Outsourcing in Mexican Manufacturing Industry: Evolution, Characteristics and Spill-overs to Domestic Suppliers

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Abstract

International outsourcing has been widely analysed in the context of developed country firms. However a small number of studies have addressed the phenomenon from the perspective of supplier firms in developing countries.

This thesis aims to fill the gap in the existing literature by exploring to what extent the integration in global production networks through outsourcing and off-shoring benefits producers in developing countries opening channels for upgrading. In order to attempt to fill the gap in the literature, this thesis looks at different theories such as Global Value Chains, Foreign Direct Investment and Learning by exporting, to understand the opportunities that off-shoring and outsourcing collaborations can open in terms of spill-over effects and upgrading.

The research uses firm-level data from the National Survey of Employment, Wages, Technology and Training (ENESTyC) covering 52 manufacturing activities at a four-digit level in 1992, 1999 and 2001. Outsourcing is measured as the ratio of the income received by a firm for performing other firm's production to total revenues.

Results show that outsourcing is significant in Mexico and in 2002 it accounted 33 percent of Mexico's Manufacturing output. The econometric analysis suggests that supplier firms involved in outsourcing are: foreign, exporters, large and medium sized firms, and firms that tend to rely on imported raw materials. Similarly, firms participating in outsourcing as suppliers are more concentrated in labour intensive industries such as textile and wearing apparel manufacturing, plastic products and basic metals.

In addition, results show that firms involved in outsourcing are more likely to use low skilled labour and pay lower salaries than non-outsourcing firms. This is consistent with the labour cost saving motive of outsourcing from the leading firm's perspective. Labour productivity tends to be considerably lower for the firms engaged in outsourcing than for the firms with lower outsourcing ratios. This result is surprising, as it was anticipated that firms participating in outsourcing were more productive than non-outsourcing firms.

Finally, we find that outsourcing does not promote R & D; it does not encourage in-plant training, and it does not increases the number of organizational techniques used by firms involved in outsourcing. These results are very revealing and reflect that in the case of Mexico outsourcing and off-shoring does not have a positive effect on local producers engaged in these activities.

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Abbreviations

ALADI	Latin American Integration Association
ALTEX	Highly Exporting Firms Programme
APEC	Asia-Pacific Economic Cooperation
BANXICO	Mexican Central Bank
CMAP	Mexican Classification of Activities and Products
COMPEX	Joint Committee for Export Promotion
ECLAC	Economic Commission for Latin America and the Caribbean
EIA	National Industrial Survey
EFTA	European Free Trade Association
ENESTYC	National Survey of Employment, Wages, Technology and Training
EPZ	Export Processing Zones
FDI	Foreign Direct Investment
FTA	Free Trade Agreements
GCC	Global Commodity Chains
GDP	Gross Domestic Product
GVC	Global Value Chains
GVP	Gross Value of Production
INEGI	National Institute of Statistics, Geography and Informatics
ISI	Import Substitution Industrialisation

IFP	International Fragmentation of Production
LBE	Learning-by-exporting
MNC	Multinational Corporations
NAFTA	North American Free Trade Agreement
NASM	National Accounts Systems of Mexico
NIE	New Industrialised economies
OAP	Offshore Assembly Programme
OBM	Original Brand Manufacturer
ODM	Original Design Manufacturer
OEM	Original Equipment Manufacturer
OECD	Organization of Economic Co-operation and Development
PITEX	Programme of Temporal Imports to Manufacture Export Goods
R & D	Research and Development
SME	Small and Medium Enterprises
SCNM	National Accounts System of Mexico
U.S.	United States
UNIDO	United Nations Industrial Development Organization
WTO	World Trade Organization

Chapter 1 Introduction

1.1. Introduction

The globalisation process has triggered the physical fragmentation of production also known as "*outsourcing and off-shoring*", in which the various stages of the production process have been optimally located across the globe as firms find advantages to source more of their inputs (OECD, 2007a).

Despite the perceptions that outsourcing and off-shoring have now become much more significant in the world economy, it has been difficult to quantify their magnitude and growth due to the limited availability of relevant data. Generally, outsourcing and off-shoring decisions are normally taken at the micro-level of plants or firms; while official data are collected at the sectoral and national level and do not capture the extent of outsourcing. Current statistical concepts do not allow us to distinguish between trade in parts and components and fully fabricated goods, and this distinction is essential to capture the items that are shipped from one country for further processing (Yeats, 2001; Jones et al., 2005).

Increasingly, scholars and policy makers are concerned with this problem and have attempted to measure the magnitude of the phenomenon at the global level. Since trade in intermediate inputs[1] has been steadily growing, research has shown that multinational companies (MNCs) are more dependent on international sourcing than domestic firms. Therefore, intra-firm trade between affiliates and parent companies within the multinational network has promoted higher trade flows of intermediate inputs and higher ratios of use of foreign inputs over domestic inputs (OECD, 2010). For this reason, the

[1] An intermediate input is broadly defined as an input to the production process that has itself been produced and used in production.

first approach measures outsourcing using trade data in intermediate goods which include primary goods, parts and components and semi-finished goods (see Yeats, 2001; Lall et al., 2004; Jones et al., 2005), and input-output tables (Hummels et al, 2001; OECD, 2007a, 2007b and 2008a). More recently new methodologies have emerged to capture the significance of the phenomenon using firm-level data in specific countries (Girma and Görg, 2004; Diaz-Mora et al., 2007; Diaz Mora, 2008; Holl, 2008; Cusmano et al., 2010).

Using trade data, results show that between 1995 and 2006 trade in intermediate goods grew at an average annual rate of 6.2 per cent for goods and 7 percent for services (in volume terms). In 2006, intermediate inputs represented 56 percent of goods trade and 73 percent of services trade. These figures suggest that trade flows are dominated by goods that are not consumed but rather used in the production of other goods and services.

In addition, at the country level, the OECD recently presented a report where outsourcing indexes[2] are calculated for OECD member countries. Results suggest that off-shoring and outsourcing abroad have increased in almost all countries from 2000 to 2005. Smaller countries are typically more internationally oriented and are more likely to import more intermediates from abroad (e.g. Luxembourg 59%, Ireland 49%, Hungary 43 per cent, and Denmark 31%). Countries with a lesser degree of outsourcing are Spain 19 per cent, Italy 18 per cent, United Kingdom 18 per cent; and the United States 10 per cent (OECD, 2010).

[2] The outsourcing index is calculated as the share of intermediate inputs that are imported.

By contrast, in the Latin American and the Caribbean developing countries, statistics reflect the overall significance of off-shoring and outsourcing, since over 40% of the total manufactures exports of Mexico, Jamaica, Haiti, Dominican Republic and El Salvador encompass assembly operations (Yeats, 1998).

Thus, statistics indicate that the phenomenon is very significant and that it deserves much more research, specifically in developing countries where little evidence is available.

1.2. Motivation and Justification

The topic addressed in this thesis forms part of the current effects of globalisation on the disintegration of the production process. In this sense, outsourcing and off-shoring have played a significant role not only by gaining importance in terms of share of international trade but also because they have opened up new opportunities for developing country firms to participate in global production networks. In other words, if developing countries could not supply a whole product competitively, with the international fragmentation of production they could capture and specialize in the production of certain segments and components (Jones, et al. 2005).

Over the course of recent years, our understanding of outsourcing and off-shoring has been enriched by studies providing the conceptual grounds of the phenomenon (Jones and Kierzkowski, 1990; Arndt, 1997; Feenstra, 1998; Venables, 1999; Deardorff, 2001; Antras and Helpman, 2004) as well as empirical evidence pre-occupied with the determinants and potential impacts of off-shoring using large sets of quantitative data in developed countries (Tomiura, 2005; Girma and Görg, 2004; Görg et al. , 2004; Diaz-Mora, 2006 and 2008; Holl, 2008; Cusmano, 2010). While these studies have provided a sounder footing for the causes and effects of internationalisation of

production in developed countries particularly analysing lead firms, a small number of studies have empirically addressed the phenomenon from the perspective of suppliers in developing countries (Ajayi, 2003; Taymaz & Kilicaslan, 2005; Morrison and Yasar, 2009).

This gap in the literature is unfortunate from a theoretical point of view as outsourcing agreements presumably consist of a dichotomic relationship where buyers and suppliers of outsourcing embark on a supportive relationship. Therefore, it is not sufficient to analyze and understand one side of the relationship. Several bodies of literature indirectly shed light on outsourcing and off-shoring from the perspective of suppliers in developing countries, but they are typically approaching the topic from an industry level perspective and rarely provide evidence at the firm level perspective (Gereffi, 1994; Gereffi et al., 2003). Besides, most of these studies are based on case study analysis, and do not allow for generalisation of results.

In order to attempt to fill the gap in the literature, this thesis looks at different theories (Global Value Chains, Foreign Direct Investment and Learning by exporting) to understand the opportunities that outsourcing collaborations for developing countries can open in terms of upgrading, using firm level data. Therefore, this thesis contributes to the current literature on off-shoring and outsourcing by providing evidence of the phenomenon in the context of suppliers in a developing country using firm level data.

