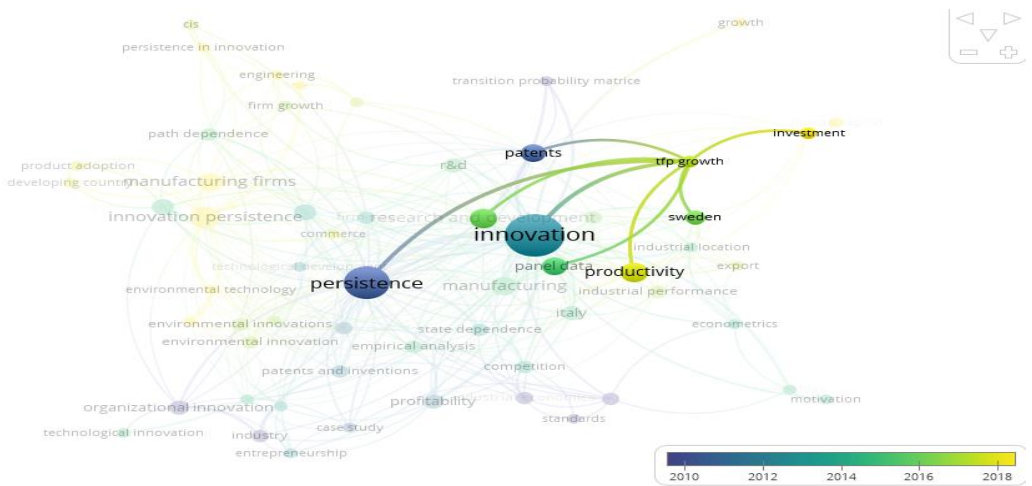
Source: own elaboration using VOSViewer based on Scopus database (2021)

Figure 3.4.b Firm Growth, Co-word in Cluster 4, ayp 2016.5



Source: own elaboration using VOSViewer based on Scopus database (2021)

Figure 3.4.c Tfp growth Co-word in Cluster 8, ayp 2017



Source: own elaboration using VOSViewer based on Scopus database (2021)

The figures of co-occurrence shows that words related to firm performance and exporting are mentioned as keywords in average year publication (ayp) after 2016, except profitability which ayp is 2012. Profitability and productivity are the most connected words of the group selected. Meanwhile profitability is relatively old for this group of words (2012), which co-words in the Cluster are DC with case studies and entrepreneurship. The measures of innovation: patent and inventions, organizational and technological innovation (measure of innovation) and persistence. The only growth measure in this cluster is profitability. Meanwhile, productivity is a new word (2017.5) connecting with profitability, performance, tfp growth and export, showing diversity in the topics and measures. However, its Cluster, the number 1, seems to be related to the topic of my interest as it is the only one that mentions export. From Sweden and Italy seem to be the studies that do an empirical analysis of the industrial performance using panel data. Productivity and R&D, appear as the firm performance and innovation measure, respectively. These figures demonstrate that the relevance of these concepts (words) is relatively new in persistence innovation literature.

3.3.2 Content analysis

The content analysis is based on the data extracted from the abstracts of the bibliography. This analysis answer the third question about the relationship between persistent innovation and firm growth. With exception of the case study of Suzuki and Kodamas (2004) and Cefis and Ciccarelli (2005), the rest of the articles related to this topic are concentrated in the last eight years. There is only one comparative study and it is about Mainland China, Hong Kong, and Taiwan.

Only 17 out of 63 documents selected from the databases, mention a variable related to firm performance. However, Antonelli et al. (2013) use TFP as a measure of innovation and not as a measure of firm performance, so it is excluded from this group, resting 16. These variables are: profitability (Bartoloni, 2012; Cefis and Ciccarelli, 2005; Nazir et al., 2021), profit (Bogliacino et al., 2017), productivity (Baum et al., 2019; Lööf and Johansson, 2014; Muínelo-Gallo and Martínez, 2018), productivity and profitability (Bartoloni and Baussola, 2018), Total Factor Productivity (Antonelli, Crespi and Scellato, 2013; Lööf and Nabavi, 2015; Lööf *et al.*, 2015; Iandolo and Ferragina, 2019), employment growth (Bianchini and Pellegrino, 2019), sales growth (Deschryvere, 2014; Guarascio and Tamagni, 2019; Suzuki and Kodama, 2004) and young ventures growth (Whittaker et al., 2020).. Table 3.4 shows the characteristics of the articles that analyze firm performance.

The data bases used are from Italy (5), Sweden (4), Spain (2), United Kingdom, Finland, Japan,, New Zeland,, Uruguay and a comparative study between Mainland China, Hong Kong, and Taiwan.

In relation to innovation measures¹², eight studies analyze R&D innovation, three patent data, seven technological or product and process innovation, one organizational innovation and one ITC. Apart from R&D, there is no other innovation input explicitly mentioned in the abstract. Persistent innovation is a dependent variable in two articles (Antonelli et al., 2013; Bartoloni, 2012) and an explicative variable in eleven articles.

The relation between firm growth variables and persistent innovation is positive for all the growth measures used, except for Guarascio and Tamagni (2019). The latter article finds there is no relation to support the existence of R&om theories of firm growth. They study Spain from 1990-2012 analyzing R&D, patent, product and process.

Table 3.4 Articles analyzing persistence in innovation and firm performance

Article	Growth measure	Type innovation	Country
Suzuki and Kodama, 2004	Sales	Patent data	Japan
Cefis and Ciccarelli, 2005	Profitability	Patent data	UK
Bartoloni E.2012	Profitability	Technological	Italy
Deschryvere, 2014	Sales	Product and process	Finland
Lööf and Johansson, 2014	Productivity	R&D	Sweden
Lööf H.et al., 2015	TFP	R&D	Sweden
Lööf and Nabavi, 2015	TFP	R&D	Sweden
Bogliacino et al., 2017	Profits	R&D, new products and profits	Italy
Bartoloni and Baussola, 2018	Productivity and profitability	Technological/organizational	Italy
Muñelo-Gallo and Martínez, 2018	Productivity	R&D/product and process	Uruguay
Baum .et al., 2019	Productivity	Patent/R&D	Sweden
Bianchini and Pellegrino, 2019	Employment	Product/processes	Spain
Guarascio and Tamagni, 2019	Sales	R&D, patent, product, process	Spain
Iandolo and Ferragina, 2019	TFP	R&D and ITC	Italy
Nazir et al., 2020	Profitability	N/D	China, Hong Kong, and Taiwan
Whittaker et al., 2020	Young venture growth	N/D	New Zeland

Source: Own elaboration based on Web of Science and Scopus data bib64 (2021)

The fourth research question is: Which is the relationship between persistence in innovation and exports? Based on the learning by exporting and self-selection hypothesis (Clerides et al., 1998; Golovko and Valentini, 2011; Greenaway and Kneller, 2007; Love and Roper, 2015), it is expected to find a positive relationship between both variables. Four abstracts mention persistent innovation and export, all of them study innovation as R&D investments. The only abstract that explicitly mentions the relationship between both variables, is Iandolo and Ferragina (2019) studying Italy's sample. They find that persistent innovation efforts are associated with a permanent presence in foreign markets and a complementarity between both variables. A firm that is persistently innovative and exporter has better productivity results than if it is not persistent in one of them.

¹² Cefis and Ciccarelli, (2005) and Iandolo and Ferragina (2019) information was extracted from the text.

The other three articles analyze Swedish samples and relate persistent innovation and exports as a particular characteristic of the firms, not studying the relationship between both variables. Only one finds that persistent innovative exporters have better performance than others. Lööf et al. (2015) examine the effect of exports, innovation and external knowledge on total factor productivity growth, demonstrating that persistent innovators and permanent exporters have higher annual productivity growth in contrast to non-innovative exporters. Lööf and Navabi (2015) find that persistent innovator exporters benefit significantly more than other exporters from access to a rich spectrum of nearby knowledge, not mentioning in the abstract that affect productivity and growth. Besides, Andersson et al. (2012) only mention export as a characteristic of the persistent innovators to explain the probability to generate entrepreneurs. With the information of two of the four articles, we observe a positive and complementary relationship between innovation and exporting, which persistence in both strategies make a better TFP performance. But the articles are not enough to be conclusive about the possible results.

The fifth research question is: what are the factors that influence these relationships: type of innovation, growth measure and country. From the content of the literature, the relationship between innovation and firm performance is positive for any database analyzed, independently of the type of innovation, growth measure, country, except for Guarascio and Tamagni (2019) which find no relation between both variables. Therefore, the positive relationship is expected to happen no matter which variable or context is taken. The articles that explain the relationship between export and persistence in innovation in this database are only four. Two of them relate persistent innovation with export and performance, show a better performance than other firms, using productivity as growth performance and R&D as innovation variable (Iandolo and Ferragina, 2019; Lööf et al., 2015). Nevertheless, no conclusion can be defined about the factors that influence this relationship because they are just two examples.

3.4. Summary

Persistence in innovation and its determinants is the main subject of this literature. There are seven distinguished articles in this topic, which citations are between 120 and 184. All of them were written between 1997 and 2009. However, the subject itself, as “persistence in innovation”, has not been given the relevance it deserves (Clausen et al., 2012). It has been analyzed in a timid and not constant way.

In this research, first, I do a systematic literature review to analyze the conceptual evolution in this topic, emphasizing in the incidence of persistent innovation in firm performance, and its relationship with exports. I do a bibliometric analysis to see the literature evolution and the relevance of my interests

in the literature. Then, I analyze the content of the literature that relates persistence in innovation with firm performance and exports, to find common patterns.

The systematic literature review analyzes statistics, publications and conceptual evolution of 25 years of Innovation persistence articles. The number of publications reached its peak in 2014, but still has a low level. The most cited publications are the old ones, there is no collaboration between countries and only few authors have more than one publication. The interests and concepts in this literature have evolved and this is represented in the graphics of co-occurrence presented in this study.

The literature of innovation persistence and firm growth or export is of recent data. Most of this literature was published after 2014. I find that there is less than 30 percent that analyze firm performance in relation to persistent innovation and 6 percent that consider export in its abstract. The sixteen articles analyzed about firm performance demonstrate a diverse perspective, utilizing diverse firm growth measures and type of innovation, all of them show a positive relationship between persistent innovation and firm performance. The samples are quite diverse although some countries are repeated like Italy and Sweden. Only one study finds no clear relationship between persistent innovation and firm growth (Guarascio and Tamagni, 2019). The other finds a positive relationship and they also reference it as a virtuous circle.

The relation between exporting and persistent innovation is explicitly studied only by Iandolo and Ferragina (2019) and Lööf et al. (2015) which find a positive and complementary relationship. They find that being persistent in both activities has better results in productivity than if it is not persistent in one of them. Other two studies mention persistent innovation and exports. However, only one analyzes persistent innovators and exporters and finds that this condition gives them a better productivity performance towards other exporters (Lööf and Nabavi, 2015). The first study is about Italy, meanwhile the others are Swedish samples. There are no studies related to developing or undeveloped countries.

This Systematic review is an advance in exploring the literature in innovation persistence, it gives a temporal evolution of scientific production in relation to lines of research and authors. It examines more articles than Arena et al. (2020) and shed some light on two lines of research that were not analyzed in the previous review. The information given in table 3.2 shows some common variables used by the articles that can inspire some meta-analysis review or comparative studies between countries in the future.

3.5. Discussion, implications and research recommendations

The findings of this systematic review exhibit different areas that are still unexplored. The literature about the relationship between persistent innovation, exports and firm growth shows that the studies are concentrated in some developed countries and that R&D is mainly used to study productivity as a measure of firm performance. In addition, for example, apart from R&D, only one article studies ITC as another measure of innovation effort.

