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Backward linkages in Costa Rica: The role of the linkages
promotion agency. Evidence from 2001 to 2008

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Abstract

Linkages promotion agencies are institutions responsible for encouraging and promoting the backward linkages between multinationals and local suppliers. They are catalogued as *productive development policy* (PDPs). PDPs should help local firms to increase value and productivity due improving the quality of the national business climate. In Costa Rica there was little evidence in terms of econometrics evidence on the analysis played by Costa Rican linkages promotion agency named *Costa Rica Provee* (CRP) on the development of backward linkages.

The objective of this document is to present new empirical evidence as to whether or not CRP has helped to develop backward linkages among high-tech multinationals (HT-MNCs) and local firms. It evaluates the relation of being part of CRP in general terms and having achieved backward linkages with higher asset specificity involved.

By using the MNC as subject of study, I perform OLS and Logit regressions. The data comes from a panel of 94 HT-MNCs from the 2001 to 2008. The empirical results do not provide robust evidence of a positive effect of CRP on the generation of backward linkages among the HT-MNCs and local suppliers.

Introduction

The foreign direct investment (FDI) is one of the key growth engines of many developing countries. One important element for developing countries is how to take advantage of these opportunities for example through backward linkages among the Multinational Companies (MNCs) and local firms.

In a world where the presence of MNCs is rising, the implications of these are increasingly relevant for developing countries. They can be an important element in a country's development strategy (Rodríguez-Clare, 1996). The 77,000 MNCs identified by the United Nations Conference on Trade and Development (UNCTAD), count with more than 770,000 foreign affiliates which, in 2005, "generated an estimated \$4.5 trillion in value-added, employed some 62 million workers, and exported goods and services valued at more than \$4 trillion (Jenkins, Akhalkatsi, Roberts & Gardiner, 2007). In particular, it is well known that high-tech MNCs (HT-MNCs) rank among the most innovative firms with the most advanced performance in their economic activity sector.

FDI flows tend to increase the productivity of domestic economies. However, there are barriers to be considered, for instance, local suppliers are not necessarily capable of supplying high quality goods and services to multinationals due to the lack of technological sophistication or entrepreneurial capabilities. This obstacle can disable them to take advantage of spillovers from business making with MNCs. That is why some countries have developed a set of *productive development policies* (PDPs) in order to promote these kinds of benefits. PDPs can be institutions and laws.

The formation of backward linkages between MNCs and domestic firms in a host economy is considered to be a way of promoting economic development, one of the reasons is because backward linkages are often associated with the generation of substantial knowledge transfer (KT) and knowledge spillover (KS). In fact, Smeets (2008) claims that backward linkages are a channel through which KT or KS can occur. Thus, backward linkages at the basics are transactions between multinationals firms and the local suppliers in host country. Therefore, they are subject to 3 dimensions of the transaction cost economics (the *frequency* at which those transactions recur, the level of *uncertainty* to which they are subject and the *asset specificity* involved).

The FDI has been a pillar for Costa Rican economic growth. A wide range of industries, including electronic components, electrical equipment, medical devices, among others, have been growing and attracting significant foreign investment in the last decade. There is evidence concluded that FDI has impact on Costa Rican economy¹.

¹ See for instance: Vargas (2007), Cordero & Paus (2008), PROCOMER (2008A and 2008B), Monge, Rivera & Rosales (2009), Monge (2010), Flores & Céspedes (2010), among others.

Costa Rica has created different programs, institutions and laws (the set of policies named *Productive Development Policies*, PDPs) in order to foster the FDI and its externalities. One of the Costa Rican institutions related to this matter is Costa Rica Provee (CRP) which is the promising attempt to promote linkages between local suppliers and MNCs. However, the empirical evidence has shown that Costa Rica has been very limited in the development of backward linkages to date (Cordero & Paus, 2008). The role of CRP has also been limited. Monge, Rivera & Rosales, (2009) claim that CRP acts more as a “potential linkage finder” than a comprehensive business intelligence intermediary. However, still missing evidence in terms of econometric studies about the role played by CRP in the development of backward linkages in Costa Rica.

The objective of master thesis is to present empirical evidence as to whether or not the Costa Rican linkages promotion agency named *Costa Rica Provee* (CRP) has helped to develop backward linkages among high-tech multinationals (HT-MNCs) located in Costa Rica and Local suppliers. Thus the research question is stated as follow: *Is there positive effect of CRP on backward linkages?*

Finally, this document is structured as follows. In the next section I describe the literature review and present the relevant economic framework. On section II I describe the main economics characteristic of Costa Rica and previous evidence on backward linkages. The hypothesis formulation is on Section III. The data description and methodology is on Section IV. On section V the results are described. And finally section VI presents the conclusions.

1. Literature review

This section describes the theoretical framework of this document. Why foreign direct investment is important for the developing countries? What role MNCs play? What are the benefits on host-economies? What are backward linkages? Why they are important? Why the asset specificity involved in the transactions is important to this document? Why institutions matter? What are PDPs? The answers to these questions will be addressed in this section.

1.1 Foreign direct investment (FDI) and Multinationals

The FDI is the main source of finance of many developing countries and Multinationals companies (MNCs)² can be an important element in a country's development strategy. Many countries strive to attract foreign direct investment (FDI) hoping that knowledge brought by multinationals companies will spill over to domestic industries and increase their productivity (Javorcik, 2004).

Countries compete fiercely to attract MNCs and high quality FDI. In fact, Javorvik (2004) aims that policy makers in many developing and transition economies place attracting FDI high on their agenda, expecting FDI inflows to bring much-needed capital, new technologies, marketing techniques, and management skills. While all of these potential benefits of FDI are viewed as important, particular emphasis is placed on the contribution of FDI to increasing productivity and competitiveness of the domestic industry. It is often hoped that knowledge transfer (KT) resulting from FDI will go beyond actual projects undertaken by foreign investors and, through knowledge spillovers (KS), will benefit domestic firms.

According with Mortimore (2008) there are four main reasons of why MNCs and FDI are important for developing countries: 1) an estimated 75 percent of FDI flows came from high-tech MNCs; they are the most important investors in the world 2) regarding to technology, it is estimated that 70 percent of R&D is conducted by MNCs and 3) In international trade, 67 percent of exports are directly related to MNCs, where 33 percent is intra-firm trade.

Multinationals

According with Barba Navaretti & Venables (2005) MNCs are firms that own a significant equity share (typically 50 percent or more)³ of another company (henceforth subsidiary or affiliate) operating in a foreign country.

² Some other author, like Barba Navaretti & Venables (2005) used different names such as: Multinational enterprises (MNEs) or Transnational companies (TNCs).

³ Other authors like Javorcik (2004) argues that the own significant equity share is around 10 percent.

MNCs are key players in globalized economies, who can circumvent national regulations and policies more easily than can national firms. They are footloose, able to move activities between their plants at relatively low cost, removing benefits as rapidly as they deliver them. They often bring scarce technologies, skills and financial resources. They are to rake advantage of new economic opportunities and thus to contribute to the creation of national wealth (Barba Navaretti & Venables, 2005).

Just as the definition of MNC is subject to much debate, the definition of high-tech is also debatable; there is no specific class of technology that is high tech, particular because the definition shifts over time (Emadi-Coffin, 2002). High-tech multinationals (HT-MNCs) are at the technological forefront of their particular industry, worldwide. Mainly, they are companies dedicated to the manufacturing of high technological level goods. The HT-MNCs are companies that have higher standards. In addition, the intra-firm trade and the technological level of the required goods make it more costing the development of linkages with local suppliers.

Barba Navaretti & Venables (2005) state that the ultimate aim of the empirical literature on the impact of MNCs is to understand how these firms contribute to national income both host and home countries, and how they affect national welfare more generally. It is particular important the extent to which they generate spillovers for home and host economies. Much of the policy a popular concern about MNCs arises from perceptions of their effects on host and home economies. They say that the effects of FDI on host (receiving) and home (sending) countries are transmitted through different channels that can be organized into three groups: 1) *product market effects*, 2) *factor markets effects* and 3) *spillovers effects*. The importance of these effects depends on the form of the investment and the characteristics of the countries.

FDI and its externalities

Over the past decade a large body of research has examined knowledge spillovers from foreign direct investment (FDI). The verdict has largely been inconclusive. Indeed, the empirical inconclusiveness has become so infamous that virtually every study reviewed here begins with this observation as its main motivation (Smeets, 2008).

Explanations for the lack of conclusive results have focused on methodological and measurement issues. Görg & Greenaway (2004) claim that, much econometric work has been done on knowledge spillovers from FDI, but the results on the importance of spillovers are mixed at best. Jarcovik (2004) aims the following: *yet there is no evidence that positive externalities generated by foreign presence actually exist*. She says that the difficulties associated with disentangling different effects at play and data limitations have prevented researchers from providing conclusive evidence of positive externalities resulting from FDI.