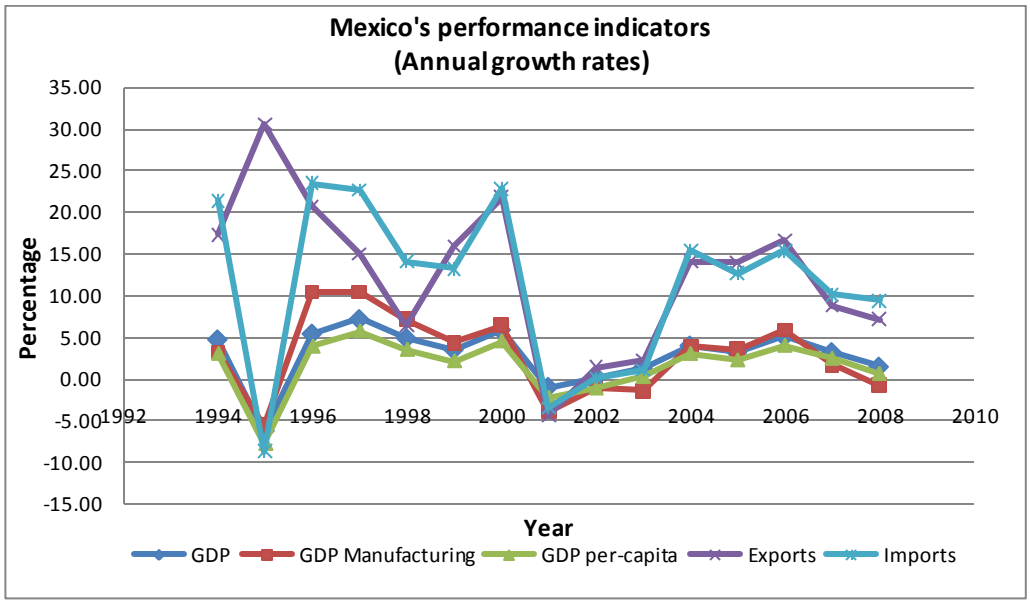
Mexico constitutes a good case study because a number of trade and foreign direct investment reforms have been implemented by the Mexican government since the 1980s, with the aim of stimulating domestic economic growth by increasing productivity and competitiveness of export-oriented manufacturing. As a result, Mexico has become the country with the largest number of free trade agreements in the world. In 2009, Mexico was the world's sixteenth largest merchandise exporter and fourteenth largest merchandise importer with a nine percent annual percentage increase in overall trade (WTO, 2009). From 1991 to 2009, Mexican exports increased

fivefold. In fact, Mexico is the biggest exporter and importer in Latin America. However, Mexican trade is fully integrated with that of its North American partners. In 2009, 84 percent of Mexican exports and 51 percent of imports were traded with the United States and Canada (Secretaria de Economia).

The recent growth in off-shoring and outsourcing has become an important part of the trade relationship between the United States and Mexico. In fact, Mexico is among the most important locations for off-shoring by US firms. From 2000 to 2003, it was estimated that the US was the source of 73.4 percent of inputs imported by Mexican assembly plants. Generally, US firms produce parts and components and export these intermediate inputs to Mexico to be assembled and processed into final goods, and then they re-import the finished goods. US firms normally specialise in R & D activities, component production, marketing and other logistics activities, while Mexican plants tend to specialise in assembly services (Bergin et al., 2009). Off-shoring and outsourcing activities have been carried out by assembly plants known as *Maquiladoras*, where employment has increased tenfold from 119,546 in 1980 to 1,191,554 in 2006 (INEGI). The sector accounts for 20 percent of manufacturing value added, and 55 percent of the country's manufacturing exports which constitutes 2.8 per cent of Mexico's GDP.

Despite the dynamism in Maquiladora's exports and production performance, Mexico's economy has failed to generate significant growth in recent years. Figure 1.1 shows annual average growth rates of selected economic indicators. From a macroeconomic point of view, the rate of GDP is the most telling indicator of how the liberalisation strategy failed to generate sustainable industrial development in Mexico.

Figure 1.1 Mexico's performance indicators



Source: Author's calculations with data from INEGI.

Some authors suggest that Mexico's paradox of successful foreign direct investment and export growth with poor economic performance may be explained by the lack of linkages between foreign firms and the domestic economy; low levels of technological capacity building; low value added exports of the Maquiladora sector; poor quality of the jobs created by Maquiladoras; and overdependence on the US economy (Puyana and Romero; 2005; De la Garza Toledo, 2007; Gallagher and Shafaeddin, 2010).

Thus, off-shoring and outsourcing through the Maquiladoras deserve a closer analysis to understand the characteristics of the firms involved in the agreements and to examine whether, by engaging in outsourcing, firms are likely to receive benefits in terms of upgrading.

1.3. Research Questions

The thesis aims to provide a better understanding of outsourcing and off-shoring in the context of suppliers in developing countries. Therefore, the central research question focuses on answering the following question:

"To what extent does the integration in global production networks through outsourcing and off-shoring benefits producers in developing countries opening channels for upgrading?"

In attempting to answer this question, some specific questions arise that need to be answered, and they are listed below:

Research question 1:

How significant is outsourcing in the Mexican Manufacturing Industry?

Research question 2:

What are the characteristics of the supplier firms involved in outsourcing in the Mexican Manufacturing Industry?

Research question 3:

Does the engagement in outsourcing increase R & T, training and improve the organizational techniques of the supplier firms involved in outsourcing?

A series of questions can be derived from question 3:

a. Does outsourcing foster R & D activities of supplier firms involved in outsourcing?
b. Does outsourcing encourage in-firm training of supplier firms involved in outsourcing?
c. Does outsourcing promote better organizational techniques of supplier firms involved in outsourcing?

1.4. Structure of the thesis

This thesis is divided into eight chapters.

Following this introductory chapter, Chapter 2 presents the conceptual framework and literature review exploring different bodies of literature that help to understand the phenomenon from the perspective of the lead firms in developed economies and suppliers in developing countries.

Particularly, the review of literature in this chapter aims to address the following issues:

- How can/should outsourcing be measured?
- What are the characteristics of the supplier firms involved in outsourcing?
- Which theories help us to understand likely benefits for the supplier firms involved in outsourcing?

One of the challenges found in this thesis was that there was not a single theory focusing on the benefits of off-shoring and outsourcing on supplier firms. Therefore, I looked at different bodies of literature such as global value chains, learning-by-exporting and foreign direct investment, which are more concerned with explaining the upgrading and spill-over effects in developing countries.

Chapter 3 looks at the origins, driving forces and trends of off-shoring, and the significance of outsourcing in the global economy.

Chapter 4 presents the evolution of the trade and FDI liberalisation policies implemented in Mexico, that make the country into an attractive location for foreign firms to source their parts and components. Since the Maquiladora firms are the main type of firms involved in off-shoring and outsourcing, the chapter also presents an overview of the history of Maquiladoras and some descriptive statistics showing the significance of the sector in the Mexican Manufacturing Industry.

Chapter 5 presents the methodology and explains the data management techniques implemented in the empirical analysis of the thesis. The chapter also presents descriptive statistics of the characteristics of the firms involved in outsourcing using firm level data in Mexico.

Chapter 6 tests empirically the characteristics that are associated to outsourcing using a probit and a tobit model.

Chapter 7 looks at the likely upgrading effects for supplier firms engaged in outsourcing. Particularly, three potential benefits on supplier firms are addressed: a) if outsourcing agreements encourage research and development of the supplier firms; b) if outsourcing increases human capital training; and c) if outsourcing improves organizational techniques of supplier firms. In order to answer these questions, econometric techniques are used.

Finally, Chapter 8 concludes with an overview of the results from the previous chapters. It then presents the limitations arising from the empirical results of the thesis and ends with suggestions for further research.

Chapter 2 Conceptual Framework and Literature Review

2.1. Introduction

During the last two decades the world economy has witnessed a rapid pace of the globalisation process which is associated with the physical fragmentation of production in which the various stages of the production process are optimally located across different places as firms find advantages to source more of their inputs (OECD, 2007a). The fragmentation of the production process across countries has opened up more opportunities for the restructuring of firms including the outsourcing and off-shoring of certain functions. While implications of the phenomenon have been studied and analysed under the perspective of firms in developed countries, less attention has been given to the developing country supplier firms participating in the outsourcing agreement (Hansen et al, 2008).

Therefore, the aim of the chapter is to present the main concepts, theories and empirical studies that directly or indirectly deal with the developing country perspective of outsourcing in order to build a framework that will help us to understand the phenomenon and the implications for the supplier firms involved in outsourcing.

Particularly, the review of literature in this chapter aims to address the following issues:

- How to measure outsourcing?
- What are the characteristics of the supplier firms involved in outsourcing?
- Which theories help us to understand likely benefits for the supplier firms involved in outsourcing?

The remainder of the chapter is organized as follows. The first part of the chapter presents the concepts of outsourcing and off-shoring. These concepts are useful to understand the phenomenon from the perspective of the lead firm. We also introduce the concept of subcontracting and a typology which addresses the relationship between both supplier and buyer. Then, taking into account these concepts and the data available for our research we present a definition for outsourcing from the perspective of the supplier.

The following section of the chapter presents an overview of the theoretical perspectives on outsourcing from the viewpoint of the supplier firms. Then we present a review of literature related to the measurements of outsourcing followed by a review of the characteristics of firms involved in outsourcing (lead firms and suppliers) in both developed and developing countries.

One of the challenges we find in this research is that there is not a single theory focusing on how outsourcing benefits supplier firms. Different theories have addressed different issues, for instance FDI literature refers to the spill-over effects and GVC literature to the upgrading effects or the theory of learning by exporting. Therefore, through the combination of these three theoretical approaches section seven aims to build up an approach to analyse the benefits of outsourcing to supplier firms. Finally, the last section presents the conclusions.

2.2. Concepts of Outsourcing and Off-shoring

The internationalization of the production process across different countries has given rise to the restructuring of firms to include outsourcing and off-shoring. In the outsourcing and off-shoring relationship two different actor are involved (see Table 2.1). On the one hand, the “lead” firms (e.g. retailers, marketers, brand manufacturers, etc.) that source out their production or assembly of goods or services either to a domestic or foreign firm and on the

other hand, the "supplier" firm takes the contract to produce or assemble a good or service.

To have a comprehensive understanding of the phenomenon we present the definition from both perspectives. However, one of the problems encountered while reviewing the literature, was that studies in the field only take into account the perspective of the lead firms. Hence, we start by presenting the concepts of outsourcing and off-shoring and then we present our concept of outsourcing from the supplier point of view.

The terms off-shoring and outsourcing have been used in a number of different ways in the academic and public debate. Furthermore a variety of alternative terms[3] have being used to refer to the phenomenon.

To clarify the differences between these two concepts, the OECD (2005, 2007a, 2007b, and 2008a) presents in different reports a clear and in-depth conceptualization of outsourcing and off-shoring from the perspective of the lead firm.

The OECD defines *outsourcing* as the purchase of intermediate goods and services from unaffiliated specialist provider. It can happen within the country where the firm is located (domestic outsourcing) or abroad (outsourcing abroad).

