ICT and FDI: Are they neglected determinants of Entrepreneurship?

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Abstract:
This paper investigates whether the Foreign Direct Investment (FDI) had a significant economic impact on the one of the most important technological drivers: the Information and Communication Technologies (ICT); which may catalyze the interrelated processes of entrepreneurship and technological change. The main idea that is proposed in this paper is that the inward FDI combined with the investment in ICT impacts on entrepreneurial activity. The Cointegrated Vector Autoregressive Approach provides important insights about the ‘pull’ of ICT and the ‘push’ of FDI, under a feedback causality context. On the one hand, the ICT pulls for more inward FDI, and on the other hand, the FDI ‘pushes’ the investment in ICT. Under a neo-Schumpeterian approach, the triple-mix among Entrepreneurship, Service FDI, and ICT, is an important driver of creative destruction through the creation of further services SMEs, which assures the ‘refreshment’ of the entrepreneurial innovative capability of the nations.

Key-Words: Entrepreneurship, FDI, ICT, Technological Change.


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1. Introduction

The analysis of foreign sector activities has been an important issue throughout the last century and the beginning of the 21st century. Many studies of factor mobility refer to 1950-60s when the cross-border capital movements were largely regulated by government. Stimulated by massive capital flows observed in 1990s, the examination of the linkages between international capital movements and international trade remains a topic issue of international economics and international business.

The reinforcement of entrepreneurship through inward Foreign Direct Investment (FDI) is considered a strategic action for promoting benefits to the remaining entrepreneurial units that are networked to multinational enterprises. At the economic level, the spillover effect intensifies the competition, the innovative capability, and the Research and Development (R&D) intensity. At the social level, it enhances knowledge spillovers, and also contributes for the reduction of social exclusion (Parker, 2006).

In what concerns to Information and Communication Technologies (ICT), the regulation actions that are oriented to the investment in communication networks have had substantial impacts on economic performance and the success of individual firms (OECD, 2004).

The relevance of ICT is due to the fact that many services process and diffuse information in abundance, such as the financial services and the telecommunications sector. So advances in ICT that allow more information to be codified and transferred, and the increasing move into knowledge technologies have expanded the scope for ICT use in many services (Pilat, 2001).

The weak evidence on positive effects of Multinational Companies (MNCs) on entrepreneurial activity might hide a significant impact of MNC’s on industrial reorganization. The theoretical proposal of Schumpeter (1934) of replacing inefficient firms by other more efficient, is still an open question, that justifies further research, especially in what concerns the framework of technological change that embraces the triple-mix among the Entrepreneurship (here measured through the Business Ownership Rate), the inward FDI (as a proxy for measuring the investment effort of MNCs) and the ICT (as the technological catalyst of economic growth).

Under a technologist approach, this paper addresses that open question aiming to contribute for our understanding on the economic impact of FDI on one of the most important technological drivers: the ICT; which may catalyze the interrelated processes of entrepreneurship and technological change.

In this sense, a Cointegrated Vector Autoregressive (CVAR) approach is developed, aiming to provide a dynamic analysis about the experience effects that result from the adoption of public policies oriented to FDI
and ICT, on the performance of two European countries, with different technological profiles: Finland and Portugal.

The paper contributes to the literature of entrepreneurship and technological change by: (i) analysing two dynamic drivers of Entrepreneurship: inward FDI and ICT, (ii) evaluating the causality relationships that are established among two neglected determinants of entrepreneurship: the inward FDI and the ICT; and a set of selected economic variables used in the relevant literature (Business Ownership Rate, Gross Domestic Product and Unemployment), and (iii) providing an innovative comparison approach between two European countries, with different technological profiles: Finland (high-tech producer) and Portugal (low-tech producer, but fast adopter of high-tech).

This study focuses on how FDI combined with ICT impacts on the entrepreneurial activity, using a comparison approach between Finland and Portugal. This paper is organized in five sections. Following the introduction, in the second section a literature review is made, for motivating the need for linking the FDI ‘push’ and the ICT ‘pull’, in the context of public policies for entrepreneurship. The section continues with a discussion about the FDI, as an investment ‘push’, and it ends with the presentation of ICT, as a technological catalyst. The third section presents the econometric methodology used in this paper, and the prior research in two distinct but interrelated frameworks: FDI and ICT. It continues with the data and method description, the initial model specification, the study of the integration order and it ends with the estimation process of the CVAR model. The fourth section presents the empirical findings and discusses the main results, in terms of bidirectional (e.g. feedback) causalities and unidirectional causalities. The fifth section ends with concluding remarks and public policy implication from the research, and guidelines for future researches.

2. Literature Review

2.1. Public Policies for Entrepreneurship: Linking FDI and ICT

One of the core questions in entrepreneurship literature is how do public policies foster the economic development and the technological change.

According to Baumol (1968: p.69), the public policies should be reversed with the objective to «induce the appearance of increased supplies of entrepreneurial skills», and the policy-maker should be «interested primarily in what determines the supply of entrepreneurship and in the means that can be used to expand it».

The theoretical model proposed by Baumol (1990) about the determinants of the ‘allocation’ of entrepreneurship, show that the regulatory framework play an important role in the determination of the
success of entrepreneurship, that is, if it will be a productive or an unproductive driver of the national productivity growth.

A related question, that is, how public policies vary according to the level of economic development, has been widely explored in the economics literature, under different approaches: (a) economic development (Lucas, 1993), (b) regional science (Acs and Storey, 2004), and (c) entrepreneurship (Acs, 2006; Acs and Szerb, 2006).

The reference empirical studies on economics of entrepreneurship of Van Stel et al. (2005), Wennekers et al. (2005) and Acs and Varga (2005), revealed that, on the one hand, for highly developed economies, entrepreneurship has a positive effect on economic growth, and on the other hand, it has a negative effect, in developing economies.

Lundstrom and Stevenson (2005) state that public policies for fostering entrepreneurship embrace the measures that aim to directly influence the entrepreneurial activity and the social and economic consequences of that kind of regulation.

In the vision of Acs et al. (2006), the differentiating factor of an entrepreneurial economy is the way how entrepreneurs are used to facilitate knowledge spillovers. This kind of spillovers and the knowledge commercialization can be pre-empted through the ‘knowledge filter’ (Audretsch and Stephan, 1999; Audretsch and Lehmann, 2005).

Acs and Armington (2006) and Audretsch et al. (2006) showed that entrepreneurship promotes economic growth, by making use of the ‘knowledge’ filter and by making possible the commercialization of ideas.

This is particularly important for policy makers, because if they really want to promote entrepreneurship through the implementation of public policies, they should take into account the Kauffman framework, which recommends regulatory actions in three areas: (i) trade, (ii) immigration, and (iii) technology and foreign policy (Acs and Szerb, 2006).