But despite that controversy, there are mechanisms on how FDI can be a source of valuable productivity externalities for developing countries, Alfaro & Rodríguez-Clare (2004) often highlighted for those externalities are knowledge spillovers and linkages from multinationals to domestic firms in host countries. Furthermore, Smeets (2008) indicates that FDI impact on host country economic development depends on the associated technological and knowledge spillovers. In the latter case, such spillovers depend on backward linkages, worker mobility and demonstration effects between MNCs and local suppliers.

Paus & Gallagher (2008) and Cordero & Paus (2008) argue that the existence of FDI spillover potential is a necessary condition for the realization of spillovers, but it is not a sufficient condition. The development of significant spillovers is conditioned by the interaction between two key factors: 1) *The spillover potential of the particular type of foreign investment in the host country*. Investment in resource extraction generally provides very limited potential for spillovers, as it tends to be very capital intensive and have no linkages to the host economy. In contrast, FDI in the manufacturing sector has higher spillover potential. Due to the R&D intensive nature of high-tech products, their production is likely to contain a greater element of knowledge production and involve a broader and more sophisticated set of skills. And 2) *The host country's absorptive capacity for spillovers*. The size of the economy is one element conditioning national absorptive capability. If the economy is small, size imposes obvious limitations on the number of fields in which the country can have absorption capabilities. Limited human and physical resources necessitate more specialization.

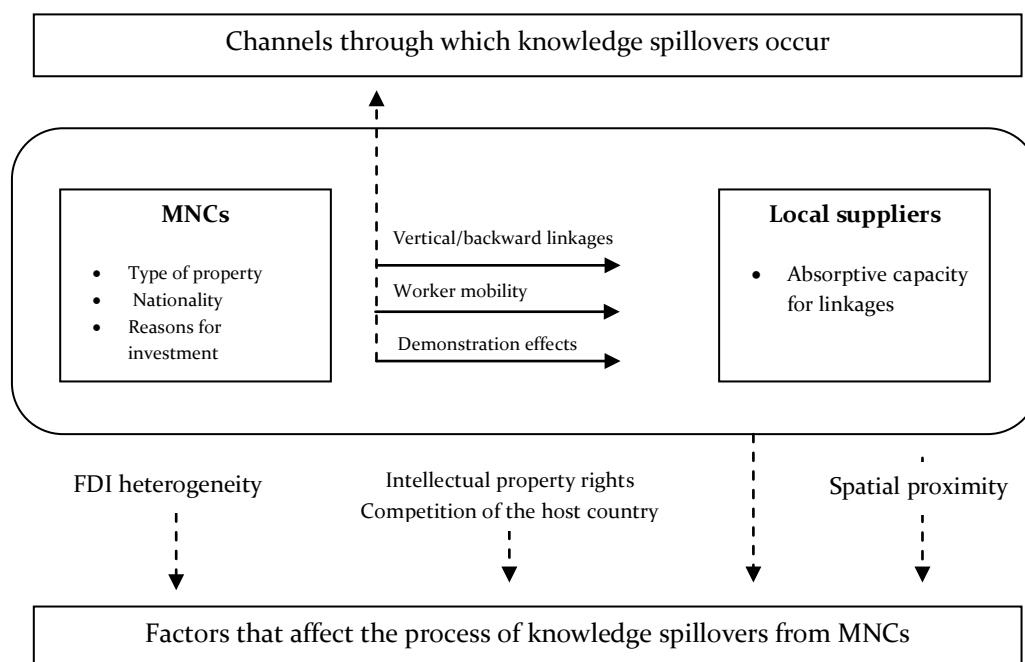
Regarding with these points Monge, Rivera & Rosales (2009) say that the success in attracting high-tech FDI does not automatically lead to the generation of knowledge spillovers related to backward linkages. Therefore, the case of backward linkages development must be approached both from the demand side⁴ (MNCs) and the supply side⁵ (local firms).

Monge (2010) develops a diagram by gathering the different considerations on how the spillovers happen in host economies. First, he takes the Smeets (2008) point of view, where he shows three possible channels for generating "spillovers" of knowledge, and the conditions necessary for the "leakage" occur and have a positive effect on local businesses. Then, as Saggi (2002) has indicated that FDI contributes to externalities of knowledge and technology depends on country's trade policies, Paus & Gallagher (2008) and Cordero & Paus (2008) emphasize that the potential linkages back depends on the domestic absorptive capacity of "spillovers" of knowledge by firms local, while Smeets (2008) adds to these requirements the spatial proximity between MNCs and local companies, as well as heterogeneity of FDI in terms of property type, nationality and motives for investment. Those elements are represented on the next figure.

⁴ For example, the productive process sophistication of the MNC or the CEO willingness to invest in local firms

⁵ The local firm capabilities (entrepreneurship, technology, production scale, manageable risk and finance)

Figure 1 Framework of analysis of knowledge spillover from MNCs



Source: Monge (2010).

Backward linkages

The formation of backward linkages between MNCs and domestic firms in a host economy is considered to be a way of promoting economic development, one of the reasons is because backward linkages are often associated with the generation of substantial knowledge transfer (FT) and knowledge spillover (KS) (Giuliani, 2008).

Spillovers are most likely to take place through backward linkages, that is, contacts between domestic suppliers of *intermediate* inputs and their multinational clients (Javorcik, 2004). Thus, backward linkages at the basics are transactions between multinationals firms and the local suppliers in host country.

Smeets (2008) claim that backward linkages are a channel through KT or KS can occur. Indeed, authors like Schoors & van der Tol (2001), Javorcik (2004), Kugler (2006), Bwalya (2006), Altomonte & Colantone (2008) or Javorcik & Spatareanu (2008) have found positive effects of knowledge spillovers from MNCs through backward linkages.

MNCs' interest in sourcing in the developing host country depends on the degree of internalized production, use of global sourcing, and technological requirements. If production is highly internalized, the MNC affiliate will have little interest in sourcing beyond *non-tradable* services and very standardized inputs like *packing materials*. If the production of inputs requires a high

degree of technological sophistication, a MNC may opt for inputs from suppliers with whom it has already developed a long-standing relationship and who have a track record of high quality production (Paus & Gallagher, 2008).

1.2 The new institutional economics

This document analyses the role of an institution in order to foster the benefits of the FDI to the host-economy. There is an economic theoretical framework which goal is to analyse institutions: the new institutional economics. According with North (1991) new institutional economics focuses on understanding the role of man-made institutions in shaping economic behaviour and, in particular, in reducing transaction costs. Institutions are the “rules of the game,” consisting of both the formal legal rules and the informal social norms that govern individual behaviour and structure social interactions.

Governance economics and transaction economics theory

Williamson (2005) defines economics of governance as the study of good order and workable arrangements. The crucial objective is finding the best governance/organizational structure for each kind of economics transaction. Thus, the core of the economics of governance is the transaction cost theory (TCT). The concept of TCT looks at the entirety of the costs of doing business, including the contracting process, and at how organizations behave with regard to the contract and how people behave during contract negotiations (Vitasek, 2011).

The transaction is the basic unit of analysis and minimizing transaction cost will result in the most efficient governance structure. Transactions differ in three ways from each other; (1) frequency at which transactions recur; (2) level of uncertainty to which they subject; (3) asset specificity involved (Williamson, 2006).

One of the three dimensions is quite important to this document, the asset specificity. According to the author asset specificity refers to the “degree to which an asset can be redeployed to alternative uses and by alternative users without sacrifice of productive value” Asset specificity distinguishes 6 different types: 1) site specificity, 2) physical asset specificity, 3) human asset specificity, 4) dedicated assets, 5) brand name and 6) temporal specificity.

Related to the asset specificity, Williamson (2006) introduces two important concepts: *Bilateral dependency* and *fundamental transformation*. Transaction specific assets introduce contractual asymmetry between the winning bidders on the one hand and no-winners on the other are because economic values would be sacrificed if the ongoing supply relation were to be terminated. Asset specificity creates a condition of “*bilateral dependency*” for the parties of the transaction. They become vulnerable: buyers cannot easily turn to alternative sources of supply,

and suppliers can redeploy their specialized assets to their next best use only at a loss of productive value. A “*Fundamental Transformation*” applies to transactions in which, due to asset specificity, a large number of potential counterparts at the outset are transformed into a small set of potential dealers during the execution of the contract and at the time of renewal.

1.3 Productive development policies (PDPs)

Melo & Rodríguez-Clare (2006) defined PDPs as policies that aim to strengthen the productive structure of a particular national economy. Monge, Rivera & Rosales (2009) claim that PDPs are designed to improve the quality of the national business climate. The term “business climate”, they say, refers to the large set of conditions existent in a country that determines its potential for successfully fostering economic growth. Porter (1998) claim that a sound macroeconomic, political, legal, and social context creates the potential for competitiveness, but is not sufficient. Competitiveness ultimately depends on improving the microeconomic capability of the economy and the sophistication of local competitive capacity. Therefore, PDPs should help firms to increase value and productivity.

According to Stein (2009) PDPs particularly in Latin America and the Caribbean (LAC) have returned to be part of the debate on economic development, after having been subject to some extent, forgotten by economists under the *Washington Consensus*⁶ (WC). According to WC, foresaw the possibility that the State intervention in markets, but at the same time, no was confident that the intervention was effective and therefore, these policies did not have the importance required. The state's role may be complementary (if it is *well-directed*) the role played by the private sector, creating necessary synergies that can accelerate economic development in the medium and long term.