In contrast, *off-shoring* happens when private firms or governments decide to purchase intermediate goods and services from foreign providers or to transfer particular tasks within the firm to a foreign location. It is therefore about sourcing decisions which involve: imports, displacement of domestic

[3] *Offshore sourcing* (Arndt, 1997); *outsourcing* (Feenstra and Hanson 1999; Ragan and Lawrence, 1999; Grossman and Helpman 2005), *delocalization* (Leamer, 1996), *disintegration of production* (Feenstra, 1998); *vertical specialization* (Hummels, Rapoport and Yi, 2001 and Irwin 2002), *slicing the value chain* (Krugman, 1995), *international production sharing* (Ng Yeats 2001; Yeats, 1998).

production and sometimes FDI outflows if sourcing happens from overseas affiliates. Off-shoring comprises two different situations.

a) International subcontracting to non-affiliated firms through arm's-length contract (offshore outsourcing): involves the partial or complete transfer of goods or services overseas to a non-affiliated enterprise. The non-affiliated foreign enterprise could be either: i) a firm controlled by domestic firms of the country; ii) foreign affiliate controlled by a third party, or iii) an affiliate of the outsourcing country controlled by another group.
b) International relocation through the corporation's own affiliates (international in-sourcing): is the partial or complete transfer of the production of goods or services abroad within the same group of enterprises (affiliates). These affiliates may already exist or have been just created (Greenfield affiliates). Table 2.1 summarizes the different situations.

Table 2.1 Outsourcing and Off-shoring

SOURCING	National	International
External Production (outsourcing)	***Domestic Outsourcing*** (Production outside the firm but within the country domestic).	**International Outsourcing** (Production outside the enterprise (or the group) and outside the country by non-affiliated firms. This involves foreign subcontracting (offshore outsourcing or subcontracting abroad).
Internal Production (in-sourcing)	***Domestic Supply*** (Production within the firm and the country *domestic-in house)*	***International Insourcing*** (Production within the group to which the enterprise belong but abroad (by its own affiliates) (offshore in-house sourcing in the sense of relocation abroad).

OFF-

Source: OECD, 2007a, 2007b and 2008a.

An interesting point that the OECD raises is the distinction between a firm off-shoring to its own affiliates called "*off-shoring in strict sense*" and to non-affiliated firms "off-shoring in the broad sense". This distinction is relevant to this research because it help us to understand closely the nature of phenomenon in both, the countries relocating its production and the ones

receiving the production. Table 2.2 shows the characteristics of both types of off-shoring in the home county and abroad.

Table 2.2 Characteristics of off-shoring in strict and broad sense

Off-shoring Type	Home	Abroad
In strict sense (Offshore in-house sourcing)	• Total or partial closure of the enterprise's production units with labour reduction. • The enterprise imports goods and services from its own affiliates abroad.	• Opening of affiliates which produce the same goods and services.
In broad sense (International subcontracting)	• Partial or total cessation of the production of goods or services with a reduction in the workforce. • The firm imports the goods or services that previously produced within the enterprise.	• The activity is subcontracted on a regular basis with a non-affiliated firm. • The firm producing in the recipient country may subcontract abroad the activities in question and then import the subcontracted goods and services, then delivering them to the firm which first placed the order.

Source: OECD 2007b.

It is important to remark that in the case of off-shoring in strict sense (offshore in-house sourcing) it always concerns multinationals and FDI. On the other hand, off-shoring in the broad sense or international subcontracting does not involve FDI but it entails multinationals, and may also engage SME which do not have operations abroad (OECD, 2005, 2007b, c).

Another concept that is important to include in the analysis is *subcontracting*. Some papers in the field use the term outsourcing and subcontracting indistinctly (UNIDO, 2003), but as we can observe from the previous conceptualization outsourcing is broader than subcontracting.

Nevertheless, we consider important to include the concept of subcontracting, because it has some elements that are more suitable to analyse the phenomenon from the perspective of the supplier firm.

According to UNIDO (2003), subcontracting refers to the agreement between two parties (the lead firm and the supplier firm). In the relationship, the main lead places an order with one or several firms for the production, or processing, or transformation and/or finishing of parts, components or sub-assemblies and/or provision of industrial services necessary for the manufacture of its final product. The supplier on the other hand, executes the work as per the specifications provided by the lead. The output is generally integrated into the principal's final products.

In terms of the types of subcontracting a conventional classification of outsourcing is provided by UNIDO (2003), and is based on the lead's motivation to subcontract distinguishing the following forms of subcontracting:

- *Subcontracting based on capacity*: describes the situation in which the available production capacity of the lead firm is not enough to cope with the total volume of production necessary to satisfy an order and when additional creation of an in-house capacity is neither feasible nor desirable. In such case, the lead firm has to rely on an external supplier to satisfy the excess of demand. The relationship between the lead and supplier takes place under a temporary period of time or until the demand is satisfied.
- *Subcontracting based on specialization:* in this case the main lead firm delegates the subcontractor or a set of subcontractors, who have specialized equipment or machinery and skilled labour with the execution of certain manufacturing operations. This kind of subcontracting may comprise either finished products or specialized components or supplies that require a higher level of technical expertise, which the main lead firm does not have or can not meet. The relationship is not associated with fluctuations of orders and hence tends to be on a long-term or structural basis. In view of its specialised knowledge of production facilities, sometimes the subcontractors may be in a controlling position.

This classification is interesting from the lead's firm stand point. It describes some of the drivers of subcontracting, and captures the length of the agreement between the parties involved. However, for the purpose of this research we are looking for a kind of classification that captures, from a developing country perspective, the characteristics of the outsourcing agreements reached between the Mexican firms and foreign firms. For this reason, Nanjundan (1987) classification is more suitable to describe subcontracting from the perspective of supplier firms. According to the author four types of subcontracting can be distinguished:

- Component subcontracting: this type is similar to the specialized subcontracting classification by UNIDO. It refers to the phenomenon where the lead firm specialises in a limited range of technology intensive segments of the final product and on the assembling, marketing post-sales service and research and development activities. Therefore suppliers specialize in the production of components or intermediate inputs needed for the production of the final good. Such component subcontracting takes place in the metalworking and machinery industries.
- Activity subcontracting: takes place where an entire process or activity could be subcontracted.
- Assembly subcontracting: occurs when the supplier (in most of the cases SME) assemble the final product in a highly-labour and skill-intensive manner. An example of this type of subcontracting corresponds to the electronics industry, where the production of components includes high-technology capital-intensive processing (e.g. chips, transistors, etc.) is performed by large specialized enterprises, while assembling of the final product is performed by small enterprises.
- Product subcontracting: takes place when a complete product is produced by the supplier firm and the lead firm only performs marketing activities. This type of outsourcing prevails in sectors such

as apparel and clothing, footwear, leather goods, small motors, transformers, electrical appliances, etc.

So far, we have presented different definitions of outsourcing, off-shoring and subcontracting but they do not conceptualize the phenomenon from the supplier perspective. To fill this gap in the literature we propose a definition of outsourcing, based on the ideas of the previous concepts and on the information that we have available for our empirical analysis.

Thus, we define outsourcing as the agreement between a supplier firm and a lead firm within the country or abroad in which the supplier firm produces one or more of the different stages of the production process of the lead firm. It is based on the firm's competitive advantage as compared to other firms, which allow them to increase its technical experience and productive efficiency. Table 2.3 describes the type of relationship that outsourcing and off-shoring may entail.

Table 2.3 Relationship between the lead firm and subcontractor

Type of relationship between the lead firm and subcontractor
• Lead firm may provide some of the materials and components • Lead firm may provide detailed design or specification • Lead firm may provide finance, e.g. loan capital • Lead firm may provide machinery and equipment • Lead firm may provide technical and/or general assistance and advice • Lead firm is responsible for all marketing arrangements

Source: Dicken, 2007

Finally, although the type of production that Mexican supplier firms are engaged in, may refer more to off-shoring we will use the terms off-shoring and outsourcing indistinctly in this thesis.

2.3. Theoretical perspectives on outsourcing: a developing country perspective

In the last few decades, one of the most significant impacts of globalisation on the patterns of production and trade is the phenomenon of international outsourcing. While the literature on outsourcing has proliferated, it has drawn too much attention on the strategies that firms follow when they consider off-shoring and outsourcing of their activities to suppliers in the domestic country or abroad. Only small number of researches have conceptualized the phenomenon from the perspective of the supplier in developing countries (Hansen, et al. 2008; and Taymaz and Kiliçaslan, 2005).

Taymaz and Kiliçaslan, (2005) propose three different theoretical approaches to conceptualize and understand the main drivers of outsourcing from the lead firm and supplier perspectives (see Table 2.4). We complement the conceptualization of the authors by including the transaction costs approach, as the firm's make or buy decision is not only a matter of differences in production costs it is also determined by the costs of setting up and maintaining a subcontracting relationship (Holl, 2008).

The dualistic economic approach, expresses that the outsourcing relationship is an uneven relationship between two different types of firms, mainly large multinational corporations and small firms (Taylor and Thrift, 1982). In this relationship, lead firms outsource mainly for two reasons: to reduce production costs and to smooth production cycles at the expense of small subcontractors. However, the typical supplier is a technologically backward small firm with a weak bargaining position. Large firms benefit as they can minimize fluctuations in demand by contracting out the unstable part to small firms. The second advantage relates outsourcing to a cost reduction strategy, where large firms subcontract out their unskilled labour-intensive production to take advantage of lower wages in small firms and developing countries.

The second approach was proposed by development economists, and offers a more positive view of outsourcing. It advocates outsourcing as a tool of development, modern technology diffusion and employment generation (Watanabe, 1971, UNIDO, 1974). The main idea is that small suppliers or subcontractors benefit from large firms in the form of guaranteed markets, secured raw materials, and technical assistance. Large firms that adopt modern technology would diffuse modern production techniques both to improve production processes and product quality of subcontractors.