In what concerns the trade, artificial barriers that impede the movement of goods, services, capital and ideas across international boundaries should be removed (Brainard et al., 2005).

The immigration area is a strategic one, since there is a need for further education of potential immigrants that may promote ethnic entrepreneurship and different combinations that lead to the reinforcement of a new innovative entrepreneurial culture (Acs and Szerb, 2006).

The technology and foreign policy should be oriented to the commercial application of continued improvements in technology. In this sense, the awareness of foreign technologies should be, actively, promoted by governments (Brezneitz, 2007).

In the framework of economic policy development, the attraction of inward FDI plays an important role, since MNCs impact indigenous entrepreneurial activity (Acs et al., 2006).
In the literature, until now, there is no answer to the research question that we address in the present paper, that is, how FDI impacts on other kind of public investments (for example, in ICT) that may promote a faster diffusion of the precedent invention and innovation through the promotion of Entrepreneurship, along the dynamic process of technological change?

2.2. FDI: The Investment ‘Push’

The Foreign Direct Investment (FDI) is related to the investment made to acquire a lasting interest in a firm operating in an economy other than that of the investor. The basic purpose is to participate in the management of firm located abroad (IMF, 1977).

A significant impact is possible when the foreign investor holds a share of at least 10 per cent of the nominal capital (IMF, 1993). From here it results that FDI can be distinguished from portfolio investment, in the sense that foreign strong investors have a stronger commitment in relation to the host economy.

FDI is operated by MNCs, through the creation of foreign subsidiaries, which are defined by OECD (1999) as firms in which more than 50% of the voting shares are owned by another company abroad, that is called the ‘parent economy’.

The FDI is a long term oriented investment abroad with the main objective, from the part of the investor, to gain a significant impact on the decision making process of the firm (Krugman and Obstfeld, 2000).

There are many scientific researches about the relationship between FDI and different macroeconomic parameters of a specific country’s economy. There is an established approach that points out that the greater is the ratio of FDI to country’s GDP, the larger will be the total private domestic investment (Brenton, 1999).

Mundell (1957) raised the relationship between FDI and trade, in the ambit of the classical theory of international trade. Within the framework of the Heckscher-Ohlin theory of trade, Mundell demonstrated that international trade in products and international capital movements are substitutes. His conclusion was that trade impediments stimulate factor movements and, correspondingly, that increased impediments to factor movements stimulate trade.

Goldberg and Klein (1999) use the Heckscher-Ohlin-Samuelson model to explain the substitutability of international trade and factor mobility. The main results reveal that trade restrictions pull for further FDI (Brainard, 1997) and thus, in a certain sense, FDI is considered as a substitute for trade.

The theoretical analysis of FDI draws out the advantageous conditions that can outweigh the inherent disadvantages of foreign production. These disadvantages are the additional costs of being present in the country. They include communication costs, the reallocation of the personal abroad, the resources used in overcoming language barriers and the costs of «being outside the business and government framework» (Markusen, 1995: p.173).
The literature on the frameworks about international economics and international business is concerned about the decision making process that leads to the internationalization of firm. In this context, the works of Vernon (1966) and Knickerbocker (1973) deserve a special mention. The first proposed that the decision about the location of the production units changes with the maturity of the product life cycle. The second suggested that in oligopolistic markets MNCs use the internalisation, as a strategic reaction mechanism.

These works are two cornerstones, which initially did not constitute a theory of the internationalization of firm, but as the literature started to strongly highlight the works of Coase (1937) and Hymer (1976), everything has changed.

According to Coase (1937), the transaction costs approach states that a firm exists when the cost for operating the market exceed the cost of internalisation of establishing a firm hierarchy. This way, in an internationalization context, MNCs may have advantages in internalising externalities that are originated from market failures, such as risk and uncertainty related to market transaction mechanisms.

Williamson (1971) presents the internationalization as an organizational and strategic process that leads the firm to the vertical integration. The implementation of a vertical integration strategy based on the hierarchical organization of the market, in an internationalization context, results from several market failures: (i) the monopolistic supply in static markets, (ii) the incomplete contracts, caused by changes at the product level, (iii) the problems associated both with ex ante and ex post incomplete contracts, (iv) the barriers to entry (for example, price discrimination or high research and development or advertising intensity), (v) the effects of information processing (e.g. lack of information, information economies and effects of expectations), and (vi) the institutional adaptation, simply economic or extra-economic (expressed by risk aversion).

Hymer (1976) argues that MNCs invest abroad for accomplishing two basic purposes, that is, to reduce competition, and to increase barriers to entry, through the establishment of collusive networks.

Dunning (1977, 1981) argues that the internalization approach is not enough to explain the level, the structure and the location of all international production. Through the development of an ‘Eclectic Paradigm’, Dunning identifies three necessary conditions that should be met, before a firm engaging in FDI: Ownership, Location and Internalization. First, the firm must posses some form of ownership advantages, such as product, production process, technology, brand image or other intangible assets, which allow the firm to operate international markets. Second, the host economy must offer some location advantages, such as customer access, lower taxes and wages, or tariff avoidance, implying that production in more than one country is efficient. Third, the investor has to be able to internalize the benefits to the host economy derived from his property knowledge.

According to Porter (1980), the internationalization process that is based on vertical integration, corresponds to the companies’ decision on using internal or administrative transactions, instead of using
market transactions to reach their economic goals. This way, MNCs must hold some firm-specific advantage, since they face higher cost abroad, during the internationalization process, compared to local domestic firms. This kind of firm-specific advantage is related to superior technology, brand image, innovative capability, intangible assets, and also cost advantages associated both with scale economies.

In this sense, the implementation of public policies oriented to internationalization and competitiveness, were proposed to the governments, taking into consideration a micro unit of analysis, that is, the firm (Porter, 1980, 1985, 1998, 2006; Northdurft and Grossman, 1996).

In this context, Raposo (1994), Holm et al. (1996), Ahokangas (1998), Coviello and McAuley (1999), Anderson (2000), and Tornroos (2002) defend the importance of networking MNCs and Small and Medium Enterprises (SMEs), through the development of cooperative and interdependent relationships, in an internationalization context.

The concept of network, under an internationalization approach, was, firstly, introduced by Porter and Fuller (1986), but it has been expanded by Thorelli (1986), Campi (1989), Raposo (1994), Coviello and Munro (1997), Ahokongas (1998) that reveal the importance of connecting FDI and Entrepreneurship, especially by promoting the creative and innovative nature of SMEs.

This is quite important since the SMEs present a dimension that provides the design and the execution of more flexible production processes, and that is constantly promoting the technological change, which is a kind of subsistence entrepreneurship that may be ‘pushed’ by the FDI promoted by MNCs.