Linkages promotion agencies

Linkages promotion agencies are institutions that are responsible for encouraging and promoting the linkages between MNCs and local suppliers. Axèle & Delane (2008) conclude that developing appropriate MNCs linkage policies is neither easy, nor automatic. Government are facing initially the challenge of developing developmental goals, combined with the difficulty of identifying key sectors and companies that should be supported.

⁶ The economist John Williamson of the *Institute for International Economics* in 1989 coined the term *Washington Consensus* to characterize policies that ultimately supported a group institutions domiciled in Washington, D.C. (including the IDB, WB, IMF, and International Department of the Treasury United States Government). Some of them are: fiscal discipline, tax reform to broaden the tax base and reduce taxes, liberalization of interest rates, trade liberalization, privatization, among others (Vargas, 2007).

The single most important host country factor influencing linkage formation is the availability of local suppliers with competitive costs and quality. Local suppliers' development can be supported by special programmes, but their competitiveness is also dependent on a favourable enabling environment comprising broader policy, economic, social and cultural aspects. Therefore, the overall government policy of the country matters, not only FDI and industrial policies (UNCTAD, 2001). Thus, linkages promotion agencies are PDPs, which pursue the improvement of the national business climate.

According to UNCTAD (2006) the linkages promotion agencies are programmes share certain common features. The majority tends to encourage the creation of new backward linkages with local suppliers, as well as the deepening and upgrading of existing backward linkages with those suppliers. The activities that constitute most business linkages programmes can be grouped into three broad categories: 1) *Matchmaking and networking*. To the extent that their constituents are investors seeking to establish a presence in the host country or region, they are ideally positioned to facilitate matchmaking between foreign affiliates and local SMEs, provided their mandate permits them to engage in this activity. 2) *Provision of information*. An important component of any effective business linkages programme is the ability to collect and provide accurate information on linkages opportunities to investors and 3) *Technology partnerships and SME upgrading support*. The provision of resources and advice to local SMEs to help them upgrade their capabilities and become effective partners of foreign affiliates.

2. The case of Costa Rica

2.1 Brief economic history

Costa Rica has had a remarkable transformation in the past 6 decades⁷. Rodríguez-Clare et al (2004) suggest 5 sub-periods of the recent economic history of Costa Rica. The first period is the transition from the agricultural exporting model to the imports substitution model (1950-1963). The second period is located around 1963 and 1973 where the country suffered a development model of import substitution by the incorporation to the Central American Common Market (CACM). Then, around 1973-1980, the country went through the period of entrepreneurial state and unsustainable macroeconomic policy. During the first years of the 80s the country suffered the worst economic crises ever; this period is called by the authors as the crisis and stabilization period. The last period is the exports promotion model and initial structural reforms: 1984-2000. Since 2000 the country continues on the process of trade integration.

As a result of the trade integration, the country improved its competitiveness (including legal certainty and the adoption of international standards in business as result of joining the WTO) but also developed a platform for the production of goods and services through which a significant number of MNCs chose Costa Rica to develop their global activities. According to Paus & Gallagher (2008) Costa Rica was able to attract high-tech FDI due to a combination of factors: the legacy of its past development policies—especially in education, the country's political and macroeconomic stability, its proximity to the US market, its generous tax incentives to attract FDI, and the acumen of its foreign investment promotion agency CINDE (for its acronym in Spanish).

2.2 PDPs in Costa Rica

Costa Rica has implemented *Productive Development Policies* (PDPs) for decades. For instance, during the 60s and 70s, the country adopted PDPs based on industrial protection and the entrepreneurial state model. After the economic crisis at the beginning of the 80s, Costa Rica did not abandon industrial policy interventions, but its scope and objectives changed. The New PDPs shifted to the promotion of non-traditional exports to third markets, which involved a change in policy instruments, sector targets and beneficiaries (Monge, Rivera & Rosales, 2009).

Several public and private institutions have collaborated in the design, execution and planning of PDPs. Specifically speaking about the PDPs that enhance the FDI in Costa Rica, we can speak of

⁷ For a better understanding of the Costa Rican Economic History there are studies that explain it with more details, such as: Céspedes, González, Jiménez & Vargas (1983), Céspedes, Di Mare & Jiménez (1985), Céspedes, González & Jiménez (1990), Vargas (2007), Céspedes & Mesalles (2008) and Lizano (2010).

mainly two: the Free trade zone regimen and the Linkage promotion agency named *Costa Rica Provee*. In the following subsections, there will be discussed in detail both PDPs.

The Free trade zone (FTZ) regimen

The FTZ regimen emerged in Costa Rica with the promulgation of Law 6695 of December 10, 1981, the *Export Processing Zones and Industrial Parks Law*, as a mechanism for promoting the export of non-traditional products and fostering productive investment by attracting foreign direct investment. Also with the intention of creating new employment, improving the balance of payments and helping to create a diversified productive basis. Almost all MNCs and particular the HT-MNCs are located in this regimen.

Technically speaking, the FTZs system is a set of incentives and benefits granted by the Costa Rican government to companies that make new investments in the country. The most important incentive is the exemption granted on income tax up to 100 percent for 8 or 12 years, and 50 percent for an additional 4 or 6 years (See [Table 9](#) and [Table 10](#)).

Among the principal achievements Monge, Rivera & Rosales (2009) claim the composition exports of FTZs export has changed significantly in the last decade and the promotion of the non-traditional exports to third markets.

This is evidenced by the entry of a large number of MNCs (including an important group of HT-MNCs) into the country (see [Figure 2](#)), creating the possibility of having more opportunities to development backward linkages with local firms. Hence, the need to assess the MNCs' impact on the domestic economy.

The Costa Rican Linkages promotion agency: Costa Rica Provee

Costa Rica Provee (CRP) is a public institution part of the Ministry of Trade of Costa Rica and subdivision of PROCOMER. Its main goal is to develop linkages among Multinationals (MNCs) and Local suppliers. Originally, the program was designed to promote linkages among HT-MNCs and Local suppliers only; however, over the years, the program was devoted not only to work with the HT-MNCs if not all MNCs in general.

Being part of the CRP means implies evaluating each local supplier participant in the program, identifying business opportunities and needs of the MNCs. Furthermore, CRP recommends registered suppliers meeting the production, technical, and quality specifications and characteristics. And then the MNC might achieve a transaction with the local firm. In other cases, CRP helps local suppliers in the gathering of requirements, such as international high-standard certifications, in order to become suppliers of the MNCs.

This program has oriented its services toward six strategic business areas⁸: a) *Information & Communications Technology*, b) *Electrical - Electronics / Metal Mechanics Sector*, c) *Medical / Chemical / Pharmaceutical Sector*, d) *Agribusiness / Textiles*, f) *Services and outsourcing sector* and g) *Other Sectors*.

The agency has records of each transaction among the participants: MNC and Local supplier. Each transaction was recorded in terms on the technological level involved, the type of the transaction (good or service) and the amount of the transaction. And finally, the records have information about the type (High-tech MNC or not), the Industry and the ownership of a local supplier development policy from each multinational.

The **Table 7** presents the numbers of linkages located in those chain value areas during the time period from 2001 to 2008. It shows that the largest amount of transactions between SMEs and MNCs is located in the area of *Productive processes* with 431 transactions (67 percent) and in terms of amount; they represent US\$ 15 million (74 percent of the total amount). Other areas of interest are: *Research and Development*, with 2 transactions (0.3 percent), *Raw materials*, with 84 (13 percent), *Management* with 4 (0.6 percent) and *Marketing* with such just two transactions (0.3 percent). Within area of *Productive processes*, the sub-areas which have more transaction are: *external process and sub-assembly*, with 112 links, and *packaging* with 235. Both sub-areas represent almost the 80 percent of the total amount of transaction between MNCs and local suppliers through CRP.

The information recorded in the CRP database, however, has an important limitation, since it has only been recording statistics for the "first transaction" made between them. If an SME sale any good or service to MNC in the records of CRP would appear only the amount of the first transaction, although these two companies have continued steadily, trading in that year and subsequent years⁹. For this reason, it is important to note that these records of "first transaction" from SMEs to MNCs are not sufficient for the purpose of assessing the impact of CRP on the development of local suppliers in the long term¹⁰. To correct this problem, CRP should maintain records showing all sales approaching SMEs to MNCs during the year and not just the amount of the first sale as it has been done so far.

⁸ There are some similarities between sectors of CRP and PROCOMER (See **Table 1**). Basically, the *Precision instruments & medical equipment* and *Machinery, electrical materials & components* sectors of PROCOMER are homologous to the *Medical / Chemical / Pharmaceutical* and *Electrical - Electronics / Metal Mechanics* sectors of CRP, respectively. Although there are two PROCOMER sectors that could be included (*Chemical & pharmaceutical products* and *Metal products*) in the sectors of CRP, however they are a relatively small group of MNCs, which are interrelated.

⁹ Unless, the MNCs request consulting to CRP in a particular project, which it could implies a development of a new transaction.