In addition, lead firms improve their competitiveness by focusing only on their core competencies; also they can have access to world-class capabilities and share risks. This approach also introduces the idea that if the size of the market is not enough or if there is a lack or non-existence of potential subcontractors, firms can make use of international subcontracting. Firms can benefit recipient countries (most of the times developing countries) by transferring knowledge, designs, production techniques, quality control methods, promoting employment, and export promotion.

This approach is more suitable to adopt in the research in order to explain the benefits of outsourcing to suppliers in terms of productivity spill-overs.

The third approach emphasises networking and clusters. Basically this approach is focused on SMEs. Outsourcing is considered as a means of knowledge and technology transfer, where cooperation plays an important role to achieve collective efficiency[4] (Humphrey, 1995; Nadvi and Schmitz, 1999; Rabellotti, 1997). These studies show that small firms located in clusters, both in developed and developing countries are able to overcome some of the major difficulties they usually face: lack of specialized skills, difficult access to technology, inputs, market, information, credit, and external

[4] Collective efficiency means the combination of incidental external economies and the effects of joint actions that help to explain the efficiency gains of firms located in clusters, and their increased capability to up-grade and grow.

services. Firms benefit from each other, outsourcing is one of the main types of networking on which clusters could be established (Taymaz and Kiliçaslan, 2005).

The last approach is based on the theory of industrial organization, and its origins are embedded in the transaction costs approach (Coase, 1937; and Williamson, 1975 and 1985). The theory states that the boundary of a firm is determined so as to minimize transaction costs. In this approach, outsourcing is feasible as long as the costs of related asset specific investments, contractual incompleteness, and search efforts are lower than the expected cost advantage (Olsen, 2006). Many of the recent studies of outsourcing adopt this approach to study the decisions of whether an intermediate input or component is produced within a vertically integrated agreement or through subcontracting. Also this literature deals with the problems that may arise from this decision (incomplete contracts) (Antras, 2003 and 2005, Antras and Helpman, 2004, Spencer 2005).

Table 2.4 Theoretical approaches of outsourcing

	Dualistic Approach	Development Approach	Networks/Clusters	Transaction costs
Unit of Analysis	Contractor-Subcontractor	Contractor-Subcontractor	Group of interacting firms	Contractor-Subcontractor
Nature of the outsourcing	Exploitation/ Subordination	Dependence/ Developmental	Equal benefits	Dependence
Size of the Firm				
Contractor	Large	Large	Small/Large	Large
Subcontractor	Small	Small	Small/Large	Small/Medium/ Large
Bargaining power				
Contractor	Active	Active	Active	Active
Subcontractor	Passive	Passive	Active	Active
Technological Level				
Contractor	High	High	High/Medium	High/Medium
Subcontractor	Low	Low, but raised by the client	High/Medium	High/Medium
Driven forces of subcontracting				
Contractor	Flexibility, risk and cost transfer	Focus on core business	Collective efficiency and flexibility	Reduction of costs (transaction costs), compete in global markets
Subcontractor	Market survival strategy	Access to markets and technology	Collective efficiency and flexibility	
Product/process design	Driven by the client	Driven by the client	Client/subcontractor	Client/ Subcontractor

Source: Adapted from Taymaz and Kiliçaslan, 2005.

2.4. Measurement of Outsourcing

In the last decades, one of the most significant impacts of globalisation on the patterns of production and trade is the phenomenon of international outsourcing. Although outsourcing has increased at a rapid pace and has shown a dynamic performance, it has been hard for researchers to assess its magnitude. To a large extent, this is because trade data generally does not differentiate between trade in components and assembled products. Identification of trade in parts and components is crucial, since it reflects the items that are shipped from one country to another for further processing due to international outsourcing.

However, different methodologies have been proposed in the academic literature and can be classified into two categories according to the level of data used: macro-data measures of outsourcing such as in Campa and Goldberg, (1997); Feenstra and Hanson, (1997); Geishecker and Görg, (2003); Hummels, et al, (1997); Athukorala, (2003); Yeats, (2001); Lall, et al, (2004); and Kimura et al, (2005), and micro-data at the firm level, like in Jones (1998); (Diaz-Mora, 2005); and Tomiura, (2005).

The methodologies within the first group make use of aggregated trade data sets such as Standard International Trade Classification (SITC Rev 2 and 3), Harmonized System (HS); Standard Industrial Classification (SIC) and Input-output tables. Annex 1 summarizes various measures of foreign outsourcing.

The use of these industry-level measures has contributed enormously to our understanding of international outsourcing, especially for comparisons across different countries and periods. However, there are several shortcomings from the above measures. For instance, trade data generally have not differentiated between components and finished products (Yeats 2001). Separating finished products from parts and components (P & C) does give an indication, but it is partial and sometimes is misleading. Outside of the SITC 7 (Rev 3), the SITC still fails to differentiate sufficiently between assembled

goods and components, therefore meaningful tabulations of the magnitude of trade in parts cannot be made. Trade data also do not show different stages of manufacture of a given product; this is a major gap, since outsourcing often comprises the same product undergoing different processes in different locations (Lall, et al, 2004).

In addition, the majority of the above methodologies often measure outsourcing by the ratio of material intermediate inputs to output, but this is a broad measure because it includes raw material purchases as well as arms-length purchases of standardized components in the market. As Grossman and Helpman, (2005) point out, "outsourcing means more than just the purchases of raw materials and standardized intermediate goods". At the same time, this measure is narrow since foreign outsourcing does not necessarily involve the export of parts and components, and could include processing of final products, assembly or specific production tasks and trade in services, which is hard to identify from trade statistics.

To overcome these pitfalls we need to obtain more direct evidence of outsourcing such as studies using micro-level data. To date evidence of this kind has been limited, (Jones, 1998; Diaz-Mora, 2005; Tomiura, 2005) and has focused only on developed countries such as Japan, Spain and the United States.

Jones (1998), provides the first attempt to measure outsourcing using firm-level data. The methodology consists in the identification of the purchaser of the imports in the men's dress shirt market, to draw inferences about the value-added on to the imports that occurs in the U.S. The data was collected by the U.S. customs service (Top 100 apparel importers) in 1993. The author argues that outsourcing strategies have become one of the key elements for the large apparel and retail companies.

Alternatively Diaz-Mora (2005), provides an indicator for outsourcing derived from the Industrial Companies Survey (Encuesta Industrial de Empresas). This survey contains annual data since 1993 on employment, wages, hours

worked, sales, intermediate inputs, external services and more variables for 93 manufacturing industries at the 3-digit level of NACE (Rev 1). One characteristic that makes this survey particularly interesting is that it includes outsourcing as a variable, where outsourcing is defined as the production performed by other firms. It comprises contracting out manufacturing as well as activities at any stage of the production process like product design or even final assembly. However, it does not include the subcontracting of services such as accounting, consulting and cleaning.

In the model, outsourcing is measured as the ratio of the production tasks carried by other firms to gross output. If the ratio increases it expresses that manufacturing firms are substituting in-house production for external production. The study finds that outsourcing is higher in the textile sector, wearing and apparel, footwear, publishing and printing, fabricated metal products and shipbuilding and aerospace industry. This outcome is expected considering that Spain is a developed country, and the theory predicts that the fragmented sectors are those in which labour intensity is higher as in apparel or footwear, etc.

Finally, Tomiura (2005), used firm-level data derived from the Basic Survey of Commercial and Manufacturing Structure and Activity. The survey includes 118,300 Japanese manufacturers and is highly representative of the entire manufacturing sector in Japan. One of the main characteristics of the survey is that it directly asks “contracting out” of manufacturing processes to other firms. Therefore, outsourcing in the survey comprises any activities in the production process, and final assembly. However, outsourcing of non-production overhead services is not covered, contracting-out to own subsidiaries is not separated, and arm’s-length purchases of standardized components are not included. If the firm decides to replace in-house parts production by components regularly available in marketplace, this kind of outsourcing is not covered in the survey. Also contracting out by wholesalers/retailers is not included in the data. Although this data set has several constraints, it is a good attempt to capture outsourcing. In the results

it is found that the industries with a relatively high percentage of outsourcing overseas include leather products, rubber products, apparel, electric machinery and precision instruments. An important outcome is that less than three percent of the firms are outsourcing their production across national borders and firms more prone to have outsourcing practices are the ones with higher productivity or those who outsource more-labour intensive activities.

Having a broad overview of the existing measures of outsourcing, it can be noted that firm-level measures capture better the extent of outsourcing. For this reason, our empirical analysis in Chapter 6 and 7 is based on firm-level data and is discussed in detail in Chapter 5.

2.5. Review of literature of the characteristics of Outsourcing lead firms in developed countries

To date, empirical evidence using firm-level data remains limited and has focused on the buyer's decision to outsource in developed countries: Girma and Görg, (2004) for some UK manufacturing industries, Tomiura, (2005) for Japan, Holl (2008) and Diaz-Mora (2006 & 2008) for Spain and Cusmano et al., (2010) for Italy (see 0).

Girma and Görg (2004), study empirically the firm's decision to outsource and the effect of outsourcing on that firm's productivity[5]. Outsourcing is defined as the contracting out of activities that were previously performed within the firm, to subcontractors outside the boundaries of the firm[6]. The analysis is performed using establishment-level data from 1980 to 1992 for three broad UK manufacturing industries: chemicals, mechanical and instrument

[5] The study does not make any differentiation between foreign or domestic outsourcing because the authors are more interested in the firm's specific characteristics that determine outsourcing.

[6] This definition does not include non-industrial services such as accounting, consulting, cleaning or transportation.

engineering, and electronics[7]. Each of the three industries is analysed separately, due to the degree of heterogeneity that may exist across firms and sectors.

The authors proposed a model to assess the determinants of outsourcing arguing that the three main reasons which may affect firm's decision to outsource are wage cost savings, output cyclicality and economies of scale. Outsourcing is measured as the logarithm of cost of industrial services received by establishment at time t. In the model three variables capture the cost saving reasons for outsourcing: logarithm of wage rates for skilled and unskilled workers; and the degree of unionization at the four-digit industry level. It is expected that high-wage firms do more outsourcing than other firms. The variable *size* captures the economies of scale motive for outsourcing, and is measured in terms of employment. Since the dependent variable is measured in absolute terms, it controls for the fact that large firms may do more outsourcing (in absolute terms) than smaller firms. The variable *foreign* is included to control the ownership of the establishment. It is expected a positive coefficient if foreign firms are more intensive users of outsourcing. The cyclicality is controlled by using sectoral time dummies in the four-digit industries. Finally, three dummy variables are included to control for sectors; time and region. The equation is calibrated using OLS estimation for each of the broad sectors separately. Results show that high wages, foreign ownership and productivity are positively related to the firm's outsourcing intensity.