FDI is also associated with technology transfer and knowledge spillovers, that may be transferred in several ways, such as, product and process technology, management practices and expertise (Findlay, 1978; Dyker, 1999), information about access to foreign countries (Rasiah, 1995) and intensified competition (Blomström and Kokko, 1997; Markusen and Venables, 1997).

The economic activity of a foreign investor will help to accelerate technological development in the host economy to some degree (Hunya, 2000; Lim, 2001; Dyker and Stolberg, 2003; Barbosa and Eiriz, 2007).

2.3. ICT: The Technological Catalyst

Since the industrial revolution in the 19th Century, ICT are the key driver for the innovation and growth, especially in services industries that are interrelated with manufacturing industries that operate international markets. The non-technological innovations (for example, organizational and strategic process that lead firms to vertical integration, in an internationalization framework), and technological innovations (such as ICT), have been widely used, in separate frameworks, to better understand the dynamics of economic growth and technological change.
By making use of several reference studies of the neo-Schumpeterian literature, namely, Gershuny and Miles (1983), Barras (1990), Evangelista (2000) and Miles (2005), we consider ICT as a technological catalyst, which promotes the economic growth through a dynamic process of creative destruction based on technological innovations.

During the last century, the services industries played an important role, in what concerns the introduction of technological innovations. As a consequence of this change, several economists focused their researches on the framework of technological change (Barras, 1986; Andersen et al., 2000; Metcafe and Miles, 2000; Devezas, 2005).

In the 90s, major research projects on service innovation were launched, and services started to be included in R&D and Innovation Surveys (Miles, 2000).

In the last decade, the emergence of the ‘Service Economy’ was observed. This could be related to the rise of the ‘Digital Economy’ (Tapscott, 1996) and to the increasing innovation intensity in services (Castells, 1998). Therefore, ICT could be regarded as the most important technology for service innovation which has consequently resulted in better economic performance of the service industry (Licht et al., 1999).

Fuchs (1968), Gershuny (1978), Stanback (1979), and Gershuny and Miles (1983), on the one hand, point out that most services are becoming an important component, both on national and regional innovation systems, and on the other hand, innovation in services is considered an important determinant of services industries’ competitiveness.

The ICT form a technological platform, where innovation in services may be designed and implemented. Thus, the ICT are a major technological driver which has reduced the productivity gap between the services industries and the manufacturing industry (Barras, 1986; OECD, 1996).

The services are considered as adopters of new technologies, especially ICT, which are the main enabler of their increasing contribution for the national economic growth (OECD, 2000).

There is a growing literature about technological innovation in services that is grouped in three approaches (Gallouj, 2002): (i) Technologist (in which is stated that the introduction and diffusion of ICT may improve the productivity and the economic performance); (ii) Service oriented (which advocates that innovation in manufacturing and service industries are, substantially, different); and (iii) Integrative (that explores the boundaries between goods and services, and try to fill up the gap between them).

In the present paper we follow a technologist approach, in the sense that ICT promotes the economic growth but it also function as a technological catalyst that ‘pulls’ further non technological innovations associated with the FDI. Although other factors are also essential for fostering entrepreneurship, in this paper we argue that this reliance can also be placed on the dynamic capabilities to catch up the waves of technological change that may be regulated through the adoption of public policies oriented to the investment in ICT and to inward FDI.
3. Econometric Methodology

3.1. Empirical Evidence

In this item we made a review of the prior empirical research, by establishing an innovative bridge between two frameworks: (i) the traditional FDI, and (ii) the more recent ICT. The first framework is concerned with the relationships established among FDI, trade, economic development and Entrepreneurship. The second deals with the impact of the technological driver ICT on economic growth, employment and productivity.

3.1.1. FDI Framework

Meier (1995) defends that institutional environment induces FDI. The development and growth of institutions, which include such factors like information, property rights and laws transparency, cultural base, is the precondition for the efficient functioning of a market economy.

According to North (1994), institutions, the formal and informal constraints for economic agents in the economy, form the incentive structure in society. The rise in the culture of entrepreneurship to a large extent depends on the foreign sector. Both FDI and foreign trade have the highly valuable learning effect on the host economies. The non technological factors such as the new organizational methods and business management methods are critical for realizing the entrepreneurship potential of the host economies. In this regard, the analysis of country’s external sector is highly important for entrepreneurship and growth oriented public policies’ measures.

Fontagné and Pajot (1997) made an empirical research on developed countries: France, Sweden and the US, where it was revealed the complementarities between trade and inward FDI. In case of France and the US, outward FDI is found to be a complement for export, but substitute for import. They also emphasize the positive impact of FDI on competitiveness at the recipient country market.

Inaba (1999) analyzed the effect of FDI on the Japanese balance of payments. The results revealed that, on the one hand, FDI did not necessarily contribute to reducing the huge Japanese trade surplus, and on the other hand, the worldwide structural changes may have had a great impact on the trade balance.

Somwaru and Bolling (1999) investigate whether FDI and trade are substitutes or compliments for the case of food processing industry of the USA. They show that the relation between FDI and trade depends on the «stage of similarities of economic development of the host countries as macroeconomic factors – such as
exchange rate fluctuations and income growth – act differently in developing vs. developed countries and exporting vs. importing countries» (Somwaru and Bolling, 1999: p.8).

Ericsson and Irandoust (2001) used a Vector Autoregressive (VAR) model, in order to detect the relationship between FDI and economic growth, in Denmark, Finland, Sweden and Norway, by making use of the forecasting techniques: Variance Decomposition of Cholesky and Impulse Response Functions. The authors pointed out the existence of a feedback relationship in Sweden and a unidirectional relationship in Norway. For the remaining countries, no causality relationships were detected. The results were justified through the existence of a larger number of MNCs, in Denmark and Finland, especially, in services industries. For its turn, the multinationals installed in Sweden and Norway, developed, fundamentally, industrial activities.

In the framework of FDI determinants, several authors tested the existence of cointegrating and causality relationships, in emergent economies: Fiji Islands (Jayaraman and Choong, 2004); China (Zhang et al., 2004); Pakistan (Ahmad et al., 2004); and in developing economies (Nonnenberg and Mendonça, 2004), as for example, in Brazil (Seabra and Flach, 2005), and in Chile, Malaysia and Thailand (Chowdhury and Mavrotas, 2005). All provided significant empirical evidence about the existence of both unidirectional and feedback relationships between the FDI and the economic growth.

De Backer and Sleuwaegen (2003) studied the relationship between FDI and domestic Entrepreneurship, and their findings are in line with theoretical occupational choice models that predict FDI would crowd out domestic entrepreneurs through their selection in product and labor markets. Nevertheless, empirical results also suggest that the referred crowding effect may be moderated or even reversed in the long run due to the long term positive effects of FDI on domestic entrepreneurship as a result of experience, learning, demonstration and networking effects between foreign and domestic firms.