¹⁰ In addition, as discussed with the staff of CRP, the information associated with the "first transaction" could not be significant from the standpoint of the future stream of income or sales for a local supplier who finalized the first link. Sometimes that first linkages is, at best, a test transaction to verify quality, quantity, standard operating SMEs, commitment to delivery times, etc. and, therefore, is not indicative of what would be the relationship among them in the long term.

2.3 Backward linkages in Costa Rica

The evidence was focalized in two main areas: 1) the analysis of the presence of backward linkages, particular in the two main high-tech industries in Costa Rica –*Medical devices* and *Electronics*¹¹- and 2) the role played by CRP in the development of backward linkages. The main motivation has been seeking to establish whether or not the existence of knowledge transfer (KT) and knowledge spillovers (KS) through backward linkages. It was a very important issue for the country, due to a better study of this phenomenon could allow better policy implications.

Some key indicators to measure the linkages have been: the *amount of national expenditures of the MNCs*, the ratio of *Total inputs sourced domestically over total purchases* and the value of specialized inputs sourced locally by worker hired locally (*coefficient of linkage*). Authors like Monge, Rosales & Arce (2005), Monge-Naranjo (2008), Cordero & Paus (2008), Monge (2009), Monge (2010) or Vargas (2010) used these indicators along their studies.

The evidence is mixed, according to the perspective with which it is measured (absolute or relative). But, according with Cordero & Paus (2008) Costa Rica has been very limited in the development of backward linkages to date.

MNCs purchases of domestic goods have grown in absolute terms. During the time period 2001-2008, the local purchases had a strong increase, which may be due to a greater willingness (or opening) by MNCs to generate purchases of goods with local suppliers. At the early 2000s on average the MNCs had purchases around US\$ 1 million, in 2005 were 2 US\$ million per MNC located in the FTZ regime and finally, in 2008 the average purchases were around US\$ 3 million (See [Figure 3](#)).

In relative terms, the picture shows very little progress particular in some sectors¹². The ratio of *Total inputs sourced domestically over total purchases*¹³ is a measure to analyses the backward linkages in relative terms. The [Table 1](#) shows the different ratios according the productive activities (or sectors) used by PROCOMER. The ratio achieved a value of 9 percent in 2001. The same ratio increased at almost 12 percent in 2005, and in 2008 the ratio was 15.1 percent. The performance of the ratio implies that MNCs are buying more inputs sourced domestically.

However, the sectors with potentially dynamic high-tech activities, like *Machinery, electrical materials & components* or *Precision instruments & medical equipment* had difference behaviour

¹¹ According to Costa Rican institutions CINDE and PROCOMER and empirical studies like Paus & Gallagher (2008), Cordero & Paus (2008), Giuliani (2008) or Monge (2010) the HT-MNCs in Costa Rica are located in two main categories: *Electrical electronics & metal mechanic* (or just *Electronics*) and *medical chemical pharmaceutical* (or just *Medical devices*). Both sectors represent more than 80 percent of total export flows of the firms located in the FTZ regime.

¹² According with Cordero & Paus (2008) with respect to the share of imports, national expenditures were 13 percent in 1997 and 12 percent in 2005; and as a share of exports they were 11 percent in 1997 and 10 percent in 2005

¹³ This ratio is composed by the total inputs sourced domestically at the t period (G) by the MNC i and divided by the total purchases, which are the sum of the (G) and the imports (M) of the i MNC at the t period.

among them. For instance, the *Machinery, electrical materials & components* had a ratio of 3.1 percent in 2001, in 2004 the ratio decreased at 2.6 percent, and continuous relatively constant around 2 percent, until 2008. In the other hand the *Precision instruments & medical equipment* had higher ratios: in 2001 the ratio was 4 percent, the ratio was 6 percent in 2004 and by the year 2008 the ratio was almost 13 percent. According with the authors and other studies, these sectors have limited development of backward linkages.

Table 1 MNCs located in FTZ regimen: Ratio of *Total inputs sourced domestically over total purchases* according to PROCOMER sectors (Percentages, 2001-2008)

Productive activities	2001	2002	2003	2004	2005	2006	2007	2008
Services	20.6	17.6	25.5	24.0	26.0	24.9	34.6	37.6
Machinery, electrical materials & components	3.1	2.4	2.6	2.6	2.3	2.1	2.1	2.0
Textiles, clothing, leather & shoes	6.2	5.7	5.5	7.6	7.3	7.1	7.6	9.6
Agro-industry	82.7	77.7	86.2	84	80.7	83.9	85.6	83.5
Precision instruments & medical equipment	4.0	5.0	6.1	6.0	8.3	9.5	13.3	12.8
Metal products	7.2	8.0	15.1	37.9	42.4	49.3	43.5	45.5
Plastic, rubber & their manufacturing	25.3	21.8	30.3	24.4	25.1	21.4	20.5	18.9
Chemical & pharmaceutical products	36.0	28.4	41.4	47.3	45.5	41.8	44.3	49.6
Agriculture	97.7	98.1	97.0	97.3	91.0	87.8	95.4	96.9
Others	20.0	23.7	20.8	21.7	16.2	17.6	18.9	19.5
Total	9.0	9.6	10.5	11.9	11.6	11.5	14.9	15.1

Source: PROCOMER.

Similar results found by Giuliani (2008), when she explored the pattern of local technology transfer by HT-MNC subsidiaries in Costa Rica. The study¹⁴ finds that only a relatively small percentage of technical knowledge transfer is attributable to backward linkages between subsidiaries and Costa Rican suppliers. She claims that backward linkages are based on other grounds and local suppliers are often required to possess certain skills in order to be selected. It is plausible that knowledge linkages occur when there are opportunities for reciprocal learning and bi-directional flows between foreign subsidiaries and domestic firms. In these conditions, knowledge linkages are also more likely to be persistent over time.

In other hand, Rodríguez-Clare (2001) argues a better indicator is the increase in the *coefficient linkage* between local and international companies. Alfaro & Rodríguez-Clare (2004) indicate that MNC might use more inputs regarding workers they hire. As a result, MNCs not necessarily be generated very weak linkages with local firms. Monge (2010) calculate the linkages coefficient.

¹⁴ The study is based on empirical evidence for a sample of MNC subsidiaries operating in the electronics and medical device industries. The survey was based on face-to-face interviews, using a structured questionnaire.

However, by limitations in available data, it was not possible to calculate these coefficients using only tradable inputs as suggested by Rodríguez-Clare. Despite this limitation, the author found interesting results.

Table 2 shows that sectors such as *Chemical & pharmaceutical products*, *Metal products* and *Plastic, rubber & manufactures*, purchased more goods locally on people used. Once again, the main representatives of the HT-MNCs (*Electronics* and *Medical devices* industries) have low coefficients. In the case of *Electronics* the linkage coefficient remained almost constant between 1997 and 2007. And in the case of the *Medical devices* industry, the coefficient even suffered an important dropping. The author says that is evidence of low development of backward linkages of these two main sectors.

Table 2 Costa Rica: Linkages Coefficient from MNCs located in FTZ regimen (US\$ per worker)

Productive activities	1997	2002	2007
Services	2.435,7	7.368,7	7.626,1
Machinery, electrical materials & components	5.523,8	3.924,8	5.238,9
Textiles, clothing, leather & shoes	2.398,7	1.604,9	2.325,3
Agro-industry	11.233,5	15.921,9	35.800,0
Precision instruments & medical equipment	12.592,6	2.448,7	6.845,5
Metal products	45.454,5	2.864,6	41.842,8
Plastic, rubber & manufactures	15.384,6	15.762,5	14.365,4
Chemical & pharmaceutical products	59.803,9	75.531,9	434.285,7
Others	3.549,8	7.577,9	7.321,2
Total	3,771.7	6,724.1	11,838.6

Source: Monge (2010).

Among the reasons about the low development of backward linkages in Costa Rica, Cordero & Paus (2008) conclude two main reasons:

1. *Limited potential for spillovers for part of the foreign investment.* The authors say while FDI in high-tech products, theoretically, holds out greater potential for spillovers than FDI in low-tech products, in the case of Costa Rica, that potential is reduced considerably for two main reasons:
 - a) Most of the high-tech FDI is at the low end of the spectrum of technology intensity, involving assembly type jobs, though in the case of INTEL, testing and assembly of microchips is substantially more involved than ‘assembly’ would suggest.
 - b) The large HT-MNCs in Costa Rica (Intel, Abbot, and Baxter) source the major inputs from the company-internal global network, i.e. a lot of the production is

internalized among the affiliates spanning the globe. In addition, many of the key inputs that are outsourced cannot be produced in Costa Rica, either because the requisite scale is too large or the technology is too sophisticated. In contrast to the large HT-MNCs, however, many of the small and medium-sized MNCs in Costa Rica are eager to buy inputs domestically. They have great interest in achieving cost reductions through local sourcing, as long as technological sophistication, quality, and scale permit it.

2. *Insufficient domestic absorptive capacity for linkages.* According to the authors, some domestic firms have become successful suppliers to high-tech MNCs, producing mouldings and parts of metal and plastics. But they are the exception rather than representative examples of the state of national linkage capability and capacity.