This topic has been studied by more articles than the ones listed in the review. However, not all contemplate the concept “persistence in innovation”, “persistent innovator” or gives the relevance it should have in their studies (e.g. Golovko and Valentini, 2011) as a particular phenomenon that is more than just investment on innovation once, which has its specific characteristics and effects. The literature analyzed in this study considers and differentiates the cumulative knowledge effects of persistence in innovation from a particular innovative intervention. That is the reason why they have better performance than other firms that do not innovate and export persistently.

Future lines of investigations should explicitly differentiate between one period innovation and the cumulative effect of persistent innovation. The analysis of persistence in innovation considers that the continuous investment in innovation potentiates its positive effects on performance and, as the few studies described in this review demonstrate, when the firms not only innovate persistently but also export persistently, their performance would be better. However, more studies about persistence in innovation and in exporting should be done to have more empirical evidence about this relationship.

Furthermore, the effects of persistence in innovation and exporting should be studied in more detail as promoting innovation is a recurrent policy in different governments’ levels. Future research should consider the effects of persistence in innovation and exporting together on firm growth and compare the results of doing both strategies isolated. Other lines of investigation are to explore different inputs of innovation as determinants of persistence, analyze other measures of firm performance different from productivity such as employment growth or sales growth, or analyze the relationship between intensity of exporting and innovating and its persistence. Investigate the specific difficulties to persist in both strategies for SMEs and how this affects its performance.

This review has some limitations because of the available information. As this systematic review pretends to be a first approach to unexplored lines of research, it was based mainly in the analysis of the abstracts of the articles. The limitation is that in some analyzed abstract important items are not mentioned or are imprecise. In some cases, the information was found in Google scholar or the full text, but in others, they remain missing.

4. THE EFFECTS OF PERSISTENCE IN INNOVATION AND EXPORTING ON FIRM GROWTH

4.1. Introduction

Recent industrial policies stimulate the persistence in innovation and exporting to increase survival likelihood, improve competitiveness and enhance firm performance (e.g. Horizons 2020 in UE and others in different countries). Learning by exporting and self-selection hypothesis explain the relationship between exporting and innovation that is reinforced in a virtuous circle and improves firm performance (Bernard and Jensen, 1999; Clerides et al., 1998; Golovko and Valentini, 2011). As a result of cumulative knowledge process, persistent innovative exporters have better performance than others (Andersson et al., 2012; Baum et al., 2019; Lööf et al., 2015; Lööf and Nabavi, 2015).

Persistence in innovation has been widely studied. Meanwhile, the persistence in exporting is not studied much (Bernini et al., 2016; Blum et al., 2013; Love and Máñez, 2019). The literature about persistence emphasizes on the accumulative process that exists either in innovation activities (Antonelli et al., 2012; Antonioli and Montresor, 2019; Costa et al., 2020; Ganter and Hecker, 2013; Le Bas and Scellato, 2014; Suárez, 2014; Tavassoli and Karlsson, 2015) or in exporting (Love and Máñez, 2019).

The systematic literature review of persistence in innovation shows that previous studies concentrate on the mechanism of persistence with focus mainly on developed economies. The analysis of persistence in innovation and its effects on firm performance has more recent data, concentrating on productivity growth. Nevertheless, there is not much research about the effect of persistence in innovation and exporting on firm sales growth. Also, there is a lack of information about the effects of persistence in innovation and exporting on firm performance in adverse contexts, such as developing countries or unstable economies.

Particularly, there is not much research done about the Uruguayan case (Muinel-Gallo and Martínez, 2018), however, entrepreneurship, innovation, and support programs have gained relevance in recent government policies. This country is considered on account of its main characteristics: an open agro exporter developing economy, with a small market, limited capital market, and scarce qualified population. In this sense, the growth is expected to be driven by the exports of quality and innovative services and products. However, because of restrictions such as the payback period or financial access difficulties (ANII, 2015; Horta Berro, Silveira Argenzio, and Ferreira Muñoz, 2021), exporting and innovating may be alternative strategies for the firms. For that reason, the government's policies are expected to improve the effectiveness of innovation, generally related to an internationalization plan.

Therefore, it is mandatory to evaluate the effects of persistence in innovation and exporting on firm performance to justify the continuity or modification of the policies that promote the internationalization of innovative products.

This study attempts to fill the gap by analyzing the individual and cumulative effects of persistence in innovation and exporting on firm sales growth. Furthermore, I intend to arrive at clear results in relation to the relevance of the measure used to analyze these relations, comparing the incidence of different variables associated with exporting and innovation, frequently used.

The research questions are: What are the effects on firm growth if the firm only innovates persistently? What are the effects on firm growth if the firm only exports persistently? And What impact does persistence in exporting and innovation have on the growth of companies? And what is the effect on firm growth if the firm only exports or innovates?

I consider the cumulative learning process discussed in evolutionary theory and the development of capabilities to persist in innovation and exporting in a changing environment, explained by dynamic capabilities view. The cumulative knowledge effects that differentiate the firms' performances may be clearly reflected in the three possible strategies involving these activities: doing exporting and innovating together, only innovating and only exporting (Golovko and Valentini, 2011; Ito and Lechevalier, 2010). I find that: 1) only persistence in exporting has a positive effect on sales growth and 2) only innovation has no significance on the dependent variable.

The contributions of this study are: 1) increase empirical literature on persistence in innovation and firm growth, 2) distinguish different effects related to exporting and innovation on firm growth, 3) consider the innovation effort in a wider concept and not only R&D classification, trying to create empirical evidence for exporting and innovating supporting policies, 4) present evidence for developing context, with restrictions to persist in innovation and exporting in the same period.

This document is divided into six sections. In the next section, the conceptual theory and the empirical studies taken as reference for the hypotheses of this research is described. In section three, the methodology is explained, the Uruguayan context, the econometric model, the data and variables description. In section four the results and robustness test are shown. Then, in section five, the conclusion includes discussion, implications for future research agenda and limitations.

4.2. Framework theory and hypotheses

Based on Dynamic capabilities and evolutionary theory, I present the framework of this research. In general, the bibliography analyzed treats the relationship of persistence in innovation with exporting and firm performance separately (Arenas et al., 2020; Bartoloni and Baussola, 2018; Deschryvere, 2014; Guarascio and Tamagni, 2019; Love and Máñez, 2019; Muínelo-Gallo and Martínez, 2018).

The literature about the relationship between persistent innovation and firm growth shows that the articles are concentrated in some developed countries and that R&D is mainly used to study productivity as a measure of firm performance. In addition, for example, apart from R&D, there are no studies that consider other measures of innovation effort.

The systematic literature review on persistence in innovation shows that there is bibliography exploring this persistence but the articles about innovation and exporting persistence and their effect on firm performance are only two and are relatively new (Iandolo and Ferragina, 2019; Lööf et al., 2015).

In accordance with Ito and Lechevalier (2010)¹³, Golovko and Valentini (2011) and the findings of the documents of determinants, I consider three strategies related to innovation and exporting: doing both strategies, only innovating and only exporting. Although doing both is the desirable strategy because of the complementary effects between them, there are some firm restrictions that state these growth strategies as alternatives (Roper and Love, 2002). This is undoubtedly the case of several Uruguayan firms with regional dependent exports and a limited capital market. This is undoubtedly the case of several Uruguayan firms with regional dependent exports and a limited capital market.

In this case, I analyze the effects on firm growth of persistence in only innovating, persistence in only exporting and persistence in doing both strategies. In the next section I present the theories and the most recent studies that explore the relation between persistence in these activities and its effect on firm performance.

4.2.1 Persistence in innovation and firm growth

The evolutionary model of Schumpeterian competition (R. R. Nelson and Winter, 1982) argues that firms' growth is related to innovative firms and the above-normal profits they generate. The causal mechanism implicit in this theory is that these profits are invested in firms' capabilities, producing an increase in firm size that stimulates to keep on reinvesting profits. In this direction, the evolutionary

¹³Which analyze innovation and exporting persistence and their effect on firm performance but did not appear in Scopus or Web of science searches about persistence in innovation.

theory explains an intimate relation between investment decisions and their growth at the firm level. The creation of a virtuous circle between profits and investment is due to the fact that the expansion reinforces firms' set of effective routines and the firms "do not have any incentive to behave in another way" (Federico, 2016). According to Nelson and Winter (1982), firms' investment produces growth in capacity and sales revenue. In the innovation process, there is knowledge accumulation and capability building (Dosi, 1988; R. R. Nelson and Winter, 1982). Based on previous knowledge, innovation is a continuous process, which builds future learning and knowledge production that enables firms positive results in the future (Suárez, 2014) as well as innovation persistence (Ganter and Hecker, 2013).

The lack of capabilities and the available stock of managerial services that restrict the Firm growth¹⁴ are overcome by developing dynamic capabilities. Integrating, building, and reconfiguring internal and external competencies to achieve, in changing environments, innovative forms of competitive advantage (Teece et al., 1997). According to Teece (2007) the sustainability in firm growth depends on the ability to innovate, recombine, and reconfigure assets and organizational structures, with changes in markets and technologies. This ability is essential to escape from unfavorable path dependencies.

Persistent innovators have better performance in profitability than non-persistent innovators or non-innovators (Cefis and Ciccarelli, 2005). Deschryvere (2014) finds that only continuous innovators have positive associations between R&D growth and sales growth.

For the reasons explained above, it is expected to confirm hypothesis 1:

H4) Persistence in only innovation has a positive effect on firm growth.

4.2.2 Persistence in exporting and firm growth

Persistence, considered as a firm's continuous exporting period, derives in significant greater productivity benefits than if it sells overseas occasionally (Andersson and Lööf, 2009), demonstrating that persistence in exporting matters for firm performance. The accumulated knowledge derived from export experience, develop useful routines and capabilities that gives a lower 'cost of foreignness' and may encourage the firms to persist in exporting (Love and Máñez, 2019). These processes of organizational learning improve specific managers' skills and develop dynamic capability (Zollo and Winter, 2002). For example, managing the exporting process, developing key relationships, accessing and assimilating relevant market information (Barney, 1991; Zou and Stan, 1998). Therefore, the organizational routines developed around exporting will help firm adaptation to changes in market conditions (Miller et al., 2012; Pentland et al., 2012). They also facilitate the pursuit of growth

¹⁴ Penrose effect or "Growth curve".

opportunities and the diversification of revenues, encouraging a result that may be long lasting (Love and Máñez, 2019). Moreover, a firm with a high percentage of exported sales is expected to continue exporting because replacing foreign sales with domestic sales is unlikely to be possible in the short run, and may be neither easy nor cheap in the long run (Love and Máñez, 2019). Outstandingly, intense exporters deal with a wide range of overseas customers and countries with the scope and extent of learning opportunities which exporting provides. Therefore, they are “in a good position to develop the deep-seated and knowledge-enhancing routines on which learning by exporting is based, leading to greater export persistence in the future” (Love and Máñez, 2019). Because of the reasons explained above, it is expected to confirm hypothesis 2:

H5) Persistence in only exporting has a positive effect on firm growth.

4.2.3 Persistence in innovation and exporting

Most of the literature has studied the effects of exports and innovation persistence on firm performance separately. However, Iandolo and Ferragina (2019), Ito and Lechevalier (2010) and Golovko and Valentini (2011)¹⁵ find that both activities are complementary and reinforce each other in a “dynamic virtuous circle” (Golovko and Valentini, 2011, p.362). Also, studies on persistent innovators find that they get better performance when they also export (Löf and Nabavi, 2015; Löf *et al.*, 2015).