Gani and Sharma (2003) use a sample of technologically advanced countries that was selected taking into consideration the Technological Achievement Index (TAI), for the period 1994-1998. A fixed effects model provide evidence that technology diffusion of new instruments of ICT, such as mobile phones and Internet hosts are, are major pull factors of FDI. The results also provide evidence for ratifying the existence of several determinants of FDI, namely, robust economic environment, low unit cost and high degree of openness.

Chang (2005) analyze dynamic relationships among FDI, economic growth, unemployment and trade in Taiwan, by making use of a Cointegrated Vector Autoregressive (CVAR) approach. The results pointed out that both economic growth and exports have positive impacts on inward FDI, whereas the expansion of exports impacts negatively on outward FDI. Other significant empirical finding pointed out that there is no relationship between inward FDI and unemployment. Additionally, a positive relationship exists between economic growth and exports, and a negative one exists between unemployment and economic growth.
Barbosa and Eiriz (2007), by using firm-level panel data for the Portuguese manufacturing and service industries, for the period 1986 – 2000, analyzed the conditions whether FDI had a positive impact on entrepreneurial activity, by using as measure the net creation of firms. The analysis does not confirm that there is a *U-shaped* relationship between FDI and entrepreneurship, either in manufacturing or service industries. The authors only find support for a *U-shaped* relationship in the high-tech industries and large firms. Although the main results provide some doubts about the real effect of FDI on entrepreneurship, the authors reveal that the impact of first foreign investment is, in general, positive but the marginal impacts of additional investments appears to be negative.

One of the limitations revealed by Barbosa and Eiriz (2007) constitutes an important guideline for the present research, that is, the weak evidence on positive effects of MNC’s on entrepreneurial activity might hide a relevant impact of MNC’s on industrial reorganization. In this context, the Schumpeterian mechanism for replacing inefficient firms by other more efficient, is still an open question, that justifies further research, especially in what concerns the so far neglected triple-mix of Entrepreneurship, inward FDI and ICT.

3.1.2. ICT Framework

One of the strongest evidences for the impact of ICT has been illustrated as coming from the firm-level analysis in developed countries (OECD, 2003). Most of these studies use a combination of growth accounting methods and econometric models to examine samples of industries and firms.

Recent works by the OECD (2001, 2003, 2004, 2005) also substantiate ICT as one of the key-drivers of the rapid growth for economies, and the service industry as the main consumer of ICT. Empirical evidence from these studies also underscores the relationship between the growing economic importance of ICT and the demand for ICT-intensive services, which is seen as one of the drivers of the increasing weight of services in the economy.

According to Vu (2004), during the 90s the ICT contributed, in a remarkable way, to the output growth in several economies. For example, the US labor productivity revived with a significant acceleration during the period 1995-2000, and ICT capital input accounted for more than one fifth of Gross Domestic Product (GDP) growth throughout the last decade of the 20th century (Jorgenson and Stiroh, 2000; CEA, 2001; Oliner and Sichel, 2001). The impact of ICT on growth was also significant in Australia (Parham et al., 2001), Canada (Armstrong et al., 2002), Korea (Kim, 2002), United Kingdom (Oulton, 2002), the Netherlands (Van der Wiel, 2001) and Finland (Jalava and Pohjola, 2001).

Antonelli (1998) analyzed the co-evolution of ICT and the knowledge intensive industries. The results revealed that ICT affects the actual conditions of information, in terms of its basic characteristics of
appropriation and tradability, by favoring the role of business services as forces of interaction amongst knowledge components in the generation of new technologies.

Gretton et al. (2002), studying firm-level data from the Australian Business Longitudinal Survey, found positive and significant links between the use of ICT and growth in both manufacturing and service industry.

Brynjolfsson and Hitt (2003), investigating US firm-level data, proved that ICT has a solid impact on productivity. Pilat and Wolfl (2004) examined the role of ICT producer and key ICT-consumer sectors in explaining overall productivity growth in OECD countries; they found that the impact of ICT-producer sectors is most significant in Finland, Ireland, and Korea whereas ICT-consumer sectors in some countries, remarkably US and Australia, had an impressive growth in the second half of the 90s.

Hempell et al. (2004) analyzed comparable panel data of the Dutch and German firms in the service industry and found that ICT capital deepening and innovation have complementary impact on productivity.

More recently, Leitão and Ferreira (2008) analyzed the impact of the liberalisation of European Telecommunications Markets, on the Business Ownership Rate, the Employment, the Gross Domestic Product, and the Investment in ICT, in two European countries: Germany and Portugal. A dynamic analysis performed through the development of a Cointegrated Vector Autoregressive (CVAR) revealed, in the case of Germany, a surprising causality relationship, in the sense that Gross Domestic Product precedes decreasing Business Ownership Rates, whereas, in the case of Portugal, the Business Ownership Rate pulls for additional investments in ICT. Besides, a creative entrepreneurial destruction is somehow ratified, since the Business Ownership Rate impacts, negatively, on the level of employment.

The aggregate-level approach applied in this paper aspires to add to the studies of Thurik and Grilo (2005), Carree and Thurik (2006), Baptista and Thurik (2007), Barbosa and Eiriz (2007), Freytag and Thurik (2007), and Leitão and Ferreira (2008), the evidence regarding the analysis of the impact of public policies oriented to FDI and ICT on entrepreneurship, economic growth and unemployment rates of two developed countries that present very different technological profiles and trajectories.

Prior researches illustrated above highlights evidences which suggest that FDI and ICT might have a vital role in supporting growth and performance of all sectors, including manufacturing and service. So far, in the literature, research about the combination of public policies oriented to FDI and ICT is inexistent, especially, using a comparison approach between an high-tech country (e.g. Finland), and a low-tech country (e.g. Portugal). Emphasis is placed on the analysis of the experience effects in both countries, in consequence of inward FDI (that is, the non-technological factor associated with internationalization of companies) and investment in ICT (that is, the technological catalyst).

The question as to what extent FDI and ICT play a role in explaining the entrepreneurship, the economic growth and the level of unemployment needs still needs an answer, especially through empirical evidence based on cross-country comparison approaches.
3.2. Data and Method Description

Three databases are used: the COMPENDIA 2002; the UNCTAD 2005; and the ITU World Telecommunications Indicators 2006, in the period from 1976 until 2002. From the first database, information about Business Ownership Rate (BOR), Gross Domestic Product (GDP) and Unemployment (UNEMP) is collected. The information related to inward Foreign Direct Investment (FDI) is collected from the second database. The investment in Information and Communication Technologies (IICT) is collected from the third database. The variables are used in a CVAR approach, which provides the possibility of accomplishing longitudinal case studies and developing a dynamic analysis.