In terms, on the critics to the role played by CRP, Matarrita (2006) suggests that more efforts to identify the most important factors that difficult backward linkages in fields as technology, quality standards, entrepreneurs and technical knowledge, are required. According to Paus & Gallagher (2008) there is very little that the CRP can do (on a significant scale) as long as the country does not have a strategy to create strengths in areas in which successful business initiatives might be developed.

Monge, Rivera & Rosales (2009) and other authors proposing that the despite the positive results of Costa Rica Provee (see [Table 7](#)), the magnitude of its operations is very limited with respect to the size of the Costa Rican economy and MCNs' purchases. For instance, total local purchases by MNCs in Costa Rica for year 2007 accounts for US\$591.1 millions, while those promoted by CRP in the same year account for only US\$4.4 million, that is, less than 1 percent. Finally they argue that CRP acts more as a "potential linkage finder" than a comprehensive business intelligence intermediary.

Vargas (2010) as result of the *Evaluation of long-term impact of CRP*, where it analyses the knowledge spillover¹⁵ of the local firms, he concludes the following recommendations: a) Trying PDPs that runs CRP clear address "market failures", b) Include as an objective (of CRP) the support of the growth of SME exports, c) Contributing to MNCs, under the new regulations Costa Rica adopted for the FTZ regime, to provide training directly to SMEs who meet the minimum requirements to constitute local providers of them, d) Simplification and identification of administrative reforms leading to the elimination of legal obstacles to the creation of SMEs and MNCs linkages, f) Building on the strengths of other departments of PROCOMER and CINDE,

¹⁵ The long-term evaluation was hired by the Inter-American Bank of Development (IDB) since this institution provided the first funding of the office. Although the objective was to assess the knowledge spillover between local firms and HT-MNCs, the lack of an adequate control group, did not allow developing an econometric model to measure the impact of CRP.

collecting treatment and effectiveness indicators and info of potential impact on client companies, their sales and direct and indirect exports and e) Focusing on the most productive per unit cost of operation.

New studies, like this, go further the study of backward linkages in Costa Rica. Most of the key indicators are based on national expenditure of MNCs, without differentiating between *tradable* and *non-tradable* inputs. Although the two types of inputs are backward linkages, the *tradable* are more beneficial for host economies due the more asset specificity involved. Thought this differentiation it is possible to measure from a wider perspective the backward linkages in Costa Rica. It is important to point out that some authors like Alfaro & Rodríguez-Clare (2004), Monge, Rosales & Arce (2005), Monge, Rivera & Rosales (2009) and Monge (2010) noted the importance of distinguishing between the inputs (*tradable* vs. *non tradable*), however, the main limitation was the public unavailability information.

Vargas (2010) was the first one, to analyses the backward linkages by differentiated the two kinds of inputs, although it was only possible to obtain it for HT-MNCs located in the FTZ regimen, not for all MNCs of the regimen. The author manages to calculate the ratio of *tradable Inputs sourced domestically over total purchases* for HT-MNCs. The **Table 3** shows that the HT-MNCs have achieved a continuous growth of the ratio for the tradable inputs since 2001. However, once the adjustment is made the ratio is lower than previously thought (see **Table 1** to compare).

Table 3 HT-MNCs located in FTZ regimen: Ratio of *Total inputs sourced domestically over total purchases* according to CRP sectors (Percentages, 2001-2008)

Sectors	2001	2002	2003	2004	2005	2006	2007	2008
Electronics	1.3	0.9	0.8	0.9	1.1	0.9	1.0	1.0
Medical devices	6.5	5.4	6.6	6.5	8.1	9.3	12.2	9.7
Others	2.6	5.2	4.1	22.3	19.4	24.2	33.2	36.9
Total	1.8	1.5	1.6	2.5	2.5	2.6	3.5	3.5

Source: Own elaboration based on CRP data and Vargas (2010).

The value of *national expenditure* or purchases is the sum of 16 categories, which includes *tradable* and *non-tradable* inputs (See **Table 8**). The **Figure 3** shows that during the early 2000s, expenditures on *tradable* and *non tradable* inputs were quite similar. In 2004, this trend changed and *tradable inputs* began to grow more than the *non tradable*. On average purchases of *tradable inputs* by the HT-MNCs have been growing since early 2000s. Basically, the HT-MNCs are having more *tradable inputs* transactions than *non-tradable* kind.

Finally, by distinguishing among *tradable* vs. *non-tradable* inputs, I can develop the linkages coefficient suggested by Alfaro & Rodríguez-Clare (2004) and Monge (2010), but only for the HT-MNCs located in the industries of *Electronics* and *Medical devices* at the FTZ regimen. The adjusted linkages coefficient shows that in both industries the value of inputs sourced locally by worker hired locally has experienced an increase during the period 2001-2008, which might indicate that the MNCs are not generating weak linkages with local firms. The annual average growth rate was 6 percent in the case of the *Electronics* industry and 9 percent in the case of *Medical devices*.

Table 4 Linkages coefficient: *Electronics* and *Medical devices* HT-MNCs (US\$ per worker)

Year	<i>Electronics</i>	<i>Medical devices</i>
2001	1,750.5	3,176.9
2002	1,461.7	2,509.5
2003	1,547.2	3,020.9
2004	1,707.7	2,945.2
2005	2,683.1	3,973.5
2006	2,277.2	4,231.0
2007	2,587.7	5,533.8
2008	2,932.6	6,395.9

Source: Own elaboration based on PROCOMER and CRP data.

In synthesis, the previous evidence of backward linkages in Costa Rica is mixed, but in general it has been very limited in the development of backward linkages to date. The role of CRP has also been limited. By distinguishing between inputs it is possible to measure linkages more broadly. Tradable inputs are of particular interest due to the asset specificity involved. Most common indicators of backward linkages have shown a lower magnitude than believed so far, but in other cases, rather the indicator shows a better performance of the backward linkages between HT-MNCs and local suppliers.

Methodologies have been raised which assess the impact of CRP¹⁶, but the lack of better data (particularly to define an appropriate control group¹⁷) did not allow econometric studies to measure its impact. This document analyses the role played by CRP in the development of backward linkages in Costa Rica taking into account the evidence presented above and presents an econometric model to assess the impact of CRP. In the next section presents the respective hypotheses.

¹⁶ See for instance Monge (2009).

¹⁷Vargas (2010) points out this limitation from the supply side (local firms) and related to the CRP “treatment”

3. Hypotheses formulation

Institutions matter a great deal in the emerging heterodox mainstream. Economists who have emphasized institutions include three Nobel Prize laureates: Ronald Coase, Douglass North and Oliver Williamson. On the microeconomic side, economics provides a theory with institutions and a theory of institutions. On the macroeconomic side, economics provides a theory in which institutions contribute significantly to create the macroeconomic foundations of microeconomic behaviour (Minniti & Lévesque, 2008). Several authors emphasize the need for a productive development strategy as a basic component of a dynamic, open developing economy. Some authors, like Rodrik (1999), call those strategies as *Productive Development Policies* (PDPs) which basically are policies that countries take (especially the developing countries) in order to foster their productivity with a strong State/business sector partnerships. Examples of PDPs are incentives (most common taxes incentives) or creation of institutions to foster linkages between MNCs and Local suppliers.

In terms of competitiveness, the World Economic Forum has worked in the past decades in the formulation of different conditions and requirements, not only economics, but also institutional and social, in order to achieve sustainable growth by the competitiveness of the nations. They present 12 pillars of competitiveness. Under the *n*th pillar of *Business sophistication*, the WEF measures the quality of a country's business networks and supporting industries, by the quantity and quality of local suppliers. The interaction between them is important, mainly because efficiency is heightened, greater opportunities for innovation are created, and barriers to entry for new firms are reduced. Individual firms' operations and strategies all lead to sophisticated and modern business processes (WEF, 2010).

The establishment of Costa Rica Provee (CRP) is a promising attempt to promote backward linkages between local suppliers and MNCs. Its formal integration into the Costa Rican Trade Promotion Office (PROCOMER for its acronym in Spanish) in 2005 was an important step towards the institutionalization of linkage promotion policies in the country. The main justification of PDPs, like CRP, is the idea that backward linkages are often associated with the generation of substantial knowledge transfer (FT) and knowledge spillover (KS), which is why formation of backward linkages between MNCs and domestic firms in a host economy is considered to be a way of promoting economic development.

Because there is evidence that institutions can contribute to the competitiveness of a country, as well as the development of local suppliers, it is worth measuring the impact of an institution dedicated to fostering backward linkages between MNCs and local suppliers.

The first hypothesis aims to analyze the impact of the CRP program on the linkages between the HT-MNCs and Local suppliers, measuring by the ratio of *Tradable inputs sourced domestically over total purchases*. The first hypothesis is stated as follow:

H1: Being part of the CRP program increases the ratio of Tradable inputs sourced domestically over total purchases of the HT-MNCs.