Learning by exporting and Self-selection hypothesis (Bernard and Jensen, 1999; Clerides *et al.*, 1998; Golovko and Valentini, 2011) explain the relationships between innovation and exporting, interacting and reinforcing each other towards enhanced firm performance. Firstly, it is the experience in the exporting market that improves the firm’s knowledge and encourages innovation for the needs of different international markets. Secondly, the innovative firms have superior productivity, which reduces the weight of export-related costs and stimulates exporting.

Golovko and Valentini (2011), discover that learning by exporting promotes better innovations to increase their sales in both domestic and foreign markets. For their analysis, a firm investing in export and innovation strategies at the same time has higher growth rates than those that do only one of the activities or none of them. Also, the return from one activity increases as the level of the other increases.

Exporting and innovating investments generate permanent differences in performance among firms as these are two ways to accumulate knowledge and improve firms’ capabilities (Ito and Lechevalier, 2010). Their results suggest that the R&D and export decisions are highly path dependent and that these

¹⁵ Although, Golovko and Valentini (2011) find persistence in their sample, they do not explore the effect of it on sales growth and limit their analysis to the effect of these strategies with one year lag.

two decisions are interrelated. R&D and exports involvement are strongly persistent and have complementary effects on productivity growth. Hence, the different strategies that involve exporting and innovation (doing it or not) have diverse performances in terms of productivity and survival. Firms that had conducted R&D activities and accumulated some knowledge internally, after they start exporting, have higher productivity growth.

Iandolo and Ferragina (2019) find that the effect on TFP is boosted by the joint effect of persistence in both strategies, probably in internalizing knowledge flows from interactions with foreign customers and competitors. They find that firms' persistent efforts in R&D have a positive and significant influence on TFP only if they are accompanied by a continuous export activity, otherwise, they could have a negative effect. However, without combining exporting, persistent innovation could become a factor of weakness for firms, even if they try to provide for it by internal R&D. Because of the complementary effect of innovation and exporting on firm performance, it is expected to find that:

H6) Persistence in both strategies is positively related to firm growth and has a higher effect than if persistence is only in export or only in innovation.

4.3. Methodology

4.3.1 Uruguayan context to firm growth

After a favorable scenario given by booming demand for agro-based products, extraordinary level of exports to China and capital flow to Uruguay and the region, some Uruguayan macro variables declined from 2010 to 2015. Meanwhile GDP growth showed an increasing trend, the exports value was decreasing and its foreign direct investments (FDI) reached a peak in 2013. The GDP growth in 2015 was 0.4% surrounded by regional negative numbers in Brazil and Argentina (Bancomundial.org). In this period, the industrial dynamic slowed down and the weight of the sector in the GDP decreased. Besides, some service sectors consolidated its growth, giving dynamism and the majority part of value and income generation (Bonino et al., 2012). The foreign direct investment (FDI) from different origins constantly increased from 2003 until 2013, with an average of 5.6%, getting its higher rate in 2008 at GDP 6.9%. With declining FDI, in 2015 the reinvestment was negative.

Uruguayan exports increased from 2003 to 2009, when it decreased 10% because of the development countries' crisis. In 2010, they increased up to 27% before a decreasing period until 2015 by -11.2% annual variation (Uruguay XXI, Annual Report, 2016). From 2010 to 2015, there was an increase of exports to Asia with a loss of South America exports participation. Consequently, the exporting firms

decreased as Latin American countries are the main destinations for those firms with lower exports percentage on sales, while companies with higher exports have more distant countries as primary destinations (Grosse et al., 2013)¹⁶.

During this quinquennium (2010-2015), the Uruguayan government takes an important role in promoting firms' innovation. It creates a modern National Research and Innovation Agency (ANII, for its Spanish acronym) with Science, Technology and Innovation financing programs. At the same time, it changes the regulation of the Investment promotion law to promote the advance of technologies and other innovations. In this topic, Uruguay has traditional a background in support and research institutions that improve chain resources in cattle, forestry and agricultural productive sectors. The agricultural census of 2007-2009 showed an outstanding technological dynamism in the principal agro exports products (Paolino et al., 2014). However, most of the efforts and capacities in innovation depend on the public enterprises, private firms that operate in highly regulated spaces or are hooked on regulations, such as health and transport, and the knowledge-intensive sectors (Teixeira et al., 2021). Additionally, in the periods between 2010-2012 and 2013-2015, the 24 % and the 27% of the firms surveyed, respectively, did at least one type of innovation. However, the risk aversion of Uruguayan society and the market size, restrict the development of the capital market and the amount of investment in innovations.

4.3.2 Data and Sample

The database used is the Innovation survey of manufacturing and services companies carried out by the National Agency for Innovation and Research (ANII) The two-wave survey from 2010 to 2015 provides information about firms' characteristics, innovation activities, human resources, sales and exports activity. This survey was chosen because it has recent information of the relevant variables to work with panel data. Furthermore, this period captures the consolidation of recent transformations in the Uruguayan National Innovation System.

The surveys were done in the years 2012 and 2015 to firms with five or more workers or which have declared sales for an equal and more than 5.85 million American dollars (inferior stratum), and as the superior stratum, associated with firms with more than 100 workers. The principal economic activity is defined by the International Industry Uniform Classification fourth revision (CIIU. Rev. 4) and is

¹⁶ For example, in 2015, there were 1.000 exporter firms in Uruguay, which 70 per cent were SMEs and represent per cent of the total exports, mainly to South America. The SMEs have the lower rate of export survivor. Only 19% of them exported in 2015, exported continuously from 2001 to 2015 (Uruguay XXI, 2016).

selected owing to its weight on the economy¹⁷. The samples are repeated observations taken in different moments to the same firms, taken as initial period the survey of Innovation activities of 2009¹⁸.

4.3.3 Variables and summary statistics

To analyze the effect of the persistent strategies on the firm performance, the dependent variable is the sales growth rate. It is measured as the difference of the logarithms of firms' sales between two consecutive years in constant prices (deflated by consumer price index).

The explicative variables are related to innovation and exporting strategies. Persistence in doing both strategies, persistence in only innovating and persistence in only exporting are binary variables. The persistence is defined for each year of the period, as the continuity of doing any of the three strategies from the beginning of the period (year 2010) until the year t . It gets the value 1 when they have been doing the same strategy since 2010 to time t .

The variables are considered at time $t-1$ to show the incidence of the variables on firm growth one year later with exception of persistence variables. Variables are measured in constant prices. Sales and exports were deflated by consumer price and export index with 2010 as the base year. The export intensity is deflated by exports index and consumer price index; knowledge intensity, technology intensity, preparation for commerce and production intensity are deflated by consumer price index¹⁹. All of them calculated as a percentage of total sales in constant prices. All of them are used to show the effect of the accumulated knowledge of these strategies (Love and Máñez, 2019).

Being innovative, being an exporter, doing both strategies in the same year is for dummies. The first variable gets value one when the firm is innovative and has an investment in Knowledge innovation (R&D, Technology transfer, Training and Marketing), Technology innovation (acquisition of technology information or machines) or Preparation for commerce or production innovation. To be an exporter means that the firm has sales overseas in year t and the value of the variable is one. When the firm does both activities, the value of the variable of doing both strategies is one.

¹⁷ <http://www.anii.org.uy/upcms/files/listado-documentos/documentos/encuesta-de-actividades-de-innovaci-n-en-la-industria-manufacturera-y-servicios-seleccionados-2010-2012.pdf>

¹⁸ The base sample of the Innovation survey for the period 2010-2012 corresponds to the 2009 edition, which was selected based on the 2008 Permanent Register of Economic Activities (RPAE) under a systematic, R&om and stratified design. The stratum of the design recognizes two dimensions: 1) the main economic activity class of the company (at the activity division level) and, 2) the size of the activity in terms of workers and / or sales. Then, within each stratum, a sample was selected independently under a systematic design with R&om start, ordering the companies according to their activity to four digits (class) and their average employed personnel. "(ANII, 2015)

¹⁹ These variables include: R&D internal and external, technology transfer and marketing as knowledge innovation, software and machinery as technology innovation and industrial and organizational design and training as preparation for production and commerce innovation.

For the control variables of the growth firm's regression, the studies have mainly included internal firm-specific factors, such as size (Bernard and Jensen, 1999; Bolívar-Ramos et al., 2020; Golovko and Valentini, 2011), age (Bolívar-Ramos et al., 2020) labor productivity (Bernard and Jensen, 1999; Ito and Lechevalier, 2010), percentage of foreign capital (Golovko and Valentini, 2011), year dummies (Golovko and Valentini, 2011; Bolívar-Ramos *et al.*, 2020) and external factors such as industrial affiliation (Bernard and Jensen, 1999; Bolívar-Ramos et al., 2020). The control variables are: size (logarithms), age and labor productivity, dummies: foreign capital, year 2012 and year 2015 (the last year of each wave survey), agro industrial sector (13.17 percent of the sample), chemistry industry (2.94 percent), and technology sector (2.52 percent), which are 19 percent of the database. The other sectors are the rest of the manufacturing industry, mining, agricultural and service sector.

Table 4.1 shows the export and innovation status of the firm in the final sample. Compared to Golovko and Valentini (2011) database, which has an annual average of 40 percent of exporters and 35 percent of innovators (ten years sample), this one has an annual average of 17.5 percent of exporters and 25 percent of innovators (five year sample). Nevertheless, there is a clear increase in exporters and innovators firms between the first and the second Uruguayan wave.

Table 4.1 - Export and innovation status 2011- 2015 (en percentage)

	2011	2012	2013	2014	2015
Exporters	15.14	15.52	18.91	18.91	18.73
Innovators	16.76	20.11	27.04	29.41	32.24

Source: Own elaboration based on ANII survey

The transition probability matrix, in table 2.2 shows the probability that a firm will follow a certain strategy in a specific year, given the strategy was taken in the previous year for Uruguay (2010-2015). The high percentage of persistence is evident in all the strategies and all of them have a higher percentage than the Golovko and Valentini (2011) matrix. These numbers of persistence are expected to decrease if the data period considered for the analysis is more extensive, as is the case of the Spanish sample.

In the panel study, the variables related to strategies persistence are calculated as the strategies engaged from 2010 until time t, not considering what happened before or after that. Table 4.4, summarizes the characteristics of all the variables engaged in the regression.

Table 4.2 - Summarize Panel variables

Variable	Observation	Mean	Std. Dev.	Min	Max
Sales growth t	9906	.0216125	.5308416	-16.18247	9.170596
Labor growth t	8178	-.0021736	.1023817	-1.714624	1.609438
Haltinwagner growth t	9715	.0012624	.4156568	-2	2
Size t-1	12845	3.676719	1.433133	0	9.309733
Age t-1	12924	23.72741	20.14841	0	162
Foreign capital t-1	12924	.1346332	.3413446	0	1
Agro industrial sec. t-1	14145	.1580064	.3647599	0	1
Chemistry ind. t-1	14145	.0352775	.1844868	0	1
Technology sec. t-1	14145	.030258	.1713026	0	1
Year 2012	16974	.1666667	.372689	0	1
Year 2014	16974	.1666667	.372689	0	1
Both strategies t-1	14145	.0740898	.2619262	0	1
Only innovate t-1	14145	.1416755	.3487293	0	1
Only export t-1	14145	.0931778	.2906917	0	1
Export intensity t-1	10430	.1038975	.2588286	0	1
Knowledge int t-1	10275	.008955	.1881683	0	12.69841
Technology int t-1	10275	.0114582	.1093206	0	4.882949
Prep.Produc. Int. t-1	10275	.0029761	.0671371	0	4.761905
Persistence in both	11316	.1910216	.3931199	0	1
Persistence only innovate	14145	.0450336	.2073851	0	1
Persistence only export	14145	.04772	.2131808	0	1

Source: Own elaboration based on ANII survey

4.3.4 Methodological approach

To test the hypotheses that relate exports with innovation and sales growth, a panel regression is used with data from the period 2010-2015. In the panel structure it is used a fixed – effects model to control for time invariant unobserved firm heterogeneity. The choice is made because it allows the unobserved firm’s characteristics to be correlated with the strategy selected and performance variables.