Therefore, it provides the identification of different types of impacts that are originated by the variables considered in the selected model specification. Moreover, this kind of methodology makes possible the detection of the causality relationships that are established among the variables, and the identification of the long term economic relationships, that is, the cointegration relations (Juselius, 2007).

After reviewing the empirical evidence, the econometric methodology follows an outline of four sequential steps: (i) the selection of an initial model specification; (ii) the study of the integration order of the variables; (iii) the estimation process of the CVAR model; and (iv) the dynamic analysis.

3.3. The Initial Model Specification

The BOR (defined as the number of self-employed or business owners) is a metric for measuring entrepreneurship used in the studies of Audretsch and Thurik (2001), Carree and Thurik (2006), Van Stel (2006), and Leitão and Ferreira (2008). The Unemployment (that corresponds to the rate of unemployed people in the economy) and the Gross Domestic Product (which is used for representing the economic growth) that were incorporated in the study developed by Baptista and Thurik (2007) are also considered in the initial model specification.

According to Audretsch (2003) the BOR measure has two advantages: (i) although it does not constitute a direct measure of entrepreneurship, it is a useful proxy for entrepreneurial activity; and (ii) it may be measured and compared in cross-country approaches and over time.

In this sense, the VAR model applied to the cases of Finland and Portugal presents as differentiating element the simultaneous inclusion of the variables related to the two neglected determinants of Entrepreneurship: the inward FDI and the investment in ICT.
The initial model specification is represented through a system of five equations by considering five endogenous variables:

\[
\begin{bmatrix}
    \text{BOR}_{t-p} \\
    \text{GDP}_{t-p} \\
    \text{UNEMP}_{t-p} \\
    \text{FDI}_{t-p} \\
    \text{ICT}_{t-p}
\end{bmatrix}
= \begin{bmatrix}
    \alpha_{0} \\
    \alpha_{0} \\
    \alpha_{0} \\
    \alpha_{0} \\
    \alpha_{0}
\end{bmatrix}
+ \begin{bmatrix}
    \beta_{1,1} & \beta_{1,2} & \theta_{1,1} & \Omega_{1,1} \\
    \beta_{2,1} & \beta_{2,2} & \theta_{2,2} & \Omega_{2,2} \\
    \beta_{3,1} & \beta_{3,2} & \theta_{3,3} & \Omega_{3,3} \\
    \beta_{4,1} & \beta_{4,2} & \theta_{4,4} & \Omega_{4,4} \\
    \beta_{5,1} & \beta_{5,2} & \theta_{5,5} & \Omega_{5,5}
\end{bmatrix}
\begin{bmatrix}
    \text{BOR}_{p-r} \\
    \text{GDP}_{p-r} \\
    \text{UNEMP}_{p-r} \\
    \text{FDI}_{p-r} \\
    \text{ICT}_{p-r}
\end{bmatrix}
+ \begin{bmatrix}
    u_{0} \\
    u_{0} \\
    u_{0} \\
    u_{0} \\
    u_{0}
\end{bmatrix}
\] (1)

Where: the \( \text{BOR}_t, \text{GDP}_t, \text{UNEMP}_t, \text{FDI}_t \) and \( \text{ICT}_t \) are the variables that represent: the Business Ownership Rate, the Gross Domestic Product, the Unemployment, the foreign Direct Investment and the Investment in ICT. The number of lags is given by: \( p = 1, \ldots, k \) where \( k \) corresponds to the optimal number of lags \( kp_{max} \); \( t \) corresponds to the year; and \( U_t \) are the errors or the random disturbances.

### 3.4. The Study of the Integration Order

The first step in the determination of the kind of relationship that is established between the variables in study is the application of the unit root tests that provides the detection of the integration order of the economic variables. First, we will evaluate if the time series are integrated or not, and, then, if so, we will determine the integration order of the variables, in order to find the best way of making it stationary. The procedures that are widely used to detect the existence of a unit root make use of the Dickey-Fuller (DF) Test and of the Augmented Dickey-Fuller Augmented (ADF) Test (Dickey and Fuller, 1979).

In order to specify the model, which provides the best adjustment, we make use of two different information criteria: the Akaike Information Criteria (AIC) and the Schwarz Bayesian Criteria (SBC).

For detecting error autocorrelation, the LM test is used, and the probability of the \( Q \) statistics, originally, proposed by Ljung and Box (1979), is also computed, taking into consideration the correlograms generated from the estimation process.

The asymptotic distribution of the estimators of the regression, as well as their \( t \) ratios, depend on the parameters \( \sigma^2 \) and \( \sigma_u^2 \). In practice \( \sigma^2 \) and \( \sigma_u^2 \) are not known, and so it is necessary to proceed with their estimation, in a consistent way.\(^2\)

*Please insert Table 1 and Table 2 here.*

First, the integration order of the economic variables was studied. Afterwards, some of the variables were differentiated, in order to estimate the models just with \( I(1) \) variables. After this procedure, once having differentiated the time series, the null hypothesis is rejected, that is, all the economic variables are stationary and integrated of order one, or \( I(1) \).

\(^2\) For a consentaneous example of the estimation process, see Newey and West (1987).
3.5. The Estimation Process of the CVAR Model

In the selection process of the optimal number of lags ($p_{\text{max}}$), the values of five different information criteria are computed. After detecting the inexistence of error autocorrelation, through the use of Lagrange Multiplier (LM) tests, with one lag and two lags respectively, and considering the results obtained through all the criteria, we retain that in the estimation process two lags should be considered (Table 3).³

Please insert Table 3 here.

The analysis of error autocorrelation was made through the simulation of two different estimation processes, and by making use of LM tests. For both cases, two lags were considered in the estimation of VAR models.

In order to detect the number of cointegrating relations, we follow Johansen and Juselius (1990). The principle of the maximum likelihood is taken into consideration, by using the Trace Statistic and the Max-Eigenvalue Statistic.

Please insert Table 4 here.

According to the observed values of the tests previously presented in Table 4, we reject the first null hypothesis of nonexistence of cointegrating relationships among the variables. For the remaining lines of test, the procedure adopted states that if the observed values are smaller than the correspondent critical values, then the null hypothesis can not be rejected. From this, we consider, in the case of Finland, just one cointegrating vector, whereas in the case of Portugal, we consider two cointegrating vectors in the subsequent estimation process of the Cointegrated Vector Autoregressive (CVAR) model, using the correspondent Error Correction Terms ($ECT$), e.g., in the case of Finland, the $ECT1$, and in the case of Portugal, the $ECT2$ and the $ECT3$.

4. Empirical Findings and Discussion

Following Granger (1969) a dynamic analysis based on the evaluation of the causality relationships is made. Moreover, the results regarding the significant feedback causalities relationships are discussed by

³ For a discussion about the use of different information criteria, consult Lütkepohl (1999, 2004).
making use of the variance decomposition of the forecasting error of Cholesky, and of the simulated coefficients of impulse-response functions.