The second hypothesis pretends to measure the likelihood of achieving linkages in a particular area of the value chain of the multinationals, as a result of being part of the CRP program. The aim is to analyse the role of CRP on fostering backward linkages with higher asset specificity involved

Transactions may differ in 3 main dimensions: the *frequency* at which those transactions recur, the level of *uncertainty* to which they are subject and the *asset specificity* involved (Williamson, 2006). Backward linkages are transactions, which are subject to these dimensions. The development of backward linkages with higher asset specificity involved requires more effort. Both parties (HT-MNCs and local suppliers) are in situation of *bilateral dependency*, where buyers cannot easily turn to other sources of supply, and suppliers can redeploy their specialized assets to their next best use only at a loss of productive value. The *subcontracts* purchase category has more asset specificity involved than the rest of the categories. The last hypothesis is stated as follows:

H2: Those HT-MNCs that are being part of the CRP program are more likely to develop linkages in the category "Subcontracts" than non-participants.

Thus, the objective of these hypotheses is to present empirical evidence as to whether or not the Costa Rican linkages promotion agency named *Costa Rica Provee* (CRP) has helped to develop backward linkages among high-tech multinationals (HT-MNCs) located in Costa Rica and Local suppliers.

4. Data and methodology

4.1 Data

The data used in the analysis originates from Costa Rican Trade Promotion Agency (PROCOMER, for its acronym in Spanish) and Costa Rica Provee (CRP) both institutions are part of the Trade Ministry of Costa Rica (COMEX, for its acronym in Spanish).

The data set is a panel data. In cooperation between CRP's staff and the consultants of the long-term evaluation was possible to identify all the HT-MNCs located in the Free Trade Zones (FTZ) regime. This list was given to PROCOMER (institution responsible for carrying the statistics of the FTZ regime) which provided the national-scale data for each HT-MNCs identified. The data set contains information of 94 High Tech Multinationals (HT-MNCs) located in the FTZ regime from time period: 2001-2008. In total it contains 591 observations.

Among the data included is the following: time series of what each HT-MNC buy locally, according to PROCOMER's categories of local purchases. There are 16 different categories: *Raw materials, Office supply, Publicity, Parts and Accessories, Laboratory services, General supplies, Subcontracts, Customs, Rent, Fuel & lubricates, Mail and Couriers, Interesting and commissions, Insurance, Professional services, Public services (telephone, water, electricity) and Transport services*. I only use the tradable inputs for the analysis, which are the first 8 types of inputs. As mention in previous section; the tradable inputs are more beneficial for host countries due the asset specificity involved. Furthermore, the data set contains the inflows of imports of each HT-MNC.

4.2 Methodology

Most of the previous empirical evidence of backward linkages has tried to prove that domestic firms in host economies benefit from multinationals. These studies have been for the supply side, where the local firms are the subjects of study. This document implies a demand side approach; the subjects of study are the multinationals.

The hypotheses are formulated in order to analyses the role played by CRP in the development of backward linkages in Costa Rica among HT-MNCs and local suppliers. For that purpose, there are two dependent variables and two crucial explanatory variables. The two dependent variables are measures of backward linkages. The first explanatory variable named *Working_CRP* is used in Model (1). It implies a general evaluation of the CRP's impact and the second one, named *CRP_year* is used in Model (2), implies a more specialized measure of impact evaluation.

The first hypothesis claim to analyses the impact of the CRP program on the development of backward linkages between the HT-MNCs and Local suppliers. I measure the backward linkages

with the ratio of *Tradable inputs sourced domestically over total purchases* (TISDOTP). I take a linear regression approach and perform OLS regression. The first hypothesis analyses the general support of CRP to develop of backward linkages in Costa Rica among the HT-MNCs.

Each HT-MNC has a TISDOTP ratio at the year t . This ratio is given by the formula $\frac{G}{(G+M)}$, where G represents the tradable inputs sourced domestically for each i HT-MNC in the year t ; and M is the imports for each i HT-MNC in the year t . The ratio TISDOTP is the dependent variable of the Model.

The crucial explanatory variable is the dummy variable *Working_crp*. Working with CRP means that, each i HT-MNC listed on CRP receives services like identify business opportunities with local suppliers. CRP recommends to the i HT-MNC local options for its production needs. This dummy variable does not imply the development of a linkage (or transaction) through the agency.

The dummy variable is given by

$$Working_crp = \begin{cases} 0: \text{if the MNC does not work with CRP} \\ 1: \text{If the MNC does work with CRP} \end{cases}$$

I include industrial dummies as control variables. In order, to investigate whether the two main industries of HT-MNCs are different among the rest industries.

$$Electronics = \begin{cases} 0: \text{If the MNC is not in the electronic industry} \\ 1: \text{f the MNC is in the electronic industry} \end{cases}$$

$$Medical\ devices = \begin{cases} 0: \text{If the MNC is not in the medical industry} \\ 1: \text{f the MNC is in the medical industry} \end{cases}$$

And finally, year dummies are also included. Thus, the model can be stated as follows:

$$TISDOTP_j = \alpha + \beta_1 working_crp + \beta_2 Electronics + \beta_3 Medical\ devices + year\ dummies + \varepsilon_i \quad (1)$$

The second hypothesis measures the likelihood of achieving linkages in a particular area of the value chain of the multinationals, as a result of being part of the CRP program. I want to evaluate the role of CRP on fostering backward linkages with higher asset specificity involved. For that purpose, I choose a different measure of backward linkages and crucial explanatory variable compares with Hypothesis 1 and perform logistic regression to evaluate this hypothesis.

The data set contains records of the all different categories of the HT-MNCs' purchases. One particular category named *Subcontracts* implies the records of the transactions like deals for the development a part or an entirety process of the value chain of the foreign company. Comparing with the rest categories like *Office supplies* or *Raw materials*, the *Subcontract* category implies more asset specificity involved than the others categories.

The dependent variable named *Subcontracts* ranks each HT-MNC at the year t the binary choice of having or not domestic purchases on this particular category. The variable is given by the following dummy variable:

$$Subcontracts = \begin{cases} 0: It has not expenditure in subcontracts \\ 1: It has expenditure in subcontracts \end{cases}$$

The support of CRP, to advise HT-MNCs (which it was measured in the hypothesis 1), does not necessarily end in the development of a backward linkage. In this way, I use another crucial explanatory variable, which can measure CRP's role, beyond just advising the foreign company, like the actual development of a backward linkage through the office.

The crucial explanatory variable is *CRP_year*. This dummy variable measures the impact of CRP in terms of the achieving of linkage (transaction) through the office.

$$CRP_year = \begin{cases} 0: The MNC has not achieved a transaction through CRP, in that year \\ 1: The MNC has achieved a transaction through CRP, in that year \end{cases}$$

As in the previous model, I include industrial dummies as control variables. In order, to prove whether the two main industries of HT-MNCs are different among the rest industries.

$$Electronics = \begin{cases} 0: If the MNC is not in the electronic industry \\ 1: f the MNC is in the electronic industry \end{cases}$$

$$Medical\ devices = \begin{cases} 0: If the MNC is not in the medical industry \\ 1: f the MNC is in the medical industry \end{cases}$$

And finally, year dummies are also included. Thus, the model 2 can be stated as follows:

$$Subcontracts = \alpha + \beta_1 CRP_year + \beta_2 Electronics + \beta_3 Medical\ devices + year\ dummies + \varepsilon_i \quad (2)$$

Furthermore, to control for unobservable factors of firm heterogeneity, the model will include the firm fixed effects.

5. Results

The results of the estimation of (1) using OLS are presented in [Table 5](#). I find that being part of the CRP program increases the ratio of *Tradable inputs sourced domestically over total purchases* of the HT-MNCs located in FTZ regimen, but the evidence is not statistical strong enough. According with the simple OLS regression (Model 1.A) there is weak evidence regarding to the hypothesis, the coefficient is 6.17.

By comparing the two main HT-MNCs (*Electronics* and *Medical devices*) the results show that the two sectors have, in general, a lower TISDOTP ratio than the other sectors (*Communications & information technology, Agribusiness & textiles, Services and outsourcing* and *Others*, which they were grouped for convenience) and this evidence is statistical significance at 1%. The evidence is consistent with reported on [Table 1](#) (by using the PROCOMER's classification of sectors) and the table in the [Table 3](#) (by using the CRP's classification of sectors) where the others sectors have better performance than those two sectors.

The Model 1.B column addresses the measurement problem by firm (MNC) effect effects. In this case, the model does not bring statistical evidence regarding the hypothesis 1. Once again, the different among the two main HT-MNC sectors is relevant.

Table 5 Being part of the CRP program and the ratio of *Tradable inputs sourced domestically over total purchases* of the HT-MNCs

Variable	Model 1.A	Model 1.B
	OLS	OLS
Working with CRP	6.167 (-3.436) *	1.739 (-3.202)
<i>Electronics</i>	-39.279 (-4.517) ***	Omitted
<i>Medical devices</i>	-45.807 (-4.423) ***	Omitted
Constant	50.415 (-6.037) ***	19.813 (-2.224) ***
Years dummies	Yes	Yes
Fixed effects	No	MNCs
R ²	0.299	0.014

The dependent variable in three regressions is a continuous variable that ranges between 0 and 100. All regressions contain 453 observations. Robust standard errors are in parentheses. * Significant at 10%, ** Significant at 5% and *** Significant at 1%

The second hypothesis measures the likelihood of achieving linkages in a particular area of the value chain of the multinationals, as a result of being part of the CRP program. The claim behind the hypothesis is that CRP is helping to development those backward linkages that imply more asset specificity.