I estimate four regressions to compare results between them, using a fixed-effect model. The first regression includes all the independent variables of the other three estimations. The second regression includes the strategies related to persistence in innovation and exporting. The third regression has the export intensity, knowledge innovation intensity, technology innovation intensity and preparation for commerce and production intensity with one year lagged as independent variables. The last regression only includes the three strategies related to innovation and exporting one year lagged as the independent variables. The first one analyzes the effect of the cumulative knowledge process of doing the strategies persistently. The second one considers Love and Máñez (2019) assumption that previous experience

assists export intensity (the ratio of exports to total sales). They explain that the scope of learning opportunities and the high export intensity will probably stimulate a significant effort to continue exporting because in the short run it is difficult to replace foreign sales with domestic sales. I extrapolate this behavior to innovation intensity and consider that the intensity of both variables is a proxy of accumulated knowledge and persistence intentions of the firm. The last regression I only consider the effect of doing the strategy once, without information about the previous strategy. These variables are frequently used as explicative variables of firm performance (Golovko and Valentini, 2011; Ito and Lechevalier, 2010; Love and Máñez, 2019).

To check the robustness of the model, I estimate them using Haltinwagner index (a sales growth index measure) and labor growth as alternative measures to firm growth. For each model, I replicate the four estimations I did for the sales growth but changing the dependent variable, to compare.

4.4. Results

4.4.1 Multinomial analysis

The results of the panel 2010-2015, prove that persistence in doing both strategies has a positive relationship with firm performance, which confirms hypothesis 3. In relation to hypothesis 2, persistence in only exporting has a positive relationship with firm performance. However, as in equation 1, has a positive and significant coefficient associated but in equation 2, is positive but not significant, this seems to indicate that its effects are not very strong. Meanwhile, hypothesis 1 is not confirmed as the coefficient associated with persistence in innovation is positive but insignificant. The results do not confirm the existence of a complementary effect between both variables as we cannot say that the persistence in doing both strategies persistently has higher effect than if persistence is only in export or only in innovation.

Comparing these results with the alternative variables of strategies (one year lagged intensity and propensity), we can observe that knowledge and technology innovation intensity positively explains the firm's sales growth and the export intensity has a negative effect on the firm's sales growth. Having the rest of the variables status quo, an increase in investment in these innovations in the previous year, increase in firm's sales growth, but an increase in the percentage of foreign sales in total firm's sales the previous year, staying the rest of the variables unchanged, decreases the firm's sales growth. Meanwhile, having done both strategies or only exporting the previous year, has a negative effect on firm sales growth.

The innovation intensity results are according to the theoretical framework but not exporting intensity results. The sign of the effect of all the propensities on firm growth are neither the expected.

Doing both strategies persistently has a positive effect on firm sales growth but being an exporter and innovator the previous year, has a negative effect. Furthermore, being persistent in only exporting for a period of time, is positively related to firm's growth, being only exporter in year t-1 or increasing the export intensities in t-1, having the rest of the variable unchanged, does not increase the firm growth sales. This indicates a divergence between the results of being persistent and a probable isolated strategy the previous year or a probable isolated increase in the export intensity the previous year, demonstrating the relevance of considering persistence as an explicative variable of firm sales growth, instead of the other variables. Additionally, the result of intensity contradicts Love and Máñez (2019) statement about export intensity as a predictor of export persistence.

Table 4.3 - Sales growth regression

Variables	All	Persistence	Intensity	t-1
Size	0.212***	0.213***	0.215***	0.221***
t-1	(10.37)	(10.41)	(10.56)	(10.76)
Age	-0.00253	-0.00256	-0.00377**	-0.00363**
t-1	(-1.93)	(-1.94)	(-2.92)	(-2.79)
Foreign capital	-0.00838	-0.00610	0.00782	0.00339
t-1	(-0.15)	(-0.11)	(0.14)	(0.06)
Agro industrial	0.976	0.972	1.007	1.011
sec. t-1	(1.49)	(1.48)	(1.54)	(1.54)
Chemistry ind.	0.805	0.793	0.815	0.820
t-1	(1.74)	(1.71)	(1.76)	(1.77)
Technology	-0.0490	-0.0483	-0.0522	-0.0560
sec. t-1	(-0.18)	(-0.18)	(-0.20)	(-0.21)
Year 2012	-0.00477	-0.00297	-0.0265	-0.0267
	(-0.30)	(-0.19)	(-1.85)	(-1.86)
Year 2015	-0.0517***	-0.0529***	-0.0698***	-0.0703***
	(-3.88)	(-3.96)	(-5.39)	(-5.40)
Persistence	0.0757***	0.0816***		
in both	(4.36)	(4.74)		
Persistence	0.100	0.0824		
only innovate	(1.91)	(1.65)		
Persistence	0.0971*	0.0379		
only export	(1.99)	(0.84)		
Export	-0.0164		-0.135*	
intensity t-1	(-0.20)		(-1.97)	
Knowledge	0.275***		0.270***	
intensity t-1	(5.29)		(5.20)	
Technology	0.308***		0.293***	
intensity t-1	(3.69)		(3.54)	
Prep. Production	0.0811		0.0908	
intensity t-1	(0.65)		(0.73)	
Innovate and	-0.115*			-0.0989*
Export t-1	(-2.38)			(-2.31)
Only innovate	-0.0270			-0.0145
t-1	(-1.12)			(-0.63)
Only export	-0.147**			-0.116**
t-1	(-3.11)			(-3.00)
Constant	-0.932***	-0.964***	-0.915***	-0.918***
	(-5.25)	(-5.40)	(-5.14)	(-5.14)
Observations	9901	9901	9901	9901

Source: Own elaboration based on ANII survey

4.4.2 Robustness checks

To check the robustness of the results, it is used the variable of employment growth rate and the Haltinwagner growth rate²⁰ as firm growth measures alternatives.

Considering employment growth rate involves the old discussion in the center of the policy debate between innovation and employment. The OECD Jobs Study (1994) regards technological development as a crucial force in determining employment growth in the long run (Zhen, 2018). No definite answer has been found. Theoretical and empirical arguments are ambivalent about jobs' creation or destruction by technological change. The antagonist postures are: a) a compensation effect made through introducing new products that expands the demand and increases the employment and b) destroying jobs by using less labor input in light of the labor-displacing technology (displacement effect).

For example, Aboal *et al.* (2011), for Uruguayan samples from 1998 to 2009, demonstrate that creating technology in-house has the biggest positive impact on employment, followed by the make-and-buy strategy. In general, innovation does not lead to job losses, even finding weaker evidence that process innovation has displaced labor. In the same direction, Deschryvere (2014), for an Australian sample (2007-2014), finds a positive relation between employment growth and subsequent R&D growth in persistent innovators. However, for occasional innovators it is insignificant.

Labor growth regressions estimations for the Uruguayan sample (2010-2015) do not show any significant relation with persistence of strategies (see Table 4.5). The only variable that is significant is only innovating in the previous year and it is negative, which is one expected result for destroying job innovation. But this effect is not very strong as the fourth equation shows no significance of the negative coefficient.

On the other hand, Haltinwagner growth regressions are estimated as the differences between sales from period t and $t-1$ divided by the average of both sales (t and $t-1$). This index is a transformation to reduce the influence of those cases which have a very small initial size. This regression confirms hypothesis 3, doing both strategies is positively related to sales growth. Hypotheses 1 and 2 are not confirmed by this index as neither persistence in only innovating nor persistence in only exporting are significant.

Haltinwagner estimations show similar coefficient sign and significance to sales growth regressions in the following variables: persistence in both strategies, export intensity and knowledge innovation intensity, doing both strategies in $t-1$ and only exporting in $t-1$.

²⁰ Haltinwagner growth = $\text{Sales}(t) - \text{Sales}(t-1) / ((\text{Sales}(t) + \text{Sales}(t-1))/2)$

Table 4.4 - Labor growth regression

Variables	All	Persistence	Intensity	t-1
Size	0.180***	0.188***	0.180***	0.189***
t-1	(42.06)	(42.78)	(42.05)	(42.81)
Age	0.000110	0.0000905	0.000136	0.000122
t-1	(0.42)	(0.33)	(0.52)	(0.45)
Foreign capital	0.00967	0.0109	0.00952	0.0103
t-1	(0.88)	(0.96)	(0.87)	(0.91)
Agro industrial	-0.139	-0.145	-0.144	-0.142
sec. t-1	(-1.22)	(-1.23)	(-1.27)	(-1.20)
Chemistry ind.	-0.100	-0.107	-0.106	-0.103
t-1	(-1.25)	(-1.28)	(-1.32)	(-1.23)
Technology	0.0101	0.0111	0.0106	0.0111
sec. t-1	(0.22)	(0.23)	(0.23)	(0.23)
Year 2012	0.00254	0.00296	0.00335	0.00299
	(0.93)	(1.06)	(1.31)	(1.13)
Year 2015	-0.00815***	-0.00778***	-0.00832***	-0.00759***
	(-3.81)	(-3.52)	(-3.90)	(-3.44)
Persistence	-0.0185	-0.0186		
in both	(-0.98)	(-0.96)		
Persistence	0.0206	0.0161		
only innovate	(1.91)	(1.50)		
Persistence	-0.00537	-0.00750		
only export	(-0.52)	(-0.74)		
Export	0.0174		0.00678	
intensity t-1	(1.17)		(0.55)	
Knowledge	-0.00550		-0.00618	
intensity t-1	(-0.45)		(-0.50)	
Technology	-0.00886		-0.0112	
intensity t-1	(-0.52)		(-0.66)	
Prep. Production	-0.0146		-0.0150	
intensity t-1	(-0.58)		(-0.60)	
Innovate and	-0.0118			-0.00794
Export t-1	(-1.35)			(-1.00)
Only innovate	-0.0105*			-0.00810
t-1	(-2.47)			(-1.92)
Only export	-0.0112			-0.00744
t-1	(-1.32)			(-1.03)
Constant	-0.644***	-0.675***	-0.645***	-0.674***
	(-20.19)	(-20.53)	(-20.22)	(-20.49)
Observations	8127	8178	8127	8178

Source: Own elaboration based on ANII survey

Table 4.5 - Panel Haltinwagner regression

Variables	All	Persistence	Intensity	t-1
Size	0.0692***	0.0637***	0.0697***	0.0678***
t-1	(4.80)	(4.28)	(4.84)	(4.55)
Age	-0.000201	0.000207	-0.000928	-0.000358
t-1	(-0.22)	(0.22)	(-1.04)	(-0.39)
Foreign capital	0.0407	0.0327	0.0472	0.0367
t-1	(1.08)	(0.83)	(1.25)	(0.93)
Agro industrial	1.228**	1.214*	1.248**	1.239**
sec. t-1	(2.71)	(2.56)	(2.75)	(2.61)
Chemistry ind.	1.205***	1.200***	1.216***	1.224***
t-1	(3.77)	(3.59)	(3.80)	(3.66)
Technology	-0.0786	-0.0791	-0.0817	-0.0847
sec. t-1	(-0.43)	(-0.41)	(-0.44)	(-0.44)
Year 2012	-0.0242*	-0.0274*	-0.0387***	-0.0429***
	(-2.15)	(-2.34)	(-3.68)	(-3.92)
Year 2015	-0.0524***	-0.0606***	-0.0607***	-0.0680***
	(-5.69)	(-6.32)	(-6.77)	(-7.27)
Persistence	0.0490***	0.0515***		
in both	(3.94)	(4.04)		
Persistence	-0.0226	-0.0340		
only innovate	(-0.62)	(-0.94)		
Persistence	0.00251	-0.0219		
only export	(0.07)	(-0.66)		
Export	-0.0456		-0.114*	
intensity t-1	(-0.80)		(-2.38)	
Knowledge	0.258***		0.254***	
intensity t-1	(5.01)		(4.96)	
Technology	0.111		0.101	
intensity t-1	(1.76)		(1.62)	
Prep. Production	0.0392		0.0307	
intensity t-1	(0.36)		(0.28)	
Innovate and	-0.0716*			-0.0875**
Export t-1	(-2.12)			(-2.83)
Only innovate	-0.0126			-0.0237
t-1	(-0.75)			(-1.43)
Only export	-0.0662*			-0.0909**
t-1	(-1.99)			(-3.24)
Constant	-0.562***	-0.551***	-0.551***	-0.524***
	(-4.52)	(-4.28)	(-4.43)	(-4.07)
Observations	9609	9699	9609	9699

Source: Own elaboration based on ANII survey

4.5. Conclusions

4.5.1 Discussion

Based on evolutionary theory and dynamic capabilities approach, I assume that there is a cumulative knowledge process that increases effectiveness in innovating and exporting, and innovation process improves firms' abilities in changing environments. Learning by exporting and self-selection hypothesis give a theoretical framework to believe that innovation and exports are complementary towards growth, contributing to a better firm growth performance (Golovko and Valentini, 2011).