Tomiura (2005), uses a cross-section firm-level data for 118,300 Japanese manufacturers. One of the main characteristics of the survey is that it directly asks about "contracting out" of manufacturing processes to other firms. However, outsourcing of non-production overhead services is not covered, contracting-out to own subsidiaries is not separated, and arm's-length purchases of standardized components are not included. If the firm decides to

[7] This is the first paper that analyses the determinants of outsourcing at the firm level.

replace in-house parts production by components regularly available in marketplace, this kind of outsourcing is not covered in the survey. Also contracting out by wholesalers/retailers is not included in the data. The author analyses the determinants of foreign outsourcing intensity using as explanatory variables the log of productivity, the intensity of computer usage (this tests for cost-reduction effect of IT), physical-capital ratio and human-capital ratio, the R & D intensity, size of the firm and industry dummies to control for industry-specific factors. The author finds that less than three percent of the firms in the sample are outsourcing their production overseas and about half of the firms outsource in the domestic market. The results show that firms are more likely to outsource overseas when their productivity is higher and when their products are more labour intensive. Finally, industries such as leather products, rubber products, apparel, electric machinery and precision instruments have a relatively high percentage of outsourcing overseas.

Diaz-Mora and Triguero (2008) analyse the determinants of outsourcing production using a panel of 93 Spanish manufacturing industries at the 3-digit level of NACE (Rev 1) from 1993 to 2002. One characteristic that makes this survey particularly interesting is that it includes outsourcing as a variable and is defined as the production performed by other firms. It comprises contracting out manufacturing as well as activities at any stage of the production process like product design or even final assembly.

Outsourcing intensity is calculated dividing the production works carried by other firms over the output. The dependent variables considered in the model are unit labour costs, percentage of small firms (firms with less than 20 employees), national ownership, export propensity ratio, a dummy variable controlling for skills and 10 dummy variables to control for period-specific effects. The export propensity ratio test the hypothesis that exporting firms are more likely to outsource. The dummy variable “skills” is included and takes value of 1 for sectors with high skill requirements and 0 otherwise.

Finally, the dependant variable is lagged because today's outsourcing decision may be related to the level of outsourcing in period *t-1*.

Results show that higher unit labour costs are related to higher levels of outsourcing. This result refers to the cost saving reason for outsourcing and is consistent to the results obtained by Girma and Görg (2004). The dummy variable high skills, exhibits a positive and significant coefficient, showing that the likelihood of high-skilled labour industries to contract out internal production is higher. The authors find positive correlation between firm size and outsourcing decisions, which can be explained due to the fact that large firms face lower fixed entry costs for outsourcing.

The results also show that outsourcing is higher in labour intensive industries such as the textile sector, wearing and apparel, footwear, publishing and printing, fabricated metal products and shipbuilding and aerospace industry.

Previous studies suggest that the main drivers for outsourcing are related to the reduction of production costs as well as higher flexibility for the firm to face changes in demand. However, Holl (2008) argues that the firm's decision to outsource is also associated with higher agglomeration economies. The author uses a panel for Spanish manufacturing and includes characteristics of the firm such as wages, size, age, foreign ownership, demand fluctuations, agglomeration variables and industry dummies. The results suggest that the firm's decision to subcontract is not only associated with characteristics like size, labour costs, age, fluctuations in demand and industry dummies but also with agglomeration. In other words, firms located in larger industrial areas have higher probabilities to outsource. The model also includes interaction variables between wages, size of the firm and the location show that industry agglomeration makes subcontracting more attractive for smaller and lower wage firms. Table 2.5 shows a summary of the studies mentioned above.

Table 2.5 Determinants of outsourcing and expected signs

Variables	Expected Sign	Authors
Labour costs	+	Girma and Görg (2004), Diaz-Mora et.al (2007), Diaz Mora (2008), Holl (2008) and Cusmano, et. al (2010)
Labour Productivity	+	Tomiura (2005), Diaz Mora (2008), Cusmano, et. Al (2010).
Degree of unionization	(Not significant)	Girma and Görg (2004)
Firm Size	+	Girma and Görg (2004), Tomiura (2005), Holl (2008) and Cusmano, et. al (2010).
Market Changes	+	Girma and Görg (2004), Diaz-Mora et. Al (2007).
Skill requirement	+	Diaz Mora (2008).
Physical capital ratio	-	Tomiura (2005).
Human Capital Ratio	-	Tomiura (2005).
Product Innovation	+	Diaz-Mora et.al (2007)
Process Innovation	+	Diaz-Mora et.al (2007).
R & D	+	Tomiura (2005), Diaz-Mora et.al (2007).
Product Standardization	-	Diaz Mora (2008).
Industry Size	+	Diaz-Mora et. Al (2007).
Export Propensity	+	Diaz-Mora et.al (2007) and Cusmano, et. al (2010).
Age	+	Diaz-Mora et.al (2007).
Subcontract $_{t-1}$	+	Diaz-Mora et. Al (2007); Diaz Mora (2008).
Market competition	+	Diaz-Mora et.al (2007).
Foreign Ownership	+ / -	Girma and Görg (2004), Diaz-Mora et.al (2006) Holl (2008)
National Ownership	+	Diaz-Mora et. Al (2006), Holl (2008).
Agglomeration	+	Holl (2008).

Source: Author

2.6. Review of literature on the characteristics of outsourcing from a supplier's perspective in developing countries

Despite evidence suggesting that outsourcing is gaining importance in less developed countries (UNCTAD, 2004 and 2005), some empirical evidence has been produced to analyse the characteristics of the firms engaged in outsourcing, its determinants and impacts not only from the demand side but also from the perspective of the supplier in LDC.

In this section we review the empirical evidence of the characteristics of firms involved in outsourcing in LDC.

Ajayi (2003), Taymaz & Kilicaslan (2005), and Morrison and Yasar (2009), are among the first to provide original contributions of outsourcing in Nigeria and Turkey respectively. Ajayi (2003), presents a qualitative study of the nature and scope of subcontracting linkages in Nigeria. In the study, 68 contracting firms were interviewed in 15 industrial estates in Lagos. To analyse the nature of outsourcing, the author distinguishes two types: specialised outsourcing and complementary outsourcing. The former arises to the lack or inadequate technological know-how or equipment from the lead firm's side. The later occurs because of low production capacity of the lead firm to meet delivery times. The author finds that 97 percent of the surveyed firms are involved in speciality outsourcing by independent subcontractors. Moreover subcontracting practices are more frequent in the Chemical and pharmaceutical industry and textiles,

In this sense, Taymaz and Kiliçaslan, (2005), offer an interesting quantitative analysis of the determinants of subcontracting from the perspective of both lead and supplier firms in Turkey for the electronics and textile industry. This research is more applied to the present study and some variables considered in the empirical model will be taken into account for our analysis.

The authors estimate two models, one for the share of subcontracted inputs (subcontract offering firms), and other for subcontracting output (subcontracting receiving firms). The data is at the firm-level from 1993 to 2000, and the analysis uses a random-effects Tobit model.

Following the literature on subcontracting the authors include several variables (see Table 2.6). For instance, the dualistic economy and developmental subcontracting approaches point that wages and size are among the main determinants of subcontracting. In the case of size, large firms are more likely to offer subcontracting to small firms. Hence, the coefficient of size is expected to be positive for the subcontract offering firms and negative for the subcontract-receiving firms. On the other hand, wages is included to test the hypothesis that high wage firms are more likely to subcontract a larger part of their production to firms paying lower wages.

The model also includes the number of hours worked in the second and third shifts in total of number of hours worked, to control for the rapid growth of the demand of the products. The intuition behind this variable is that if a firm's demand increases it will have to increase the number of hours worked by employees. But, if its installed capacity reaches to its maximum capacity it may decide to subcontract a part of its production to a third party firm. Annual output growth is used to capture the effects of the production constraints on the firms subcontracting behaviour.

Networks and cluster approaches stress the importance of networks and clusters in promoting subcontracting relationships between firms that own complementary assets. For this reason, the authors use the logarithm of the number of firms operating in the same sector and province to test the effects of regional clusters on subcontracting behaviour. The model also includes the proportion of expenditures on communications services to total sales revenues, the advertising intensity of the firm, annual depreciation allowances per employee.

Three variables are included to control the effects of composition of the labour force on subcontracting: female, administrative personnel and skilled personnel. Finally, a time variable is included to control the exogenous shifts in subcontracting not explained by the other variables.

Table 2.6 Determinants of Outsourcing in Turkish Textile Industry

Variables	Sub. Receiving	Sub. Offering
Wages	-	+
Size	-	+
Number of hours worked in the second and third shifts	+	-
Output Growth rate	-	+
Number of the firms operating in the same sector	+	+
Proportion of expenditures on communication services to total sales revenue	+	+
Advertisement expenses	+	+
Annual depreciation allowances	-	+
Female	+	+
Administrative	-	+
Skilled	-	-
Time	-	-

Source: Taymaz and Kiliçaslan, (2005)

One of the strongest results that the authors find is that the existence of local clusters seems to be an important determinant of the outsourcing decision for both subcontracting offering and receiving firms. In addition, results show that capital-intensive firms are more likely to offer subcontracting contracts, whereas labour-intensive firms in the textile industry are more likely to receive contracts.

In the case of wages and size of the firms, in the textile industry results show that large firms tend to subcontract out their production, while small firms are more likely to receive more subcontract orders. In contracts, in the engineering industries results show that size has a positive relationship for both subcontracting receiving and offering firms.

Finally, the authors point that in the textile industry the subcontracting relations entail unequal power relations as suggested by the dualistic

approach, while firms in the engineering sector subcontracting is established between equals like the cluster/networks approach suggests.