*Please insert Table 5 and Table 6 here.*

In the case of Finland, the results provide the identification of feedback causalities relationships that embrace the following pairs of variables: \((FDI, BOR)\), \((IICT, GDP)\), \((FDI, UNEMP)\) and \((IICT, FDI)\).

In what concerns the pair \((FDI, BOR)\), after two years, the \(FDI\) does not present a significant impact on the \(BOR\), since it has a weight lesser than 5%. Nevertheless, after the fifth year, the \(FDI\) starts to have a growing and persistent importance on the determination of the \(BOR\). The detection of a negative sign for the accumulated percentage weight should be enhanced. Although the observance of lagged positive effects on the level of entrepreneurial activity, the bigger the \(FDI\) is, the smaller the \(BOR\) will be, in case of Finland.

The result obtained for the causality relationship established from the \(BOR\) in direction to \(FDI\), it is extremely important, since it reveals the importance of promoting an entrepreneurial and dynamic environment, in order to attract further \(FDI\). According to the results now obtained, the \(BOR\) impacts, in a significant way, on the inward \(FDI\), by explaining 17.65% of its forecasting error, past two years.

The pair \((IICT, GDP)\) provides also interesting results, in the sense that \(IICT\) has a positive impact on \(GDP\), although it should be considered a long term investment because it only became significant from the fifth period. For its turn, the \(GDP\) impacts in a negative way on the behaviour of the \(IICT\) variable. It presents a significant and growing impact starting from the second period. This is an unexpected result, but it is justifiable by decreasing levels of \(IICT\) that were observed during the 80s, and also in the first half of the 90s.

In what respects the pair \((FDI, UNEMP)\), it should be stressed that the \(FDI\) impacts, positively, on the \(UNEMP\) variable, by explaining 9.32% of the forecasting error of the \(UNEMP\), past three years. This is an expected result, especially, if we are dealing with MNCs that promote the downsizing of the firms and changing locations of their production units, according to comparative and competitive advantages, as it happens with large international firms that invested in Finland. The competitive pressure over the domestic producers may also justify increasing levels of unemployed people, since the less efficient national units are pressured to close their production activities. The other side of the feedback causality relationship reveals that the \(UNEMP\) does not have a significant impact on the \(FDI\). This way, we find out that \(UNEMP\) does not influence the strategic decision of investing abroad.

In relation to the pair \((IICT, FDI)\), the \(IICT\) presents a positive impact on the \(FDI\), although, in the case of Finland, it is not significant. For its turn, the \(FDI\) impacts in a negative way on the \(IICT\), and it contributes for explaining 84.22% of the forecasting error of the \(IICT\), which provides further insights for the referred decreasing levels of \(IICT\) during the decade of 80s and the first half of 90s.
In terms of unidirectional causalities, it should be stressed that the IICT impacts in a negative way the behaviour of BOR, although it never reaches a significant impact, e.g., a value higher than 5%. Additionally, the GDP has a positive and significant impact on the FDI that reaches 52.14% after the first year. This result is quite important, since it reveals how the creation of wealth is an effective mechanism of signalling that makes possible the attraction of FDI.

In the case of Portugal, two pairs of variables that represent feedback causality relationships were detected, namely: (IICT, UNEMP) and (IICT, FDI).

In what concerns the first pair, we reveal that although the causality relationship established from the IICT in direction to UNEMP present a negative signal, it does not constitute a significant impact, at least for a forecasting period of ten years. Whereas, the other side of the relationship reveals a positive and significant impact of the UNEMP on the IICT, which is justifiable by the increasing values of public investment in ICT, during the first half of 90s, in order to improve, on the one hand, the infrastructural conditions for the domestic and the foreign production units, and on the other hand, to modernize the education structure, both at the basic and the university level.

The second pair of variables also provides interesting insights, since the IICT impacts positively on the FDI, although it does not reach a significant impact of 5%. But the insightful signal that the dynamic analysis provided is very important, because in the Portuguese case for attracting additional values of inward FDI, we should assure, in a previous basis, increasing values of IICT. This is a quite important feedback relationship, because IICT is considered a technological catalyst, and according to the results obtained through the dynamic analysis, one of the strategic ways to assure technological change, is to attract further FDI. This attraction capability will provide further IICT, since the FDI explains 9.55% of the forecasting error of the IICT, just after one year. Afterwards, in the second period, it decreases to 3.04%, but in the fourth period it presents again a significant impact of 11.05% of the variance decomposition of the forecasting error of IICT.

The results relative to the unidirectional causalities reveal that the GDP (starting from the first period) and the FDI (starting from the eighth period) have a significant and positive impact on the behaviour of the UNEMP variable. Nevertheless, it must be stressed that in the first period of the simulations both variables have a negative impact on UNEMP. In the case of GDP, the referred negative impact persists during the first eight periods. For its turn, in the case of FDI, it has a null impact in the first period and afterwards a negative impact is found in the two subsequent periods.

Furthermore, the BOR and the GDP have a significant impact on the FDI variable. On the one hand, the BOR has a positive impact on the FDI, which reveals the importance of promoting a positive entrepreneurial environment, in order to attract additional FDI. On the other hand, the GDP has a negative impact on the FDI, although this causality relationship has a different sign from the second period until the eighth period of the simulation of impulse-response coefficients.
Lastly, the GDP has a negative impact on the \textit{IICT}, as it was previously detected in the case of Finland. Nevertheless, the impulse one standard deviation innovations reveal the existence of a much reduced impact on the behaviour of the \textit{IICT} variable.

4. Concluding Remarks and Policy Implication

The paper evaluates, at an aggregate range, the impact of regulation practices oriented to entrepreneurship, in terms of the causalities relationships established among different economic variables: the Business Ownership Rate, the Gross Domestic Product and the Unemployment. For this purpose, a CVAR approach is developed for two European Countries, with different experience curves and technological profiles: Finland and Portugal.

Under a technologist approach, the main idea that is proposed in this paper is related to the existence of a triple-mix among Entrepreneurship, Service FDI and ICT. This innovative approach is based on a dynamic analysis, which provides significant insights about the role played by the investment in ICT, as a technological catalyst that 'pulls' inward FDI. For its turn, under a feedback causality context, the FDI 'pushes' the investment in ICT. This feedback relationship is especially important in the services industries, in terms of the creation of further SMEs, where as it was previously stated ICT are a technological catalyst, which contribute, under a neo-Schumpeterian approach, to foster the creative destruction through the domestic entrepreneurs’ exit, which assures the ‘refreshment’ of the entrepreneurial innovative capability.