For the model 2, the variable named *Subcontracts* is the dependent variable, which is dummy variable that takes a value of 1 if the MNC has a purchase under *Subcontracts* category and 0 otherwise. The crucial explanatory variable is the dummy variable *CRP yearly*. It takes the value of 1 if the MNC has a transaction through CRP and 0 otherwise. Industry and year dummies as well as firm fixed effects are also included. The results are presented in the following table.

Table 6 Being part of the CRP program and the *Subcontract* purchases category

Variables	Model 2.A	Model 2.B
	Logit	Logit
CRP yearly	0.145 ** (-0.061)	0.08 (-0.437)
<i>Electronics</i>	0.061 * (-0.047)	Omitted
<i>Medical devices</i>	-0.037 (-0.062)	Omitted
Years dummies	Yes	Yes
Number of observations	582	465
Fixed effects	No	MNCs
Log-likelihood		-128.508
Prob < χ^2		0.000

The dependent variable in three regressions is a dummy variable that takes a value of 1 if the HT-MNC has a linkage at the subcontracts category and 0 otherwise. The table shows the marginal effects coefficients. Robust standard errors are in parentheses. * Significant at 10%, ** Significant at 5% and *** Significant at 1%

On **Table 6** shows the results of estimating Model 2 using binary logit regression. I discover that those HT-MNCs that are being part of the CRP program are more likely to develop linkages in the category *Subcontracts* than non-participants. The result is statistical significance at 5 percent. The marginal effect coefficient is 0.145.

However, once again, by measuring with firm (MNC) fixed do not bring statistical evidence regarding the hypothesis 2. On model 2 there is no evidence of the different among the two main sectors and the *Others*.

5.1 Discussion

The empirical results do not provide robust evidence of a positive effect of CRP on the generation of backward linkages among the HT-MNCs and local suppliers.

The first stage of each model is a simple regression (OLS and Logit) for each specification (1 and 2), there is weak evidence that CRP is helping to development backward linkages in Costa Rica. The Model 1 brings evidence in the *general* perception of being part of CRP and Model 2 proves that CRP has helped to development backward linkages in purchases categories where is more asset specificity involved.

However, when I use the standard econometric measure of using firms fixed effects to control for unobservable factors of firm heterogeneity, the models do not prove any statistical evidence of being part of CRP and the development of backward linkages among HT-MNCs and Local firms.

The previous evidence aims that CRP has a limited role. Paus & Gallagher (2008) and Monge, Rivera & Rosales (2009) proposing that the despite the positive results of CRP the magnitude of its operations is very limited with respect to the size of the Costa Rican economy and MNCs' purchases. Monge, Rivera & Rosales, (2009) claim that CRP acts more as a "potential linkage finder" than a comprehensive business intelligence intermediary. The results of the models contribute to the previous evidence about CRP. However, there are three possible reasons why the models do not prove the hypothesis with firms fixed:

- 1) The lack of more explanatory variables like: a measure of HT-MNCs' invested asset in Costa Rica, if the HT-MNC has operation around the world (number of factories abroad), time period in Costa Rica and particular time spent in Free Zone regimen, technological level involved, among others.
- 2) Better dependent variable. So as suggested by Alfaro & Rodríguez-Clare (2004) or Monge (2010) the linkages coefficient is a better indicator for backward linkages.
- 3) Better control group. As suggested by Vargas (2010) differentiating by the "CRP treatments" might be better control group, but not possible with the available data.

Finally, in Model 1, the industry dummies show that the two main HT-MNCs sectors: *Medical devices* and *Electronics* are not generating the same magnitude of backward linkages compares with the *Others* HT-MNCs, like *Communications/Technology*, *Agribusiness / Textiles*, or *Services and outsourcing sectors*. This is consistent with the previous evidence (See [Table 2](#), [Table 3](#) and [Table 4](#)). As mention above it seems appropriate to have more studies about the industry differences, one possible explanation is what Paus & Gallagher (2008) mention about MNCs' interest in sourcing in the developing host country.

6. Concluding remarks

The FDI is one of the main sources of finance of many developing countries and Multinationals companies (MNCs) can be an important element in a country's development strategy. Countries compete fiercely to attract MNCs and high quality FDI. According with Barba Navaretti & Venables (2005) the ultimate aim of the empirical literature on the impact of MNCs is to understand how these firms contribute to national income and how they affect national welfare. Javorvik (2004) pays particular emphasis on the contribution of FDI to increasing productivity and competitiveness of the domestic industry.

Backward linkages are contacts between domestic suppliers of *intermediate* inputs and their multinational clients. They often associated with the generation of substantial knowledge transfer (FT) and knowledge spillover (KS) and they are a channel through KT or KS can occur (Javorvik 2004, Giuliani 2008 & Smeets 2008). They depend on many factors, according to Monge, Rivera & Rosales (2009) and Paus & Gallagher (2008), particular on two factors: the MNCs' interest in sourcing inputs in the host country and the domestic linkage capability.

They, at the basics are transactions between multinationals firms and the local suppliers in host country. Therefore, they are subject to 3 dimensions of the transaction cost economics (the *frequency* at which those transactions recur, the level of *uncertainty* to which they are subject and the *asset specificity* involved). The development of backward linkages with higher asset specificity involved requires more effort. Both parties (HT-MNCs and local suppliers) are in situation of *bilateral dependency*, where buyers cannot easily turn to other sources of supply, and suppliers can redeploy their specialized assets to their next best use only at a loss of productive value.

High-tech FDI has led to significant structural change in Costa Rica's exports and manufacturing sector. For instance, *Electrical machinery* and *medical instrument products* increased its share in total exports since the late 1990s. This seeming transformation has not been mirrored by a transformation of indigenous technological capabilities, because FDI spillovers have been limited. Although there have been some positive spillovers from FDI through the training, labour mobility, and demonstration channels, spillovers via backward linkages have been small¹⁸.

Linkages promotion agencies are institutions responsible for encouraging and promoting the linkages between MNCs and local suppliers. Costa Rica Provee (CRP), the Costa Rican linkages promotion agency, is an institution catalogued as *productive development policy* (PDPs). PDPs should help local firms to increase value and productivity. Monge, Rivera & Rosales (2009) claim that PDPs are designed to improve the quality of the national business climate

¹⁸ See for instance studies like Monge, Rosales & Arce (2005), Monge-Naranjo (2008), Monge (2010) or Flores & Céspedes (2010).

In Costa Rica, the main reason why we have studied the backward linkages has also been seeking the knowledge transfer (FT) and knowledge spillover (KS) through backward linkages channel. The previous evidence of backward linkages in Costa Rica is mixed, but in general it has been very limited in the development of backward linkages to date. The role of CRP has also been limited. However, there was missing evidence in terms of econometric studies about the role played by CRP in the development of backward linkages in Costa Rica.

The main claim of this document is present evidence as to whether or not CRP has helped to develop backward linkages among HT-MNCs located in Costa Rica and Local firms. I present two hypotheses about it. One evaluates the relation of being part of CRP (in general terms) and the increasing of the *tradable Inputs sourced domestically over total purchases* ratio and the second once evaluates the relation of being part of CRP and having achieve backward linkages with higher asset specificity involved.

The empirical results do not provide robust evidence of a positive effect that CRP has contributed in the generation of backward linkages among the HT-MNCs and local suppliers. The first stage of each model is a simple regression (OLS and Logit) for each specification (1 and 2), in both case there is weak evidence that CRP is helping to development backward linkages in Costa Rica. However, when the firm fixed are using the models do not prove any statistical evidence of being part of CRP and the development of backward linkages among HT-MNCs and Local firms. The results are consisted with previous studies about the role of CRP.

Because the study is a pioneer in econometric evidence, there are extensions for further research. Some of them are the following:

- Extending the model specifications for all MNCs, not only for high-tech; including more explanatory variables and consider the linkages coefficient instead as dependent variable.
- To analyze in detail the differences between industries, like electronics and medical devices.
- To analyze in detail what kinds of inputs are traded to CRP, the technological level and the asset specificity involved.