2.7. Theoretical approaches exploring the benefits of outsourcing to suppliers

According to UNIDO (2003), by engaging in outsourcing agreements with specific customers, both suppliers and subcontractors benefit from a large amount of technology transfer[8]. In this sense, to guarantee that the parts and components meet the requirements of the home market, contractors (including large multinational firms) can provide suppliers not only with the specifications but also with the assistance in raising their technological capabilities (UNCTAD, 2001).

For instance, supplier firms involved in outsourcing might be forced to search for new technologies, use existing technology more efficiently, copy technology used by the lead firms, lead firms may also introduce new know-how by demonstrating new technologies and training workers, lead firms may transfer techniques for inventory and quality control and standardization to their suppliers.

On the other hand, there can be adverse effects such as the increasing competition from foreign supplier may lead to the crowding out of domestic supplier firms. The Trade and Development Report, 2002 (UNCTAD, 2002:74-76) highlights that developing countries involved in international production networks generally are not involved in the skill- and technology-intensive parts of the production. Hence, the following dangers have been identified:

[8] Technology transfer refers to all forms of physical assets, knowledge and human learning and capabilities that enable the efficient organization and production of goods and services (Dunning, 1993).

- The relocation of labour-intensive or unskilled assembly to developing countries may not increase overall skill requirements. In turn, this not only reduces the benefits in terms of incomes, but also diminishes the potential for technological spill-overs.
- Firms in developing countries that are part of an international production network (or GVC) depend upon the decisions of the lead firms within the network. This in turn, may reduce policy autonomy about the formulation of development strategies that put emphasis in national capabilities and goals.
- The increasing competition among developing countries to attract FDI in order to enter international production chains may lead to a race to the bottom.
- Technological upgrading can also be more difficult for economies that are used by TNCs as bases for exports to third markets than for economies where FDI is more of the market-seeking, tariff jumping kind. Since the latter form is more dependent on the domestic economy, it offers to the host country government greater bargaining power opportunities for using FDI selectively to ensure that it will generate spill-overs and linkages with domestic industry.

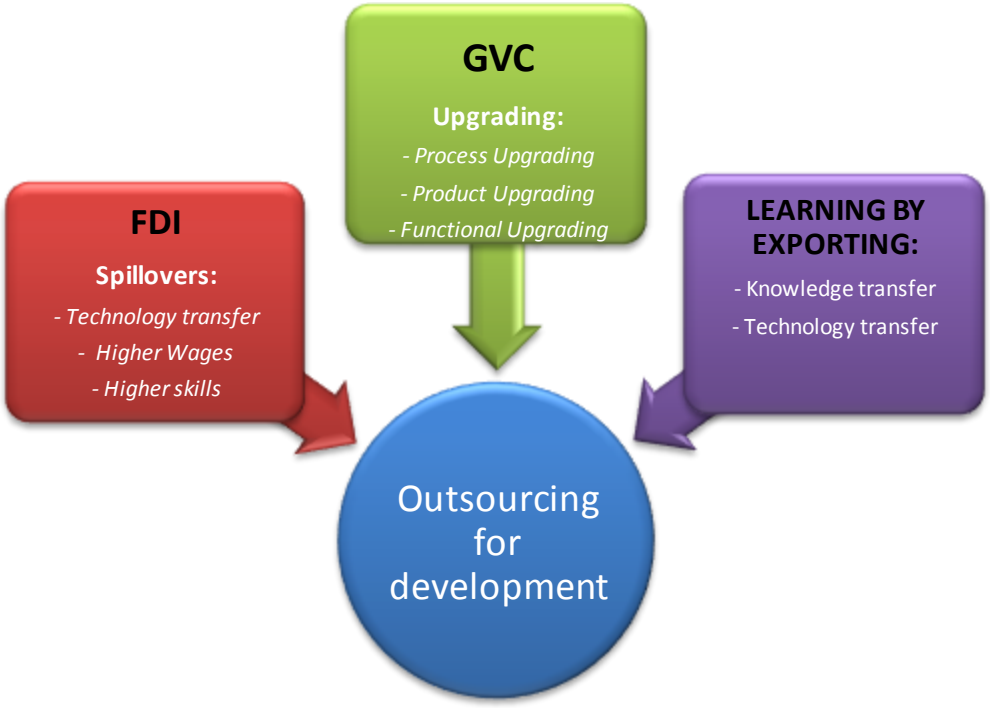
The micro-economic literature has identified three channels for the international transmission of knowledge: imports of new capital and differenciated intermediate goods (Feenstra, Markusen and Zeile, 1992; Grossmand and Helpman, 1995); learning by exporting (Clerides, Lach and Tybout, 1998; Crespi, Criosculo and Haskel, 2008); and foreign direct investment (Blomström and Kokko, 1997; Kokko, Tansani and Zejan, 2001).

In fact, the conventional wisdom is that FDI is the main channel through which technology is transfer to developing countries (Djankov and Hoekman, 2002). However, during the last decades, a rapidly growing number of studies within the GVC perspective have focused on how buyers, suppliers and different actors are linked together and how different types of value chains can

contribute to industrial upgrading for exporters in developing countries (Gereffi, 1999; Humphrey and Schmitz, 2002; Humphrey, 2004).

Therefore, based on the literature surveyed, the FDI, learning by exporting and GVC approaches are helpful in analysing the channels which suppliers firms engaged in outsourcing may benefit in terms of transmission of knowledge such as technology transfer, training, and organizational techniques (see Figure 2.1).

Figure 2.1 Theoretical Approaches to analyse the benefits of outsourcing to suppliers in developing countries.



Source: Author

The FDI literature provides an explanation of the spill-over effects of FDI on developing country firms (Blomström and Kokko, 1996; Haskel, Pereira and Slaughter, 2002). However, it fails to explain the effects of other entry modes or contractual relations as it only takes into account fully owned subsidiaries and equity joint ventures.

On the other hand, the GVC approach is a useful tool that helps us to understand how international linkages can play a key role to access knowledge and increase learning and innovation for firms in developing countries (Gerefi, 1999, Humphrey and Schmitz, 2000, 2002a and 2002b, Schmitz, 2005).

2.7.1. The theory of FDI and Spill-overs

The theory of FDI is one of the core concepts of the global development paradigm. Many academics and policy makers argue that FDI can be a source of valuable productivity externalities (Markusen, 1995; Caves, 1996; Blomtröm and Kokko, 1998; Alfaro and Rodriguez-Clare, 2004). In this sense, affiliates of MNCs may exert some influence on the economic welfare of their suppliers of raw materials and intermediate inputs in different ways. Firstly, by the quantity of goods and services they buy from them, second they can influence the terms of procurement; and finally they can have an impact on the technological capability, managerial initiative and organizational competence of suppliers (Dunning, 1993).

Due to the availability of data, we specifically aim to identify if suppliers can benefit from technology transfer, increase training of human capital or improve organizational their techniques by engaging in outsourcing.

The literature of the role of MNCs in international technology transfer, suggests that the most common channel for the diffusion of modern, advanced technology is the external effects or *spill-overs* from FDI, rather than formal technology agreements (Blomström ,1989).

Spill-overs happen when local firms have access to superior knowledge of product or process technologies or markets from MNCs without incurring a cost. However, a linkage with a MNC does not always generate spill-overs, but

it may increase the probability that spill-overs exist (Blomström and Kokko,1998; Moran 2001).

Host-country spill-overs from FDI can be captured by MNC subsidiaries, by other firms in the same industry as the MNC (horizontal spill-overs) and by downstream suppliers to the MNCs (vertical spill-overs) or by firms in upstream or other industries.

Except for MNCs subsidiaries that have direct access to knowledge through their parent firm, the literature suggests that spill-overs may occur through the following channels (see Figure 2.2):

Human capital spill-overs occur when MNCs hire and train both skilled and unskilled workers and when they leave the MNCs, skilled workers can use their knowledge to start a new firm or to work for domestic firms in the same industry. If their knowledge improves productivity in their new environment the spill-over has occurred.

Demonstration effects happen when domestic firms adopt and produce technologies introduced by MNCs through imitation and or reverse engineering. They also occur when domestic firms adopt higher technical standards of MNCs such as ISO 9000, ISO 14000, QS 9000, etc.

Competition effects, the entry of MNCs may exert price pressures on domestic firms, pushing them to adopt new technologies or to use existing technology more efficiently.

Forward linkages stem from contact with customers and MNCs. With the vertical disintegration of the production process, MNCs tend to focus on core activities and outsource many other non-core activities. Distributional and after-sales services are among the services most frequently transferred to independent firms. Outsourcing these activities involve lot of benefits for the MNCs, since they can rapidly cover more markets while minimizing the risks and investment of distributional channels. As MNCs want to keep the homogeneous and standards in their downstream activities, they often

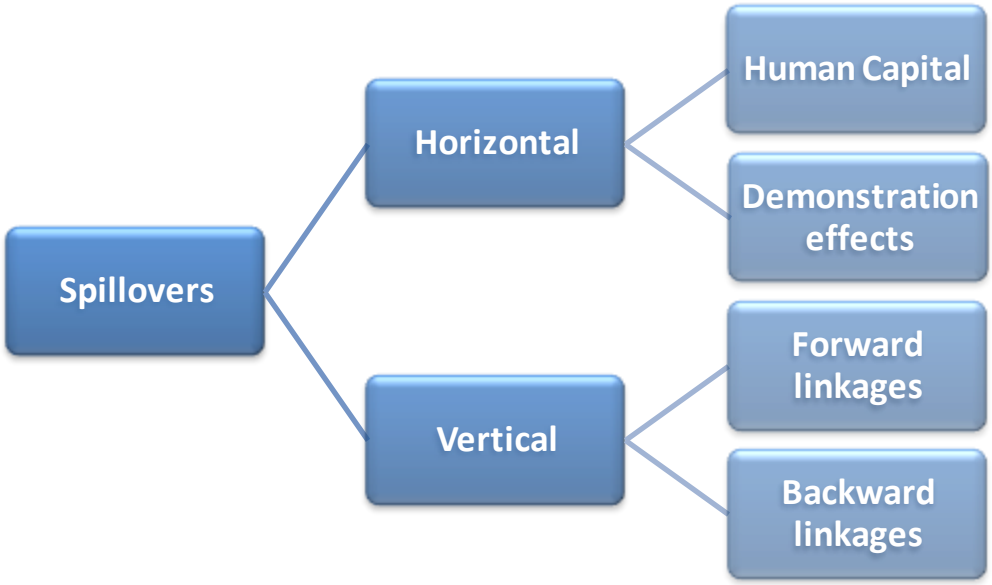
provide comprehensive training for their distributors. Therefore, distributors in developing countries benefit from an extensive use of the brand, and training (Altenburg, 2000; Galagher and Zarsky, 2007).