The main objective of the research is to understand the effect of persistence in exporting and innovating strategies on firms' growth, as a cumulative knowledge process. I used a two-wave Uruguayan innovation survey (ANII) from 2010 to 2015, considering manufacturing and services firms. The analysis explores the effects of firm strategies on firm growth. Specifically, studies the effects of persistence in: only innovation, only exporting and both strategies.

The estimation shows that persistence in both strategies are positively related to sales growth. However, the result do not confirms the existence of complementarity between both strategies in persistence. Persistence in only exporting is positively related to firm sales growth, but not very strong. However, no significance has persistence in only innovating. This last result is according to Guarascio and Tamagni (2019), which may be related to the developing country context that makes it difficult to obtain the expected results for all the innovation and exporting strategies. In this context, persistence in both strategies and persistence in only exporting are the strategies that contribute positively to sales firm growth. Therefore, it seems to be that both options have escape from unfavorable path dependencies, using their dynamic capabilities to maintain a good performance. Meanwhile, the strategies that involve only innovation persistence do not reflect a positive impact on sales growth. Probable explanations are that innovation results take longer time to give the expected returns, the innovation investment was not appropriate in quantity or quality, or there exist other factors that were not considered in this research and influence this outcome.

Additionally, to get more information about this strategy behavior, I tested the significance of alternative strategies variables. I try to demonstrate the incidence of doing these activities continuously for a period, in comparison to doing it at least once or intensively, on firm sales growth estimation. Therefore, the results demonstrate cumulative knowledge effects of persistence in doing both strategies and doing persistently only exporting on firm growth. These effects are the opposite sign of doing these strategies just the previous year or exporting intensively the previous year, without considering the preceding strategies.

These results are corroborated by the Haltinwagner growth index, but labor growth rate shows no relation to persistence in none of these strategies. The difference between both results is because of the roles of the index. The first one considers sales and the second one employment growth. The latter, shows a negative significant but not strong effect of only innovating the previous year. This result shows a “displacement effect” of the innovation (Aboal et al., 2011).

According to Suárez (2014), changes in the environment as were materialized in this sample period, will impact in firms’ innovation projects and how they encourage competitive behavior. “If the firm has to change its innovative trajectory to face the new environment, it will be difficult to predict a positive correlation between past and present innovations” (Suárez, 2014, p. 727) and no theoretical approaches may describe this relationship. In addition, obtaining revenues internationally in most cases requires more time than in the domestic markets (Kyläheiko et al., 2011), which may hinder self-financed innovations and, consequently, the persistence in this strategy.

4.5.2 Implications, further research agenda and limitations

In this research I introduced some novelties to the most frequent perspective of these studies. First, it is considered the innovation effort in a wider concept and not only R&D classification, trying to generate empirical evidence for exporting and innovating supporting policies. It uses the investment in knowledge innovation (R&D, Training, Technology transference and Marketing), technology innovation (investment related to technology information and machines) and preparation for production and commerce. The results provide a direct relationship between investment effort on knowledge and technology innovation (which usually support public policies) and the sales growth (much easier to measure and control in comparison with productivity). Second, I relate sales growth to persistence in the three combinations of exporting and innovating strategies firm choices. I contribute with more research that relates these two activities together and its cumulative incidence on firm sales growth. Additionally, this study demonstrates the effect on a developing country context, which exhibits its particularities in the no significance of only innovating on firm sales growth. Third, it compares the significance of different measures of these strategies, to relativize the relevance of their effect on sales growth. The estimation of significant variables with opposite sign coefficients suggests that each measure complements the understanding of these variables’ behavior.

The consideration of the different combinations of the strategies and their persistence involves information about firm strategy and another aspect of heterogeneity between firms (R. Nelson, 1991). The divergence between the results of being persistent and a probable isolated strategy the previous year or a probable isolated increase in the export intensity the previous year, demonstrate the relevance of considering persistence as an explicative variable for firm sales growth regression instead of the

other variables. Additionally, the result of export intensity contradicts Love and Máñez (2019) statement about this variable as a predictor of export persistence and support the use of persistence variable.

The unexpected results may show some specificity of the exporting firms but also about innovators. The results reveal that new lines of research must be taken to analyze deeply and to understand why it contradicts the expected results. In that sense, improving policy implementations may increase its effectiveness. Further research may explore crossing explicative variables like sector with persistence in strategies, expanding the period sample or collecting more information through qualitative research. Moreover, as it is explained above, the performance of the firms depends on the environment and capabilities that operate in each context, so, introducing more variables related to managers' capabilities or related to institutions involved (Suárez, 2014) in the database is expected to improve the regressions estimations and predictions.

One limitation is that the performance effects of strategic choices may have some delay and the period used in this study is not long enough to draw definitive conclusions about the effects. For example, SMEs with less financial resources have a disadvantage, since they may lack the financial muscle necessary to face an investment that they will only recover after a considerable amount of time (Wright, Hmieleski, et al., 2007). Another restriction is that there are some control variables that could not be included because there was no data for the whole 6-year period. Additionally, as defined by Guarascio and Tamagni (2019) a database with more years available will reduce the joint determination between firm characteristics and persistent innovators. Hence, increasing the probability of breaking the endogeneity as "one can measure innovation persistence and other characteristics, such as growth, in non-overlapping years" (Guarascio and Tamagni, 2019, p. 4).

5. CONTRIBUTIONS, IMPLICATIONS AND FURTHER RESEARCH AGENDA

In this section, I synthesize the main results of the three papers that structure this dissertation, and discuss their implications, contributions and limitations. Reminding the main objective, this dissertation pretends to examine the determinants and growth effects of innovation and exporting strategies.

5.1 Revisiting the main findings

5.1.1 Empirical findings

This dissertation has three main objectives. Firstly, I aim to analyze the microfoundations of dynamic capabilities that determinate innovation and exporting propensities for the Uruguayan sample. Secondly, I explore the persistence in these strategies and I do a systematic literature review to appreciate what has been studied about persistence in innovation, the most studied persistence in comparison to exporting; I inquire the studies that relate it with persistence in exporting and firm performance and exploring future research trends. Finally, these results guide me in the analysis of the persistence in innovation and exporting and its effects on firm performance for the Uruguayan sample. In addition, I pretend to demonstrate that persistence in innovation and exporting is the best measure to appreciate the potential effect of these strategies on firm performance. Likewise, considering them as three diverse strategies (only innovating, only exporting and doing both), because each one has its own requirement of dynamic capabilities to be successfully developed, and its own cumulative knowledge process that defines its effects.

After presenting the objectives of the dissertation, I will describe the findings related to the specific objectives explained above. In table 5.1, it is presented the research questions associated with each objective, the hypotheses, the expected and the obtained results. The first one refers to the effects of microfoundations of dynamic capabilities on innovation and exporting propensities. Based on the evolutionary theory and the dynamic managerial capabilities framework defined by Teece (2007), the results show that all the microfoundations chosen as the most representatives of firms behavior, employed to improve firms' capabilities and performance, have a positive and significant relationship with doing both activities and only innovating propensities (with the exception of the reconfiguration

capacity of knowledge management, which is not significant for only innovating strategy, at least for the variable selected to represent it). Besides, unexpectedly, only half of the microfoundations have a positive and significant relation to only exporting propensity: the sense capacity of process to direct internal R&D and select new technologies and alliancing process, and the reconfiguration capacities of knowledge management and the product development routines that expand product range. The not significant are the seize capacity of selecting enterprise boundaries, and reconfiguration capacity of management cospecialization, continuous improvement process and the product development routines that improve product quality. No negative effect associates any microfoundations to the propensities.

The regressions are estimated by multinomial probit, bivariate probit and fixed effect models. These estimations show that the multinomial model has, in general, the biggest significant coefficient. These results suggest a better prediction of the multinomial model, estimating the three strategies as correlated binary outcomes.

Interesting findings illustrate some particularities of the relationships between the microfoundations and the propensities that can be related to the context where they are built and its potentials or restrictions. Nevertheless, more importantly, the outcomes provide information about which microfoundation is useful to reinforce a certain strategy to make it persistent.

Table 5.1 - Summary of Research questions, hypothesis, expected and obtained results.

Article	Research Questions	Hypothesis	Results	
			Expected	Obtained
1	What influence do the microfoundations of sensing dynamic capabilities have in innovation and exporting propensities?	H1.i) Process to direct internal R&D and select new technologies is positively related to firm's innovation and exporting propensity.	Positive for all the strategies.	Supported expectations.
		H1.ii) Alliancing process is positively related export and innovate propensity.	Positive for all the strategies.	Supported expectations.
	What influence do the microfoundations of reconfiguration dynamic capabilities have in innovation and exporting propensities?	H2.i) Selecting Enterprise Boundaries is positively related to firm's innovation and exporting propensity.	Positive for all the strategies.	Only for innovative strategies (doing both and only innovating).
		H3.i) Managing cospecialization is positively related to firm's innovation and exporting propensity.	Positive for all the strategies.	Only for innovative strategies.
		H3.ii) Continuous improvement processes is positively related to firm's innovation and exporting propensity.	Positive for all the strategies.	Only for innovative strategies.
		H3.iii) Knowledge management is positively related to innovation and exporting propensity.	Positive for all the strategies.	Only for exporting strategies (doing both and only exporting).
H3.iv) Product development routines are positively related to firm's innovation and exporting propensity.	A) To expand product range.	Positive for all the strategies.	Supported expectations (expand product range).	
	B) To improve product quality.	Positive for all the strategies.	Only for innovative strategies (improve product quality)	
2	Is there any particularity in the evolution of persistence in innovation literature?		Diverse authors with not much publications.	Two clear periods defined by the subject, the quantity and citations of the publications.
	What is the relevance of the studies about firm growth and exporting in persistence in innovation literature?		Diverse and high percentage of publications.	Recent relevance. The most connected words are profitability (ayp: 2012) and productivity (2017.5). Export (2017).
	Which is the relationship between persistence in innovation and firm growth?		Positive for all the measures used.	Supported expectations. There is an exception in Guarascio and Tamagni (2019) that finds a random relationship.
	Which is the relationship between persistence in innovation and exporting, and firm growth?		Positive and better than doing only one strategy.	There are few studies but all find a positive relationship toward firm performance (productivity).
	What are the factors that influence the mentioned relationships: type of innovation, growth measure, country, etc?		Country context is expected to limit the positive relationship between variables.	No factors seem to limit the positive relationship between variables, neither country. Although, there are few studies of developing or underdeveloped countries.
3	What are the effects on firm growth if the firm only innovates persistently?	H4) Persistence in innovation has a positive effect on firm growth.	Positive.	It is not significant.
	What are the effects on firm growth if the firm only exports persistently?	H5) Persistence in exporting has a positive effect on firm growth.	Positive.	Supported expectations.
	What impact does persistence in exporting and innovation have on the growth of companies?	H6) Persistence in both strategies is positively related to firm growth and has a higher effect than if persistence is only in export or only in innovation.	Positive.	Partially supported. Is not confirmed that doing both has a higher effect than doing any of the other two strategies.