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Appendix

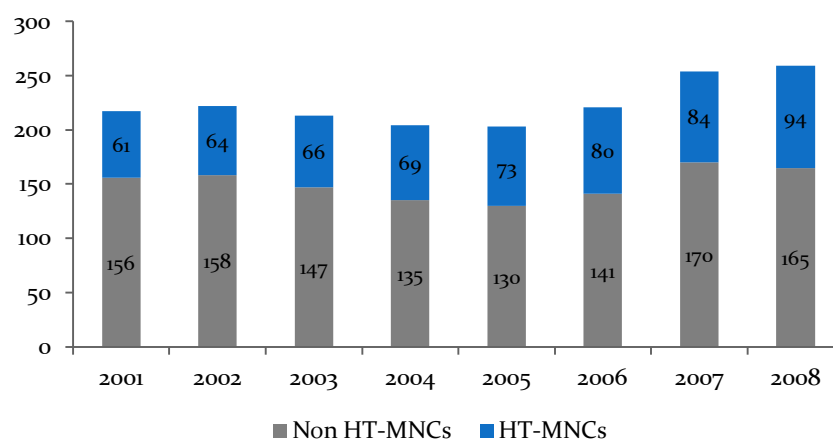
Table 7 Number of linkages between Local suppliers and MNCs, according to Areas and Sub-areas of the value chain (2001-2008)

Chain Value Area	Number	Percentages	Amount (US\$ Million)	Percentages
Research and development	2	0.3	0.1	0.3
Raw materials	84	13.1	3.0	14.0
Organic materials	9	1.4	0.5	2.5
Mineral material and polymers	22	3.4	0.6	2.7
Secondary materials	53	8.3	1.9	8.7
Infrastructure	87	13.6	1.7	7.8
Land	4	0.6	0.1	0.4
Buildings	40	6.3	0.8	3.6
Warehouse	27	4.2	0.7	3.1
IT	6	0.9	0.1	0.3
Furniture	10	1.6	0.1	0.4
Production processes	431	67.3	15.8	74.2
Equipment and machinery	47	7.3	0.9	4.1
Software	1	0.2	0.0	0.0
Tools	36	5.6	0.6	2.8
External processes and subassemblies	112	17.5	7.6	35.7
Packaging	235	36.7	6.7	31.7
Logistics	6	0.9	0.1	0.5
Transportation	4	0.6	0.1	0.3
Customs	2	0.3	0.0	0.2
Human capital	24	3.8	0.3	1.3
Employees	14	2.2	0.2	1.1
Health and safety	10	1.6	0.0	0.2
Management	4	0.6	0.4	1.8
Marketing	2	0.3	0.0	0.1
Total	640	100.0	21.2	100.0

Source: Own elaboration based on CRP data.

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Figure 2 Costa Rica: Cumulative number of MNCs in the FTZ regime (2001-2008)



Source: Own elaboration based on PROCOMER data.

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Table 8 Costa Rica: National expenditure of the HT-MNCs in the FTZ regime (2001-2008)

Categories	2001	2002	2003	2004	2005	2006	2007	2008
Tradable inputs	26.7	24.4	27.3	47.9	65.0	79.4	100.0	107.7
Raw materials	8.8	8.9	19.2	33.1	32.5	38.4	42.9	44.0
Subcontracts	0.9	1.6	0.7	1.8	8.3	5.9	16.0	6.0
General supplies	5.3	3.0	1.0	1.6	8.0	9.5	17.1	21.5
Office supplies	1.0	1.2	1.2	2.0	1.7	3.2	3.6	4.0
Publicity	5.8	4.3	0.3	0.5	1.3	1.7	2.1	2.4
Parts and Accessories	2.0	1.4	1.2	3.3	7.1	10.1	4.6	10.6
Laboratory services	0.1	0.0	0.0	0.1	0.1	0.0	0.2	0.1
Consulting	2.7	3.9	3.7	5.4	6.0	10.6	13.5	18.9
Non-tradable inputs	24.1	24.4	31.5	46.6	50.1	65.1	76.7	92.2
Customs	1.1	1.2	0.4	0.6	3.0	5.0	4.8	5.2
Transport	1.9	1.4	2.3	7.9	8.0	10.4	12.3	11.3
Rent	2.3	2.7	3.4	5.9	7.1	11.5	16.5	21.5
Interesting and commissions	3.3	1.9	2.6	1.1	3.6	5.0	5.7	8.3
Insurances	2.8	3.3	2.9	3.4	3.7	4.9	6.3	7.8
Public services (telephone, water, electricity)	11.7	12.7	13.3	16.3	19.0	22.0	26.5	30.9
Mail and Couriers	0.4	0.6	1.0	1.7	2.8	2.8	1.1	3.2
Fuel & lubricates	0.6	0.6	5.6	9.6	2.8	3.5	3.6	4.0
Total	50.8	48.9	58.8	94.5	115.1	144.6	176.7	199.8

Source: Procomer.

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Table 9 Main requirements of the RZF regime

Main requirements	MNCs type A ^a : Manufacturing under Law 740	MNCs type F ^b : Manufacturing under Law 8794	
		Small/mid scale projects	Large scale projects
Minimum export level	75%	Not required	Not required
Belong to a strategic sector ^c	Not required	Yes	Yes
Minimum employment level	Not required	Not required	Not required
Minimum required investment ^d	US\$ 150.000	US\$ 150.000	US\$ 10. 000.00 ^e

- Manufacturing firms are registered Law 740. This classification will be granted until 2015 (or later if WTO renewal extension is approved). A manufacturing firm in FZR under (a) classification may switch to (f) classification (Law 8794) to enjoy new/additional incentives.
- Manufacturing firms are registered under Law 8794. Other administrative requirements to be fulfilled (international mobility of investment, not a taxpayer in Costa Rica). And it is for projects in Greater Metropolitan Area (GMA)
- For example: Advanced manufacturing and medical devices projects, R&D activities, Innovation projects
- US\$150,000 in fixed assets within FZ Park or \$2,000,000 outside FZ Park
- Investment in fixed assets (land is not included). To be completed in 8 years

Source: Own elaboration based on CINDE.

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Table 10 Main incentives of the RZF regime

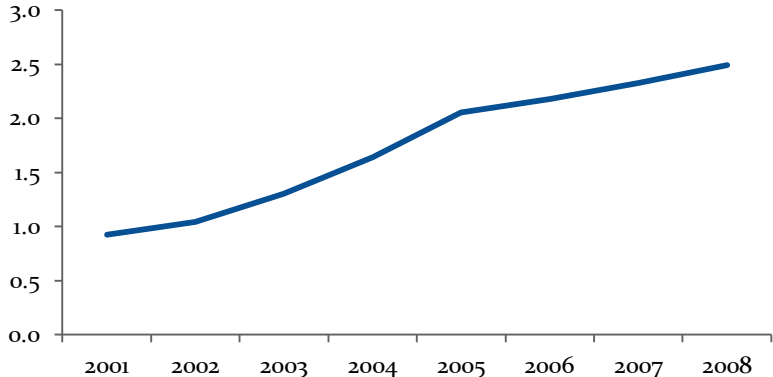
Main Incentives	Period of time	MNCs type A ^a : Manufacturing under Law 740	MNCs type F ^b : Manufacturing under Law 8794	
			Small/mid scale projects	Large scale projects ^c
Income tax (Statutory income 30%)	8 years	0%	6%	0%
	4 years	15%	15%	15%
Income tax credit	Not limit	Not available	10%	10%
Income tax deferral	Not limit	Not available	Not available	Up to 10 years
Other incentives				
Imports duties	Not limit	100% exemption	100% exemption	100% exemption
Export and excise taxes	Not limit	100% exemption	100% exemption	100% exemption
Remittances repatriation tax	Not limit	100% exemption	100% exemption	100% exemption

- Manufacturing firms are registered Law 740. This classification will be granted until 2015 (or later if WTO renewal extension is approved). A manufacturing firm in FZR under (a) classification may switch to (f) classification (Law 8794) to enjoy new/additional incentives.
- Manufacturing firms are registered under Law 8794. Other administrative requirements to be fulfilled (international mobility of investment, not a taxpayer in Costa Rica). And it is for projects in Greater Metropolitan Area (GMA).
- Additional 8 year renewal may be granted if significant reinvestment is made (Article 20 bis).

Source: Own elaboration based on CINDE.

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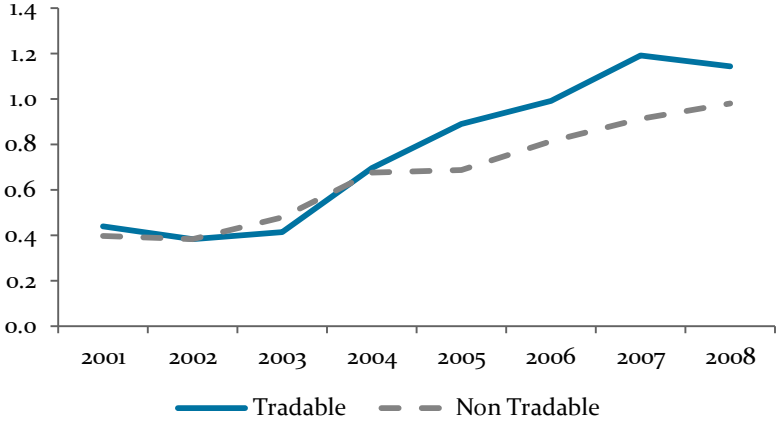
Figure 3 Costa Rica: Average local purchases of the MNCs located in FTZ regime (2001-2008, US\$ millions)



Source: Own elaboration based on PROCOMER data.

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Figure 4 HT-MNCs: Average purchases sourced locally (US\$ Million)



Source: Own elaboration based on PROCOMER data.

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