The CVAR approach now presented allows ratifying contrasting results for the two European countries. In the case of Finland, the ICT pulls for additional inward FDI, but the former does not impacts, in a significant way, on the later variable. This result reveals that investment in ICT is a necessary condition but it is not sufficient to improve the national capability for attracting FDI. In the case of Portugal, an analogous situation is detected, although the increasing tendency observed, in terms of investment in ICT, starting from the 80s until the end of 90s.

This feedback causality relationship provides insights for public policy makers about the role played by the FDI in terms of the determination of future investments in ICT, in countries with different experience curves and technological profiles. To better illustrate this, we must stress that, in the case of Finland (e.g. a high-tech producer), the FDI has a negative and significant impact on the investment of ICT. For its turn, in the case of Portugal (e.g. a low-tech producer, but fast adopter of high-tech), the FDI presents a positive and significant impact on the ICT.

Revealing this contrasting result is very important, since in the case of Finland, the implementation of public policies oriented to inward FDI precede decreasing values of investment in ICT, which reveals the growing importance of the private sector in assuring the level of investment in this technological catalyst,
which was previously supported by public funding, according to the past values of investment in ICT. For its
turn, in the case of Portugal (e.g. a low tech country), the FDI plays an important role, in the long term,
especially if the public policies aim to modify, in a progressive way, the technological profile of the country.
As previously stated, the past values of investment in ICT, the technological profiles, and by consequence the
experience curves of the countries in study are completely different, so this justifies the difference observed
in terms of the impacts on the investment in ICT.

The comparison approach also provides insightful guidelines in terms of the previous economic
conditions that should be promoted in order to attract and retain FDI. In fact, for both countries was detected
that BOR precedes inward FDI. From here, it results that is fundamental to promote a real entrepreneurial
environment and culture, because this will create dynamics that attract foreign investors.

Another interesting result that was provided through the comparison analysis is that, in both countries,
FDI impacts, in a positive way, on the UNEMP behaviour, although several differences should be underlined.
In the case of Finland, the impact is significant starting from the third period, and the positive signal never
changes during the simulation for ten periods ahead. The case of Portugal is quite different, since the impact
is significant, just after the eighth period, and taking into consideration the impulse response coefficients, we
find out that in the first period the impact is null, and in the next two periods the signal of the coefficient is
negative, afterwards the signal becomes positive. This way, in terms of the Portuguese economy, during the
first three years, the FDI contribute for decreasing levels of UNEMP, but after the initial period of the MNCs
operation, the efficiency pressure, the downsizing practices and the subsequent delocalization originate
increasing levels of unemployment.

One of the most interesting results of the paper is that, for the Portuguese case, we do not find empirical
evidence for supporting the thesis that FDI is an effective determinant of Entrepreneurship. This is justified
by the fact that the metric used for Entrepreneurship, that is, the BOR, is an exogenous variable, in the sense
that it does not present any causality relationship with one of the remaining variables considered in the model
specification. Nevertheless, in the Finnish case, the FDI plays an important role as determinant of domestic
entrepreneurship, since it contributes for decreasing values of entrepreneurial activity. This is justifiable by
the dimension of firms and the high entry barriers that are associated with the dominant technological profile
of the high-tech activities specialization in this economy.

The main policy implication for countries lagging in terms of attracting FDI is to build on public policies
focused on the creation and diffusion of ideas and products, as well as maintain a high degree of openness to
new investors, especially in ICT, because they are potential drivers of new waves of technological change.

The present paper has three limitations. First, due to data limitations, it was not possible to use the
Technological Achievement Index, in order to illustrate each country technological profile. Second, the use
of aggregate data does not make possible to analyze the potential spillovers generated through networks of
MNCs and high-tech SME. Third, the role played by social and relational capital is not explored in the present analysis, although it seems important to study how they act as determinants of the ‘allocation’ of entrepreneurship.

Finally, taking into consideration the empirical findings and the limitations, we suggest developing longitudinal studies focused on the principal of entrepreneurial activity, that is, the entrepreneur. It will be interesting to use micro data, in order to study in what extent social capital and relational capital really matter in linking Entrepreneurship and Foreign Direct Investment, under a cross-country approach.

References


### Tables

#### Table 1. The ADF tests, and the PP tests, including a constant, and without tendency

<table>
<thead>
<tr>
<th>Variables</th>
<th>First Differences</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Finland</td>
<td>Portugal</td>
<td></td>
</tr>
<tr>
<td></td>
<td>ADF</td>
<td>ADF</td>
<td></td>
</tr>
<tr>
<td>BOR</td>
<td>-3.723*(5)</td>
<td>-5.341*</td>
<td></td>
</tr>
<tr>
<td>GDP</td>
<td>-4.801*</td>
<td>-4.473*</td>
<td></td>
</tr>
<tr>
<td>UNEMP</td>
<td>-4.819*</td>
<td>-3.878*</td>
<td></td>
</tr>
<tr>
<td>FDI</td>
<td>-3.202*</td>
<td>-4.458*</td>
<td></td>
</tr>
<tr>
<td>IICT</td>
<td>-4.645*</td>
<td>-7.738*</td>
<td></td>
</tr>
</tbody>
</table>

* It denotes the rejection of the null hypothesis that is related to the existence of a unit root.
+ The number of lags is presented under brackets, when it is not automatically specified.

#### Table 2. The ADF tests, and the PP tests, including a constant and tendency

<table>
<thead>
<tr>
<th>Variables</th>
<th>First Differences</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Finland</td>
</tr>
<tr>
<td></td>
<td>Portugal</td>
</tr>
<tr>
<td>ADF</td>
<td>ADF</td>
</tr>
<tr>
<td>BOR</td>
<td>-4.009*</td>
</tr>
<tr>
<td>GDP</td>
<td>-4.718*</td>
</tr>
<tr>
<td>UNEMP</td>
<td>-4.720*</td>
</tr>
<tr>
<td>FDI</td>
<td>-3.923*</td>
</tr>
<tr>
<td>IICT</td>
<td>-4.784*</td>
</tr>
</tbody>
</table>

* It denotes the rejection of the null hypothesis that is related to the existence of a unit root.