Source: Own elaboration based on the information of the dissertation.

Remarkable results from the first paper are the relation between the effect of the microfoundations on the strategies propensities and the incidence of its explicative variable in the sample. Processing to direct internal R&D and selecting new technologies, a sense capability that has the biggest impact on the innovation strategies propensities, it nearly duplicates from one period to another but still represents a low percentage in the sample (9 per cent). Knowledge management, a configuration capability represented by the certification in product and process explicative variable, is the most important variable to increase only exporting propensity and 15 percent of the sample has done it. Meanwhile, selecting enterprise boundaries (the percentage of trained employees explicative variable), which is the least used in this sample (6 percent of the firms in 2012-2015), has the second biggest significant

coefficient in doing both and only innovating propensities. Concurrently, the reconfiguration capabilities of managing cospecialization, represented by improving the use of employee's capacities, and product development routines, represented by improving product quality variable (developed by 27 and 26 percent of the firms in 2012-2015 sample, respectively), are microfoundations with moderate effect on doing both and only innovating strategies, with no effect on only exporting propensity. This information suggests that the firms do not consider the microfoundations effect on the strategies propensities to take decisions. Meanwhile, it seems to be that if the firm chooses to consider these effects, it will improve the strategy performance.

The second objective of this dissertation is to analyze the temporal evolution of "persistence in innovation" literature and the relationship between persistence in innovation with exporting and firm growth, to identify future research trends. From the bibliometric analysis of the literature, we can observe two clear periods defined by the subject and the publications quantity and citations. The first period (1997-2011) is characterized by few publications with a high level of citations and concentrates on the determinants and patterns of persistence in innovation. The second one, from 2012 to 2021, has more publications, diverse authors and less cited papers, with an increasing number of articles on persistence in innovation and firm performance. Regarding the relationships of interest, growth performance and exporting got relevance recently; growth performance, the most connected words are profitability (average year publication, ayp, 2012) and productivity (ayp, 2017.5). Exporting, the word export (ayp, 2017) and commerce (ayp, 2017.5), are not much connected, but export is connected to productivity.

In the sample of 63 documents selected from the databases, 16 articles study the variable related to firm performance. Most of them exhibit a positive relationship on firm performance, except for one that finds no clear relation (Guarascio and Tamagni, 2019). Analyzing the content of the articles' abstracts, it is observed that the variables used to estimate firm performance are productivity, profitability, profit, total factor productivity, employment, sales and young ventures growth. One interesting result to highlight is that half of them explore R&D as innovation measure, which is associated in my previous article results to the microfoundation with the highest impact on the innovation strategies. Apart from R&D, there is no other innovation input explicitly mentioned in the abstract, although ITC is also used as an explicative variable in Iandolo and Ferragina (2019).

There are only four articles that mention the relationship between persistence in innovation, exporting and firm growth. Two of them analyze that being a persistent innovator and exporter has better performance than any other. However, no conclusion about the characteristics of these relationships can be done to generalize because of the quantity of articles found in the sample. No factors seem to limit the positive relationship between persistence in innovation and firm growth. This result is supported by a variety of type of innovation and firm performance measure, with no difference between countries. Although, there are few studies of developing or underdeveloped countries.

Finally, the third paper analyzes the relationship between sales growth and persistence in innovation and exporting. I find that persistence in both strategies and only exporting are positively related to sales growth, which are the expected results. However, only innovating has not the expected result and is not significant.

In addition, comparing three measures that relate innovation and exporting to sales growth (the propensity and the intensity at t-1, and persistence up to t), I illustrate, with the different outcome, that they explain diverse things. The persistence variable represents the cumulative knowledge process of each strategy without discerning how much dependence the firm has on these strategies (in terms of percentages, as intensity). The results demonstrate cumulative knowledge effects of exporting that diverge from the incidence of a likely punctual exporting or an increase in the exporting intensity. Meanwhile, the intensity may be affected by diverse circumstances, as for example in exporting, better conditions in the domestic market that stimulate a decrease in exporting percentage of sales (Love and Máñez, 2019), without necessarily involving a decrease in growth, explaining a negative relationship between both variables. The same may happen with the propensity variables. These results are corroborated by the Haltinwagner growth index, but labor growth rate shows no relation to persistence in any of these strategies, in contradiction to Bianchini and Pellegrino (2019) findings for product and process innovation.

5.1.2 The conceptual map after findings

This dissertation contributes to the understanding of the relationship between a firm's capacities, its innovation and exporting activities, and firm growth. Based on the evolutionary theory that describes the relationships between innovation and firm growth and the dynamic capabilities statements about how firms' dynamic capabilities lead to firm performance improvement and competitive advantage, I incorporate some specificities to the explanation of these relationships, connecting and adjusting both models.

I broaden Teece's (2007) framework integrating Eisenhardt and Martin (2000) and Anand et al. (2009) concepts into microfoundations. The first one is related to product development routines and the second one is to the continuous improvement process. In this sense, I pretend to update the framework incorporating nowadays firms' practices to facilitate the operationalization of its concepts, which is the current debate in the DC approach. I also incorporate the DEC (dynamic exporting capacities) concept from Efrat et al. (2018) that links DC with exports through its innovativeness capacities. Additionally, as the DC approach relates the generation of capacities and capabilities to a sustainable competitive advantage, I match this theory with the evolutionary theory concepts of path dependence and the virtual circle between innovation and firm growth (Nelson and Winter, 1982). The enhancement of dynamic

capabilities assures a satisfactory innovation, contributing to the firm growth and the replication of the innovation practices and investments for its persistence. Emphasizing the relevance of the routines and strategies defined in the process to differentiate firm performance (Nelson, 1991).

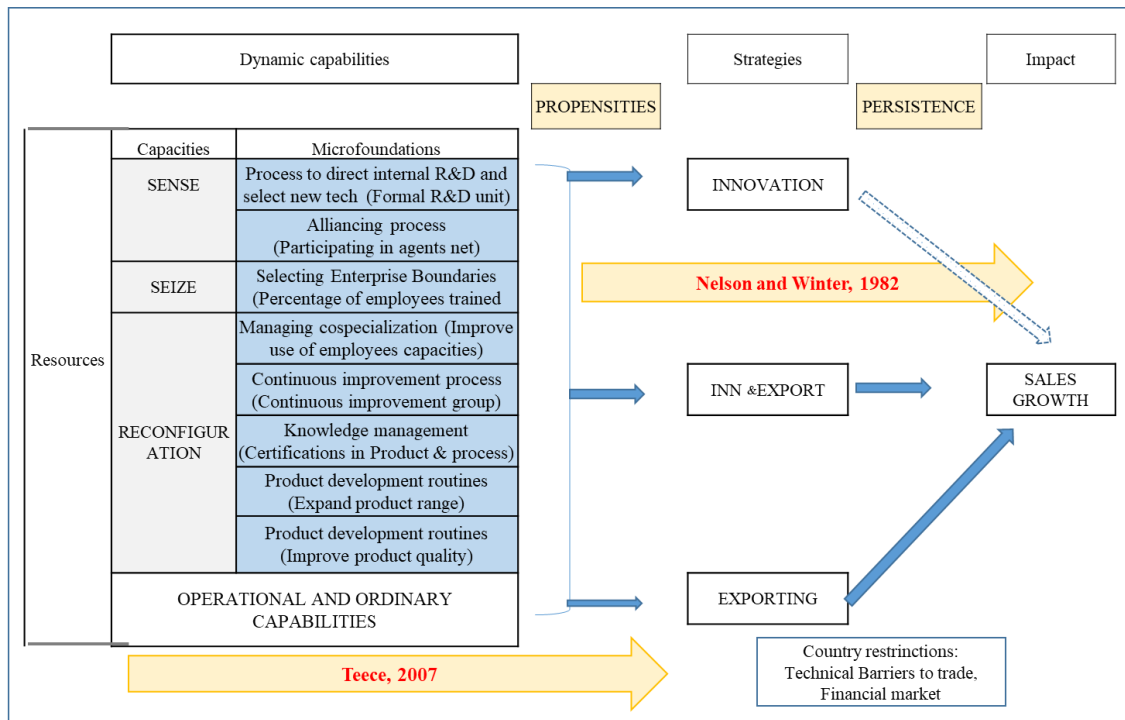
The conceptual map that is presented in the introduction, is reinterpreted in this section after the results demonstrate that not all the hypotheses are supported and some particularities of the context emerged. The first changes are related to the variables used in the analysis. In the definition of strategies, I introduce the innovation and exporting strategy. Then, I clarify which variable of the strategies are analyzed in each chapter, using the words propensity and persistence. I list each of the microfoundations used in the study and the explicative variables that represent them, associated with sensing, seizing, and reconfiguration capabilities. After that, I use sales growth instead of firm growth, nominating the variable used in this analysis as firm growth.

The second chapter studies the left side of the image, the analysis of the determinants of innovation and exporting propensities. In the two first columns, the dynamic capabilities are described: the higher-order capabilities that are associated with the microfoundations. All the relationships are positive. An arrow connects them to the propensities that they determine. As I explain previously, the development of dynamic capabilities made the strategies sustainable over time. The firm that generates a new microfoundation that is connected to any of the propensities, will increase the likelihood of these propensities.

The third chapter, focuses on the innovation persistence literature, analyzing the evolution of it and exploring the relationship between persistence in innovation and exporting in firm growth. The systematic literature review corroborates the positive relation between this variable and firm growth. However, the fourth chapter that analyzes the effect of the strategies' persistence in sales growth, the relationship with only innovating is not expected because the variable is not significant. Besides, the results of the estimations demonstrate that there are positive relationships between persistence in doing both strategies and sales growth and between persistence in only exporting and sales growth but weaker than the first one. These relationships are illustrated by a fuzzy arrow for the case of persistence innovation and darker arrows connecting the other variables. In these relationships, I assume that factors such as technical barriers to trade and financial market restrictions may operate limiting the development of the strategy and its link to growth.

Nevertheless, it is important to notice that the no relation between persistence in innovation and firm growth is a conclusion taken from the results of this sample. It may show a certain lag between the innovation period and its results in firm growth that are not perceived for the data studied.

Figure 5.1 - Conceptual map after findings



Source: Own elaboration.

5.2 Contributions and implications

5.2.1 Contributions

The results of this dissertation are academic input, but also useful for managers and policy makers. The most important contributions of this dissertation are five. First, it increases the understanding of the relationship between dynamic capabilities, persistence in innovation and exporting and sales growth, integrating the DC and evolutionary framework. Second, it operationalizes dynamic capabilities microfoundations (Teece, 2007) in terms of national survey variables, instead of surveys *ad hoc* or case studies, contributing to the standardization of DC measures (Kump et al., 2019). Third, methodologically, it proves the relevance of considering the combination of innovation and exporting strategies as four different choices because its determinants and effects depend on these diversity. Fourth, it demonstrates the importance of considering the persistence of these strategies to estimate their potential effects on firm growth, as this measure captures the cumulative knowledge process intrinsic

in their consequences, accomplished by the firm trajectory. Fifth, it increases the knowledge about persistence in innovation literature, especially about its temporal evolution and its relationships with exporting and firm performance. Sixth, the analysis of the Uruguayan sample (2010-2015), which is not much explored.