Backward linkages arise from the relationship between MNC affiliates with suppliers. They have traditionally been considered as the main instrument to promote technological spill-overs from MNCs. In fact, many developing countries have established domestic-content requirements on MNCs to trigger backward linkages and develop local supplier industries.

In an empirical study, Lall (1980) finds that MNCs can contribute to the increase supplier's productivity and efficiency as they: help potential suppliers (both domestic and foreign) to set up production facilities; provide technical assistance or information to increase the quality of suppliers' products; offer assistance in purchasing raw materials and intermediaries; provide training to suppliers; and help suppliers to diversify by finding more customers. Thus, backward linkages lead to the transfer of knowledge and technology to local suppliers and subcontractors (Giroud, 2003).

However, spill-overs are not an automatic result of the linkages between MNCs and their suppliers as they depend among other things on the quantity and types of inputs supplied, the terms of procurement, and most importantly on the willingness of MNCs to transfer knowledge and build long term relationships with suppliers (Altenburg, 2000).

Figure 2.2 Spill-over channels



Source: Author

The following section presents the literature review of some empirical evidence on the spill-over effects from the activities of MNCs. It does not pretend to be an exhaustive review of the literature; instead we aim to present an overview of some of relevant studies related to spill-overs on the host country.

2.7.2. A survey of evidence of the spill-over effects of FDI

Empirical evidence is not conclusive and suggests both positive and negative effects of the existence of spill-overs of MNCs on local firms. We can identify two kinds of academic literature in developing and developed countries looking at the spill-over effects: industry-level studies using cross-section data and firm-level panel data studies (see Table 2.7).

Most of the firm-level studies show positive correlation between foreign presence and the average value added per worker in the sector. These empirical econometric studies focus on productivity measures as a proxy measure for technology diffusion.

The first generation or cross-section studies generally find positive correlation between foreign presence and sectoral productivity. For instance, Blomström and Persson (1983) determine whether differences in technical efficiency of Mexican plants result from spill-over efficiency related to foreign investment. The authors find that labour productivity is positively influenced by foreign presence in an industry.

In addition, Blomström and Wolf (1994), look at the productivity spill-overs between domestic and foreign firms in Mexico in 1970 and 1975. Their results suggest that an increase in the share of multinationals in an industry increases the total productivity level of the whole industry. This might be simply the effect of greater presence of MNCs as they have higher productivity than local firms.

Sjöholm (1999) analyses the effect of FDI on productivity using micro-data from the Indonesian Manufacturing sector in 1980 and 1991. Results show that spill-overs effects of FDI are positive in industries with high degree of competition and sectors with high-technology gaps.

However, because of most of these studies use cross-section data the disadvantage is that we cannot make inferences of the direction of causality. For instance, it is likely that the positive correlation can be associated with the fact that multinationals tend to concentrate in high-productive industries rather than by genuine productivity spill-overs. In addition, the presence of MNC in the host economy may force less productive firms to exit and MNCs may increase their market share and as a result the average productivity in the industry will increase.

The second type of studies looking at the spill-overs of FDI on local firms use firm-level panel data. These studies analyse whether the productivity of domestic firms is correlated with the extent of foreign presence in the sector (Hadad and Harrison, 1993; Aitken and Harrison, 1999; Djankov and Hoekman, 2000). These studies cast doubt on the existence of spill-overs of FDI in developing countries as they find negative horizontal spill-overs.

Hadadd and Harrison (1993) examined whether differences in technology gap between locally-owned firms and foreign plants have an impact on spill-overs in Morocco. The authors find that higher levels of foreign investment are not associated with high productivity levels among domestic firms.

Similarly, Aitken and Harrison (1999) provide another test of the spill-over hypothesis and analyse a panel of more than 4,000 plants from 1976-1984 in Venezuela. The authors find that foreign ownership is negatively correlated to productivity of domestic plants.

Djankov and Hoekman (2000), analyse firm-level data in the Czech Republic from 1992-1996 and conclude that FDI has a positive effect on recipients firms' total factor productivity growth. However, the positive effect is only for affiliates of MNCs and not for joint ventures and firms that do not have any foreign partnership.

Lopez-Cordoba (2003) uses a panel of Mexican plants from 1993-1999 to estimate the impact of NAFTA on total factor productivity. The author finds that FDI, increased import competition and more access to the US market has a positive impact on TFP. However, intra-industry spill-overs are negative.

Empirical evidence for industrialized economies tends to be more positive. For instance, Haskel, Pereira, and Slaughter (2007), use a plant-level panel data for the UK manufacturing industries from 1973 to 1992 and find that FDI is positively correlated to TFP growth of UK plants. The authors note that there can be little doubt that local firms in the United Kingdom have enough absorptive capacity to benefit from the introduction of newer technologies by multinationals, so if spill-overs do not occur, they can not be attributed to the limitations of domestic firms. Finally the authors make some interesting predictions suggesting that a 10 percent-point increase in foreign presence in a UK industry raises the TFP of that industry's domestic plants by nearly 5 percent.

As we can observe from previous empirical evidence, there are both positive and negative impacts of FDI of on the domestic economy. The likelihood of positive effects on the domestic economy depends on specific elements such as: the size of the technological gap between MNCs and the economic activities in the host country, the nature of competition in the industry, the geographical proximity between MNCs and local firms, market size, the absorptive capacity of the domestic firms, the local content regulations (Blomströng and Kokko, 1998; Navarretti and Venables, 2004; Hoekman, Maskus and Saggi, 2005). For this reason it is difficult to identify generalized positive effects on domestic activities.

Javorcik (2004), criticized previous authors who found negative spill-over effects and argued that they might have been looking at the wrong place as spill-overs of FDI are more likely to be vertical than horizontal (eg. backward linkages through contracts between domestic suppliers of intermediate inputs and MNCs). The author stresses that in these studies it is not possible to distinguish between indigenous and foreign owned suppliers, with follow-source suppliers because data sets do not include such information. For this reason, vertical linkages have received more attention in the recent academic literature, with increasing number of studies analysing the spill-overs generated through vertical linkages (Javorcik, 2004; Ivarsson and Alvstam, 2005; Giroud, 2007).

Javorcik (2004), examined backward linkages and technology spill-overs using data from Lithuanian manufacturing firms from 1996 to 2000. The results show that productivity is positively affected by a sector's contracts with multinational customers but not by the presence of MNCs in the same industries. Thus, her results support the existence of vertical spill-overs from FDI.

On the other hand, qualitative studies have also been conducted using semi-structured questionnaires to analyse the vertical linkages of MNCs on domestic supplier firms in different developing countries. Ivarsson and Alvtam

(2005), use firm-level data from the heavy truck and bus plants of AB Volvo in Brazil, China, India and Mexico to analyse the extent in which domestic suppliers are able to compete with international follow-source suppliers and improve their operations through technological assistance from their transnational corporations buyers. The authors conclude that a significant proportion of the domestic suppliers, with the exception of Mexico have been provided with technological assistance by Volvo as part of the business relationships. In the case of Mexico, the relatively low level of technological upgrading can be explained by two reasons. Firstly, the short period that Volvo was operating in Mexico by the time the research was conducted. Secondly, Volvo was established in 1998 in Mexico through 100 percent acquisition of the country's largest bus and truck producer (MASA). The main product consisted of an upgraded version of a former MASA model, in which domestic suppliers hold cost and skill advantages. Therefore, Volvo continued using around 80 percent of the previous MASA suppliers and the managers even indicated that due to the long experience of the suppliers it was rather domestic suppliers who transfer technological competence to Volvo.

Similarly, Giroud (2007), looks at the vertical linkages of MNCs operating in either the electronics/electrical sector or in the textiles and garment sectors in Vietnam and Malaysia. Results show that locally-owned suppliers in Vietnam did not benefit from foreign firms' superior technology and managerial expertise, to the same degree as Malaysian firms. One of the explanations the author provides is that foreign firms recently entered to Vietnam and have not fully developed their network of local suppliers.

Table 2.7 Evidence on the Spill-overs from FDI on host economies

Authors	Sample	Main Results	Issues
Cross-section			
Blomström and Persson, (1983)	Mexico 1973	• Labour productivity is positively correlated by foreign presence in an industry.	Cross sectional data do not control for time invariant differences in productivity across sectors, which might be correlated with, but not caused by, foreign presence.
Blomström and Wolff, (1994)	Mexico 1970	• Higher foreign shares are associated with positive spill-overs.	
Sjöholm (1999)	Indonesia 1980, 1991	• FDI has positive spill-over effects on productivity of domestic plants. Positive spill-overs to local plants are higher in industries with high competition and possibly in industries with high technology gaps.	
Panel Data			
Haddad and Harrison (1994)	Morocco 1985-1989	• There is not significant evidence that foreign presence has an impact on productivity growth of domestic firms in the sector.	Fixed-effects estimation does not deal with the simultaneity biased that result from the dependence of factor inputs on productivity levels and exit decisions.
Aitken and Harrison (1999)	Venezuela 1976-1989	• Foreign ownership has a positive relationship with plant productivity but only in small enterprises. • Productivity in domestically owned plant decreases when foreign investment rises. • Overall the net effect of foreign ownership on the economy is small.	
Djankov and Hoekman (2000)	Czech Republic 1992-1996	• Positive spill-overs of FDI on local firms' productivity. But there is a negative effect of FDI on joint ventures and on firms that do not have foreign ownership.	
Lopez-Cordoba (2003)	Mexico 1993-2000	• FDI has a positive impact on TFP, however there are negative intra-industry spill-overs.	
Javorcik (2004)	Lithuania	• Positive spill-overs of FDI on productivity taking place through contract between foreign affiliates and their local suppliers in upstream sectors.	