#### Table 3. The selection process of the optimal number of lags

<table>
<thead>
<tr>
<th>Lags</th>
<th>LR</th>
<th>FPE</th>
<th>AIC</th>
<th>SBC</th>
<th>HQ</th>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>NA</td>
<td>4.22e+25</td>
<td>73.19478</td>
<td>73.43856</td>
<td>73.26239</td>
</tr>
<tr>
<td>1</td>
<td>140.3517</td>
<td>2.03e+23</td>
<td>67.80785</td>
<td>69.27050</td>
<td>68.21353</td>
</tr>
<tr>
<td>2</td>
<td>77.43235*</td>
<td>7.81e+21*</td>
<td>64.27697*</td>
<td>66.95850*</td>
<td>65.02071*</td>
</tr>
<tr>
<td>0</td>
<td>NA</td>
<td>1.10e+28</td>
<td>78.75701</td>
<td>79.00079</td>
<td>78.82463</td>
</tr>
<tr>
<td>1</td>
<td>108.8216</td>
<td>2.78e+26</td>
<td>75.02956</td>
<td>76.49221</td>
<td>75.43524</td>
</tr>
<tr>
<td>2</td>
<td>68.68361*</td>
<td>2.00e+25*</td>
<td>72.12359*</td>
<td>74.80511*</td>
<td>72.86733*</td>
</tr>
</tbody>
</table>

* It identifies the optimal number of lags selected through each one of the information criteria.

#### Table 4. The Cointegration Tests

<table>
<thead>
<tr>
<th>EV</th>
<th>Hypotheses</th>
<th>$\lambda_{\text{Trace}}$</th>
<th>Critical</th>
<th>$\lambda_{\text{Max}}$</th>
<th>Hypotheses</th>
<th>Observed</th>
<th>Critical</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Finland</td>
<td>r=0</td>
<td>r=1</td>
<td>r≥2</td>
<td>74.85523*</td>
<td>r=0</td>
<td>r=1</td>
<td>26.74414</td>
</tr>
<tr>
<td></td>
<td>0.955797</td>
<td></td>
<td>122.3235*</td>
<td>69.81889</td>
<td>0.971734</td>
<td>r=1</td>
<td>162.4114*</td>
</tr>
<tr>
<td></td>
<td>0.671868</td>
<td>r=2</td>
<td>47.46830</td>
<td>47.85613</td>
<td>r≤1</td>
<td>r&gt;1</td>
<td>85.58602*</td>
</tr>
<tr>
<td></td>
<td>0.97134</td>
<td>r=1</td>
<td>69.81889</td>
<td>69.81889</td>
<td>0.870264</td>
<td>r=2</td>
<td>76.82540*</td>
</tr>
<tr>
<td></td>
<td>0.518193</td>
<td>r=2</td>
<td>27.81123</td>
<td>29.79707</td>
<td>r≤2</td>
<td>r&gt;2</td>
<td>17.52506</td>
</tr>
</tbody>
</table>

* The first column corresponds to the Eigenvalues (EV). [+*] The critical values of the Trace Statistic and of the Max-Eigenvalue Statistic, at a 5% significance level, were collected from Osterwald-Lenum (1992); * It denotes the rejection of the initial hypothesis, at a 5% significance level.
Table 5. The Contrasts of the Granger Causalities

<table>
<thead>
<tr>
<th>Dependent</th>
<th>ΔBOR</th>
<th>ΔGDP</th>
<th>ΔUNEMP</th>
<th>ΔFDI</th>
<th>ΔIICT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Independent</td>
<td>Finland</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ΔBOR</td>
<td>-</td>
<td>0.460220</td>
<td>0.433286</td>
<td>10.39003*</td>
<td>1.099391</td>
</tr>
<tr>
<td>ΔGDP</td>
<td>3.805439</td>
<td>-</td>
<td>2.436646</td>
<td>18.48589*</td>
<td>6.684646*</td>
</tr>
<tr>
<td>ΔUNEMP</td>
<td>5.409202**</td>
<td>1.615022</td>
<td>-</td>
<td>20.36600*</td>
<td>0.052119</td>
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<tr>
<td>ΔFDI</td>
<td>6.175823*</td>
<td>4.287294</td>
<td>8.003672*</td>
<td>-</td>
<td>49.56665*</td>
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<tr>
<td>ΔIICT</td>
<td>8.396432*</td>
<td>6.307559*</td>
<td>3.832082</td>
<td>8.650869*</td>
<td>-</td>
</tr>
<tr>
<td>Block</td>
<td>11.53676</td>
<td>15.36291**</td>
<td>22.54837*</td>
<td>26.59668*</td>
<td>84.97624*</td>
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<td>ECT1</td>
<td>0.176836</td>
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<td>105.4301</td>
<td>687226.6*</td>
<td>-3.08E+10</td>
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</table>

Table 6. Dynamic Analysis of the Feedback Causalities: Finland vs Portugal

<table>
<thead>
<tr>
<th>Pairs of Variables</th>
<th>Feedback Causalities</th>
<th>Dynamic Analysis</th>
<th>Signal of the Relationship</th>
</tr>
</thead>
<tbody>
<tr>
<td>Finland</td>
<td></td>
<td>2 Years</td>
<td>3 Years</td>
</tr>
<tr>
<td>(FDI, BOR)</td>
<td>ΔFDI → ΔBOR *</td>
<td>VDC</td>
<td>2.42E-05</td>
</tr>
<tr>
<td></td>
<td></td>
<td>IRF</td>
<td>-1.56E-06</td>
</tr>
<tr>
<td></td>
<td>ΔBOR → ΔFDI *</td>
<td>VDC</td>
<td>17.654</td>
</tr>
<tr>
<td></td>
<td></td>
<td>IRF</td>
<td>1002.636</td>
</tr>
<tr>
<td>(IICT, GDP)</td>
<td>ΔIICT → ΔGDP *</td>
<td>VDC</td>
<td>0.129</td>
</tr>
<tr>
<td></td>
<td></td>
<td>IRF</td>
<td>-14.345</td>
</tr>
<tr>
<td>(FDI, UNEMP)</td>
<td>ΔFDI → ΔUNEMP *</td>
<td>VDC</td>
<td>2.081</td>
</tr>
<tr>
<td></td>
<td></td>
<td>IRF</td>
<td>0.192</td>
</tr>
<tr>
<td>(IICT, FDI)</td>
<td>ΔIICT → ΔFDI</td>
<td>VDC</td>
<td>1.858</td>
</tr>
<tr>
<td></td>
<td></td>
<td>IRF</td>
<td>307.669</td>
</tr>
<tr>
<td>(IICT, UNEMP)</td>
<td>ΔIICT → ΔUNEMP</td>
<td>VDC</td>
<td>0.030</td>
</tr>
<tr>
<td></td>
<td></td>
<td>IRF</td>
<td>0.010</td>
</tr>
<tr>
<td>(IICT, FDI)</td>
<td>ΔFDI → ΔIICT *</td>
<td>VDC</td>
<td>3.042</td>
</tr>
<tr>
<td></td>
<td></td>
<td>IRF</td>
<td>1.95E+10</td>
</tr>
</tbody>
</table>

Legend:  VDC is the Variance Decomposition of Cholesky; IRF corresponds to the Impulse-Response Functions.
* It is significant when the impact is higher than 5% (Goux, 1996).
[+] The sign of the percentage weight is obtained through the sum of the coefficients of the first 10 periods (Goux, 1996).