First, this dissertation links the development of dynamic capabilities with the generation of innovation and exporting activities and its effect on firm growth. It illustrates the relevance of routines in the development of dynamic capabilities to increase the propensity to innovate and export, and with their persistence, the effect on firm growth.

Second, in the effort to operationalize the dynamic capabilities, I find a clear connection between the classification of Teece (2007) microfoundations, the most frequently referred DC framework (Schilke et al., 2018), and the most used firm features to improve their performance. A conceptual contribution is the incorporation of new microfoundations to Teece (2007) framework incorporating Eisenhardt and Martin (2000) and Anand et al. (2009) concepts into microfoundations definitions. Specifically, product development routines and the continuous improvement process. In that sense, I try to demonstrate through a quantitative research method, the relevance of managers' decisions to increase innovation and export propensity.

Third, I elaborate three different estimations to prove the best model to estimate the propensities determinants (multinomial probit, bivariate probit and fixed effects models). The multinomial model has the biggest significant coefficients. These results suggest a better prediction of the propensity estimation of adopting different combinations of innovation and exporting strategies as correlated binary outcomes.

Fourth, considering the innovation effort in a wider concept and not only R&D classification, trying to create empirical evidence for exporting and innovating supporting policies evaluation, I relate sales growth to persistence in the three strategies options. In this sense, I analyze the cumulative incidence of these two activities together on firm sales growth. I compare the significance of different measures of these activities to relativize their effect on sales growth. The estimation of these variables with opposite significant sign coefficient suggests that each measure complements the understanding of the behavior of these variables and that the persistence in these strategies is the best measure to potentiate the effect on firm growth.

Fifth, the Systematic Literature Review (SLR), is an advance in exploring the literature about "innovation persistence". I illustrate the temporal evolution of scientific production in relation to the lines of research, authors, publications and citations. It encompasses more articles than its SLR antecedent (Arenas et al., 2020) and sheds some light in two lines of this topic research that was not analyzed in the previous review: the relation between persistence in innovation and firm performance and the relation between both variables and persistence in exporting. The findings of this SLR

demonstrate different areas related to persistent innovation that still are unexplored. The literature about the relationship between persistent innovation, exports and firm growth shows that the research is concentrated on some developed countries and R&D is mainly used to study productivity. In addition, for example, apart from R&D and ITC, there are no other measures of innovation effort considered by the studies.

Finally, the analysis shows some unexpected results. There are some relationships that are expected to be positive and significant but there are not. This is the case of the incidence of microfoundations on only exporting or only innovating propensities, or persistence in innovation on firm growth. From my point of view, the context influences the unexpected results. Some restrictions appear when the investment in innovation does not reflect an increase in sales growth. Sometimes because it takes more time than estimated to perceive the outcomes, other, because there are some technical barriers to trade that make the improvements fruitless to increase foreign sales. In some cases, they risk their performance in domestic the market, trusting superior percentage of production to foreign sales that generally offer a higher price, and the productions stay in the frontier without being sold.

Latin American context has different realities. In general, the financial market is not much developed, but there are cases as Brazil, Argentina, and México that have a dynamic stock exchange and big internal market. Peru and Colombia have recently developed their market to increase their propensity to innovate, attracting some foreign investment. In the case of Uruguay, a small country, it has a scarce development of stock exchange and a very limited domestic market. The development of firm performance necessarily goes through exports to niche markets of quality products or a particular input in a global value chain because its production costs are not competitive.

5.2.2 Policies implications

This analysis gives support to the application of innovation and exporting long term policies, which are an important issue to increase life expectancy, especially for new and small enterprises. Second, it demonstrates the routines that increase firm exporting and innovating propensities.

First, the results illustrate a positive relationship between persistence in innovations and exporting strategies with firm growth. Meanwhile negative signs are associated with these strategies considered in one time period, with the exception of innovation intensities. This demonstrates that the persistence in these strategies assure a positive result on firm performance, while the isolated action does not. This happens at least for the firms that do either both strategies or only export.

Second, based on the DC approach, I prove that the microfoundations have a positive and significant effect on exporting and innovating propensity. However, the results show that the most influential microfoundations are not the most developed by the firms of the sample even though there are policies

that promote them. This conclusion illustrates a necessity of reviewing the firm behavior but also the supporting policies. Why are the most influential microfoundations not the most developed by the firms? The answer will lead to a revision in the firm behavior and policies efficiency. Clear examples are the sensing capabilities associated with R&D and the seizing capabilities associated with selecting enterprise boundaries.

Processing to direct internal R&D and selecting new technologies is the most influential microfoundation to increase innovation and exporting propensity but as they are the least used in the sample, there is a space for policies and programs actions promoting the generation and formalization of R&D inside the firm. In addition, the second most influential microfoundation is selecting enterprise boundaries which is associated with the variable of employees training and it is the least used in the sample, although the number of programs that promote and finance them have increase, it seems to be that they have not been enough effective, so it calls for a revision of their characteristics and why it does not have more firms involved.

The third most influential variable for innovating and exporting propensity is expand product range, which has a positive impact in only exporting and only innovating. This variable, improve product quality and improve the use of employees capacities, have duplicated the percentage of firms that do them in in the second wave survey. The last ones are the most influential variable for only innovating strategy after R&D formal units. The influence of these changes may appear in the next wave survey's results.

5.2.3 Practical implication

This dissertation finds some results that may guide managers in their decisions to improve innovation and exporting effects on firm growth. It explores the dynamic capabilities that contribute to enhancing export and innovation propensity and find that to increase firm growth the firm have to persist in their strategies to be successful.

Persisting in both strategies or persisting in only exporting improves firm sales. Persisting in only innovating does not assure an increment in sales, at least in a short term period.

To be persistent in any of these strategies, the development of dynamic capabilities through their microfoundations increase their propensity. For example, having a formal unit of R&D, increase dynamic capabilities and have the highest influence to increase any strategy propensity (only exporting, only innovating or both) and with it, the likelihood to persist in it.

The increment of the percentage of employees trained, expand the range of products or improve the use of employees' capacities, have the highest effect to increase the innovation strategies propensities.

The certifications in product and process have the highest effect to increase the propensity to only exporting propensities.

5.3 Limitations and future research agenda

This dissertation has some limitations because of the information available. First, the limited data available in the sample. Second, the period of the two-wave survey used. And third, the information existing in the articles abstract to do a systematic review first approach, in some cases is not enough.

Further research may explore crossing explicative variables such as sectors with persistence in strategies, introducing other variables, expanding the period sample or through qualitative research, to have a deeply understanding of the firm behavior. Moreover, as it is explained above, the performance of the firms depends on the environment and capabilities that operate in each context, so, introducing more variables related to managers capabilities or institutional conditions (Suárez, 2014) in the database is expected to improve the regressions estimations and predictions.

For example, managerial capabilities may be explored to analyze if they influence on the effectiveness of the microfoundations of dynamic capabilities development. For example, most of the activities analyzed before require certain dynamic managerial capacities as: managerial cognition, managerial social capital, and managerial human capital (Helfat and Martin, 2014). For example, managerial social capital enhances the creation of alliancing.

Expanding the period sample may enable the use of other models or regressions as the Bundell and Bond (1998), Hurlin test or probitfe (Cruz-Gonzalez et al., 2017). For example, one limitation is that the performance effects of strategic choices may have some delay and the period used in this study may be too short to draw definitive conclusions about the effects. In that sense, SMEs with less financial resources have a disadvantage, since they may lack the financial muscle necessary to face an investment that they will only recover after a considerable amount of time (Wright et al., 2007). Additionally, as Guarascio and Tamagni (2019) defined, a database with more years available will reduce the joint determination between firm characteristics and persistent innovators and may increase the probability of breaking the endogeneity to measure innovation persistence and growth, in non-overlapping years.

In relation to the systematic literature review, as it pretends to be a first approach to unexplored lines of research, it was based mainly on the analysis of the abstracts of the articles. The limitations are that in some articles abstract important items are vague or are absent. In some cases, the information was found in Google scholar or the full text, but in other cases it was missing. After the information generated, deeper analysis about the persistence in innovation may be developed, as for example, associating theoretical model with estimations and results. Another future line of research may be a meta-analysis of the effects of persistence in innovation in firm growth.

The effects of persistence in innovation and exporting should be studied in more detail as promoting innovation is a recurrent policy in different governments' levels. Future research should investigate the specific difficulties to persist in both strategies for SMEs and how this affects its performance including also a qualitative point of view.

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A.2 Chapter 3- Systematic Literature Review - Persistence in innovation articles

N	Articles	Citations	Country	Data	Objective	Type innovation	Persistent innovation	Export	Growth measure
1	Geroski, Van Reenen and Malerba, 1997	169	UK	1945-1982	Firms that innovate typically do so persistently		Aim		
2	Orsenigo and Peretto, 1997	136	USA, Japan, Germany, UK, France	1978-1991	Patterns of technological change in different industries and countries	Patent	EV		
3	Malerba and Orsenigo, 1999	131	USA, Japan, Germany, UK, France and Italy	1978-1991	Patterns of technological entry and exit across sectors and over time	Patent	Characteristic		
4	Cefis and Orsenigo, 2001	184	UK		Persistence of innovative activities at the firm level in a comparative perspective		DV		
5	Cefis, 2003	120	UK		Firm innovative persistence using patent applications of 577 UK manufacturing firms.		DV		
6	Suzuki and Kodama, 2004	136	Japan		Intra-firm technology diversification and interactions between multiple technological trajectories in two Japanese firms	Patent			Sales growth
7	Cefis and Ciccarelli, 2005	95	UK		Effects of innovative activities on corporate profitability	N/D	Characteristic		Profitability
8	Cabagnols, 2006	3	French and UK		Impact of the accumulation of technological knowledge and the development of "learning to learn" on the ability to persist in innovation		DV		Profit
9	Florice and Dougherty, 2007	8	S/D		Developing a theoretical model of innovation dynamics	Technological	Characteristic		
10	Huang, 2008	8	S/D		Determine if firms innovation behavior is persistent.	Patent / R&D	aim		
11	Jang, Tsai and Chen, 2008	4	USA, Japan, South Korea	1990-2003	Firms' dynamic behaviours of patent persistence	Patent	DV		
12	Roper and Hewitt-Dundas, 2008	78	Ireland		The nature of the innovation process and innovation persistence	p&p	result		

N	Articles	Citations	Country	Data	Objective	Type innovation	Persistent innovation	Export	Growth measure
13	Martínez-Ros and Labeaga, 2009	78	Spain		Role of persistence in the decision of firms to implement and develop	P&P	EV		
14	Peters, 2009	140	S/D		Firms innovate persistently or discontinuously				
15	Andersson, Baltzopoulos, Antonelli, Crespi and Scellato, 2012	19	Sweden		How R&D strategies of incumbent firms affect the quantity and quality	R&D	Characteristic	Export	
16	Crespi and Scellato, 2012	66	Italy	1998-2006	Past and path dependent characteristics of persistence of innovation activities.	P&P/ R&D	DV		
17	Bartoloni, 2012	7	Italy	1996-2003	Dynamic interaction between innovation and profitability	Technological	DV		Profitability
18	Clausen <i>et al.</i> , 2012	74	Norway		Innovation strategies as driving force behind innovation persistence	R&D/ P&P	DV		
19	Frenz and Prevezer, 2012	7	UK		Link between technological regimes and persistence in innovation at the firm level	S/D	DV		
20	Antonelli, Crespi and Scellato, 2013	51	Italy	1996-2005	Determinants of the persistence of innovation activities	TFP	DV		
21	Clausen and Pohjola, 2013	20	S/D		Examine whether and to what extent breakthrough and incremental product innovation is persistent at the firm level	Product	Characteristic		
22	Baraldi, Cantabene and Perani, 2014	7	S/D		Further explanation of innovation persistence based on patents-R&D causality	Patent/ R&D	DV		
23	Bonaccorsi and Perani, 2014	5	Italy		Italian business R&D expenditure level, intensity, and persistence.	R&D	EV		
24	Deschryvere, 2014	42	Finland		Role persistence of innovation output plays in shaping the relationship between R&D investment	P&P	EV		Sales growth
25	Haned, Mothe and Nguyen-Thi, 2014	31	S/D		Pattern of technological innovation persistence and tests the potential impact of organizational innovation	P&P	DV		Productivity

N	Articles	Citations	Country	Data	Objective	Type innovation	Persistent innovation	Export	Growth measure
26	Hecker and Ganter, 2014	9	Germany	2002-2008	Persistence of product, process, and organizational innovations for a large sample of German firms	P&P, organizational	Result		
27	Bas and Poussing, 2014	21	Luxembourg Community	2004-2008	Influence of success in past innovation activities in the current innovation activities.	Technological / organizational	DV		
28	Le Bas and Scellato, 2014	25	S/D		Delineates theoretical frameworks assessing drivers and implications of innovation persistence		DV		
29	Lhuillery, 2014	15	France	2002-2008	The influence of marketing activities on innovation success and on persistent innovation success in high-tech industries	marketing / R&D			
30	Löf and Johansson, 2014	18	Sweden		Influence of metropolitan externalities on productivity for different types of long-run R&D	R&D	Result		Productivity
31	Matvejeva, 2014	4	Rusia		Determining the major factors supporting innovative persistence		DV		
32	Wu, Lee and Lin, 2014	5	S/D	1990-2004	Persistent innovation behavior under uncertainty				
33	Chassignon and Hamed, 2015	32	France		Forms of innovation leadership in increase the propensity to develop environmental innovations	environmental	Characteristic		
34	Le Bas, Mothe and Nguyen-Thi, 2015	27	Luxembourg Community	2004-2008	Determinants of technological innovation persistence and role of organizational innovation	Technological / organizational	DV		
35	Löf <i>et al.</i> , 2015	13	Sweden	12 year	Effect of exports, innovation and external knowledge on total factor productivity growth	R&D	Result	Export	TFP
36	Löf and Nabavi, 2015	1	Sweden		Role of innovation and localisation on the levels and growth of total factor productivity among exporting firms	R&D	Result	Export	TFP
37	Corradini, Battisti and Demirel, 2016	7	UK	1990 to 2006	Presence and importance of small firms amongst serial innovators	Patent	Characteristic		
38	Diéguez-Soto <i>et al.</i> , 2016	9	Spain	family firms	The effect of professional management on innovation in family-owned firms	P&P / management	Result		

N	Articles	Citations	Country	Data	Objective	Type innovation	Persistent innovation	Export	Growth measure
39	Fontana and Vezzulli, 2016	2	S/D		How technological leadership affects persistence in product innovation.	R&D	DV		
40	Hull, 2016	5	S/D		Financial product innovation in a model with two classes of agents: "sophisticated" and "unsophisticated."	Financial product	result		
41	Juliao-Rossi and Schmutzler, 2016	5	Colombia	2003-2008	Existence of true persistence in the generation and adoption of product innovations.	Product	result		
42	Bogliacino <i>et al.</i> , 2017	16	Italy	1998-2007	The virtuous circle between innovative inputs, outputs, and economic performance.	R&D, new products and profits	Characteristic		Profits
43	Chowhan, Pries and Mann, 2017	20	S/D		The relationship between human resource management practices and innovation outcomes.	technological	Characteristic		
44	Mothe and Nguyen-Thi, 2017	14	S/D		Open search that enhance firms' radical and incremental innovation with environmental effects (EI).	R&D			
45	Bartoloni and Baussola,	8	Italy	2000-2012	Impacts of a firm's innovative attitude on its productivity and profitability	Technological / organizational	EV		Productivity Profitability
46	Caloffi <i>et al.</i> , 2018	10	Italy		Subsidies to encourage persistent R&D investment and interorganizational networking	R&D	EV		
47	Li-Ying, Mothe and Nguyen, 2018	7	France		Driver-based EI types	R&D cooperation Technology			
48	Munelo-Gallo and Martínez,	2	Uruguay	2001-2009	Long-term relationship between research and development (R&D), innovations and productivity.	R&D/technological	Result		Productivity
49	Tavassoli and Karlsson, 2018	7	Sweden	2002-2012	Role of regional context on innovation persistency of firms.	Technological / organizational	DV		
50	Antonoli and Montesor, 2019	4	Italy	2005-2013	Extent to which firms' innovation persists in "times of crisis."	ICT	DV		

N	Articles	Citations	Country	Data	Objective	Type innovation	Persistent innovation	Export	Growth measure
51	Baum, Lööf and Nabavi, 2019	2	Sweden		Capability to recombine internal and local knowledge and the total productivity growth outcome	Patent/R&D	Characteristic		TPg
52	Bianchini and Pellegrino, 2019	8	Spain	20 year	Effect of persistence in product and process innovations on the employment dynamics	P&P	EV		Labor growth
53	Guarascio and Tamagni, 2019	15	Spain	1990-2012	Long-run contribution of innovation persistence to sales growth and market share dynamics	R&D, patent, P&P	Characteristic		Sales growth
54	Iandolo and Ferragina, 2019	2	Italy	1998-2006	Effect of persistency in innovation and export on firms' total factor productivity	R&D	Characteristic	Export	TFP
55	Juliao-Rossi, Schmutzler and Forero-Costa, 2020	2	Colombia	2003-2008	Impact of the dominant theoretical explanations have on innovation persistence	Product	DV	character	
56	Teixeira and Botelho, 2020	2	Portugal	2004-2010	The innovative strategy and the firm attitudes towards persistence	S/D	Result		
57	Del Carpio Gallegos, Durand and Gomez, 2020	0	Perú		Firms absorptive capacity to achieve technological innovation persistence	P&P /R&D	Result		
58	Nazir, Tan and Nazir, 2020	0	Mainland China, Hong	2006-2016	Relationship between intellectual capital and performance	N/D			Profitability
59	Peng, Tan and Zhang, 2020	1	China	2009-2017	Impact of human capital on innovation investment persistence	Patent			
60	Whittaker, Fath and Fiedler, 2020	0	New Zealand		Effects of the number of perceived serious competitors on venture growth	N/D			Young venture growth
61	Li and Wang, 2021	0	China		Impact of public concerns on green innovation	green inn	Characteristic		
62	Long, 2021	3	Vietnam	2005-2013	Innovation persistence in small firms	P&P	Result		
63	Nam and Bao Tram, 2021	3	Vietnam	2007-2015	Effects of business environment on the persistence of innovation of the SMEs		DV		

A3 Chapter 4 Correlation matrix Firm growth

1	Variable	1	2	3	4	5	6	7	8	9	10	11
1	Sales growth	1.0000										
2	Labor growth	0.2240	1.0000									
3	Haltinwagner growth	0.7268	0.2102	1.0000								
4	Size	0.0463	0.1462	0.0412	1.0000							
5	Age	-0.0424	-0.0249	-0.0463	0.2634	1.0000						
6	Productivity	0.1797	0.0130	0.0968	0.0044	0.1730	1.0000					
7	Foreign capital	-0.0092	0.0187	-0.0020	0.2049	-0.0064	0.2706	1.0000				
8	Agroindustrial sec.	-0.0236	-0.0337	-0.0274	0.0485	0.1194	0.0796	0.0009	1.0000			
9	Chemistry ind.	-0.0005	-0.0014	0.0071	0.0003	0.1352	0.1486	0.0907	-0.1198	1.0000		
10	Technology sec.	-0.0164	-0.0222	-0.0161	-0.0662	-0.0117	0.0588	0.0196	-0.1064	-0.0468	1.0000	
11	Year 2012	0.0285	0.0311	-0.0397	0.0502	0.0291	-0.0148	0.0075	0.0373	0.0243	-0.0081	1.0000
12	Year 2015	-0.0381	-0.0398	-0.0199	-0.0420	-0.0183	0.0128	-0.0017	-0.0331	-0.0197	0.0058	-0.3250
13	Both strategies t-1	0.0194	0.0266	0.0129	0.2063	0.1254	0.1833	0.1863	0.1161	0.1534	0.0294	0.0113
14	Only innovate t-1	0.0146	0.0156	0.0168	0.1586	0.0610	0.0117	-0.0522	-0.0666	-0.0163	0.0136	-0.0449
15	Only export t-1	-0.0314	-0.0115	-0.0311	0.0730	0.0235	0.1616	0.1832	0.1243	0.0355	0.0216	0.0314
16	Export intensity	-0.0059	0.0195	-0.0162	0.1485	0.0008	0.2249	0.3271	0.1816	0.0719	0.0431	-0.0011
17	Knowledge int	0.0299	0.0088	0.0327	0.0184	-0.0281	-0.0633	0.0497	-0.0210	-0.0030	0.0824	0.0022
18	Technology int	0.0768	0.0157	0.0457	0.0261	-0.0177	-0.0109	0.0308	0.0031	0.0022	0.0272	-0.0180
19	Prep.Produc. Int.	0.0389	-0.0051	0.0292	-0.0059	-0.0250	-0.0660	0.0083	0.0080	0.0006	0.0337	-0.0070
20	Persistence in both	-0.0069	0.0162	-0.0206	0.1883	0.1496	0.1499	0.1414	0.1071	0.1242	0.0090	0.0925
21	Persistence only innovate	-0.0021	0.0230	-0.0053	0.1908	0.0789	-0.0044	-0.0312	-0.0258	0.0085	0.0182	0.1087
22	Persistence only export	-0.0195	-0.0155	-0.0334	0.0575	0.0295	0.0981	0.1224	0.0952	0.0456	0.0202	0.1928
11	Variable	12	13	14	15	16	17	18	19	20	21	22
11	Year 2012											
12	Year 2015	1.0000										
13	Both strategies t-1	-0.0172	1.0000									
14	Only innovate t-1	0.0401	-0.1828	1.0000								
15	Only export t-1	-0.0226	-0.1329	-0.1977	1.0000							
16	Export intensity	-0.0067	0.4078	-0.2118	0.5531	1.0000						
17	Knowledge int	-0.0016	0.0882	0.0176	-0.0195	0.0195	1.0000					
18	Technology int	0.0040	0.0978	0.0847	-0.0395	0.0272	0.4123	1.0000				
19	Prep.Produc. Int.	-0.0064	0.0473	0.0421	-0.0180	0.0354	0.1031	0.0373	1.0000			
20	Persistence in both	-0.0768	0.6838	-0.1250	-0.0909	0.2734	0.0145	0.0186	0.0067	1.0000		
21	Persistence only innovate	-0.0852	-0.0944	0.5166	-0.1022	-0.1094	0.0250	0.0439	0.0522	-0.0646	1.0000	
22	Persistence only export	-0.0392	-0.0798	-0.1188	0.6006	0.3557	-0.0117	-0.0256	-0.0108	-0.0546	-0.0614	1.0000