Source: Alfaro and Rodriguez Clare, 2004, pp. 118-119.

Finally, recent changes in MNCs strategies[9] have reduced the opportunities for many suppliers in developing countries to improve their technological competence through local linkages with foreign affiliates and even to participate in GVC (UNCTAD, 1999, 2001; Humphrey, 2000; Humphrey and Salerno, 2000; Humphrey and Memedovic, 2003; Ivarsson and Alvstam, 2005). As a result, domestic suppliers face a tougher competition from follow-source suppliers. Ivarsson and Alvtam (2005), found that almost all international TNC

[9] For instance some automobile producers prefer to use the same suppliers in different countries (follow-sourcing).

suppliers are also follow source suppliers in Brazil and India, while non-follow source suppliers have taken small shares of local purchases in Mexico and China respectively. Although we can not generalize their results, we have to keep in mind that follow-source suppliers hamper the opportunities of domestic suppliers in first instance to engage in outsourcing agreements and also to gain technology and knowledge from the lead firm.

2.7.3. Global Value Chains

Drawing on GVC[10] literature this section tries to identify the key concepts and channels that help us to understand how suppliers in the developing world engaged in outsourcing can upgrade their technology and organizational practices, as Schmitz (2005) pointed out:

> *"Enterprises are not exporting into an anonymous global market; often they feed into supply chains that are governed by powerful global actors. Value chain analysis demonstrates that the relationships with these global actors exert a major influence on upgrading and earning opportunities of local enterprises, (pag.3-4)"*

In this sense, this approach is useful as it analyses the alliances and interactions between lead firms (buyers) at one end of the chain and suppliers at the different levels of the value chain. These alliances create different kinds of "governance" structures within the value chain, and upgrading is possible according to the governance structure. Governance is defined as the non-market coordination of economic activity and reflects the balance of power

[10] The GVC framework was developed by researchers at the Institute of Development Studies (Sussex). One of the main concerns of the GVC analysis is to investigate the governance structures in different global industries. It also attempts to understand the varying governance structures both within, and between different sectors in terms of varying knowledge characteristics.

between buyers and suppliers (Schmitz, 1999; Humphrey, 2000; Gereffi, 2001; Kaplinsky and Sturgeon, 2001; Humphrey and Schmitz, 2002b).

Under the global value chain there is a lead firm that in most of the cases is established in a developed country and comprises not only multinational firms but also large retailers, and brand-name firms. These firms play an important role organizing the production chain and deciding what is to be produced, how and by whom (Gereffi, et. al, 2001). The main question underlying GVC's literature is how participation in value chains can facilitate upgrading for developing country firms.

Upgrading is one of the main concepts in the GVC approach and refers to the process in which local producers have the opportunity to learn and improve the product or the process from global leaders of the chain that may be buyers or producers. Four types of upgrading are distinguished in the literature:

Process upgrading: firms can increase the efficiency of internal processes by re-organizing the production system or introducing more modern technology to attain consistent and high quality, and increase the speed of response (e.g. footwear producers in the Sinos Valley: Schmitz, 1999).

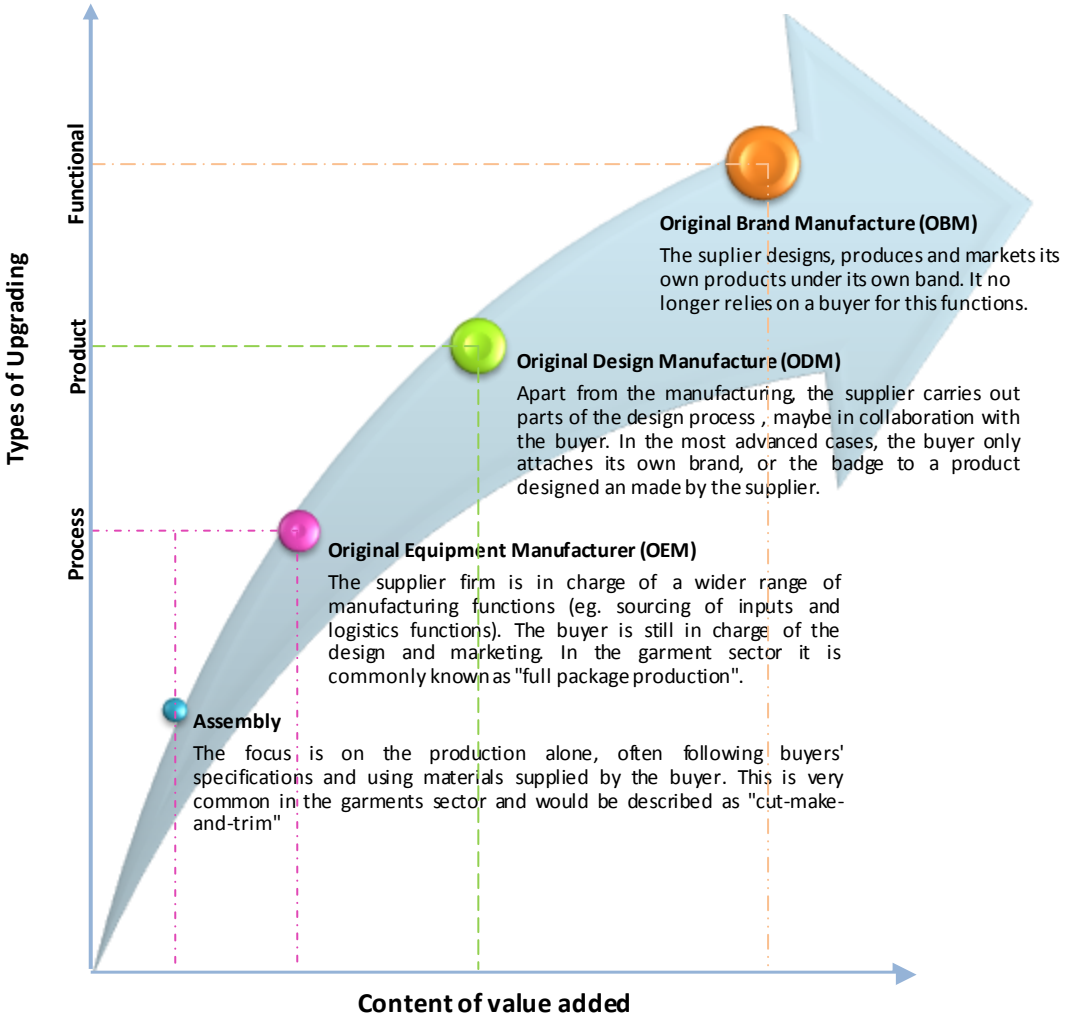
Product upgrading: occurs when firms move into more sophisticated products or introduce new products. For instance, Dolan and Humphrey (2000) argue that in the fresh vegetable sector, supermarkets drive product upgrading by introducing more sophisticated processing and packing, as well as completely new product lines.

Functional upgrading: is increasing value added in the chain by introducing superior functions, such as design or marketing or abandoning existing low-value added functions to focus on higher value added activities (e.g. Torreon's blue jeans industry upgrading from maquila to "full-package" manufacturing: Bair and Gereffi, 2001).

Intersectoral upgrading: by applying the know-how acquired in a specific function to move into a new sector. For example, in Taiwanese firms use their competence in producing TVs to make monitors and therefore move into the computer sector (Humphrey and Schmitz, 2002b).

Humphrey, 2004 distinguishes four stages of the upgrading trajectory that has been drawn from the successful experience of East Asia (see Figure 2.3). According to the author, the upgrading trajectory is seen as a process in which firms acquire capabilities and once they have reached a certain level, the firms are able to find foreign buyers wishing to buy products embedding these capabilities.

Figure 2.3 Upgrading Trajectory



Source: Adapted from Kaplinsky and Morris 2002, p. 40; and Humprey 2004, p. 8.

Although the analysis of GVC mainly focuses on case studies based in specific industries (e.g. garments, leather, and footwear) and countries; it has offered a deep perspective to understand the interrelations between suppliers and buyers within the value chain. These interactions are very important, because they play a key role in determining the level of upgrading to domestic suppliers. The GVC literature identifies a whole range of relationships between local producers and global lead firms in the value chain spanning from arm's length to hierarchy (see Table 2.8)

Table 2.8 Firm relationships in GVC

1. *Arm's length or market*: in this relationship the buyer and supplier do not need to develop a close relationship because the product is standardized, or is ordered on a made-to-order on the basis of predefined options, or the buyer provides the drawings. In this case, the supplier has the capacity to produce the product ordered by the buyer implying that the supplier will meet the requirements established such as quality, reliability, time of delivery, etc. The export of primary commodities like coffee and steel is an example of relationship.
2. *Networks*: firms co-operate in a closer information intensive relationship, and divide the essential value chain competences between them. In this type of relationship, the buyer may specify certain process standards to be reached, and the supplier must be confident enough to work out how to meet them.
3. Quasi-hierarchical relationships: occurs when the two parties are not joined by ownership, but engage in a long-term relationship. One firm exerts a high degree of control over the firms in the chain "governor", in most of the cases this firm specifies the characteristics of the product to be produced, and sometimes it can even indicate the process to be followed and the control mechanisms to enforce them. The governor sometimes helps producers to meet the standards and audits the performance of producers.
4. Hierarchy: the lead firm or buyer takes direct ownership of developing country operations of the chain.

Source: Humphrey and Schmitz, 2002a; UNIDO 2004; Schmitz, 2005.

As it was mentioned above, the upgrading prospects of the local suppliers differ according to the type of value chain they feed into. This implies that different forms of chain governance have different upgrading impacts (Humphrey and Schmitz, 2002a).

In a systematic and comparative study to determine the implications for developing country producers, Humphrey and Schmitz (2000), conclude that:

- The participation in a quasi-hierarchical chain offers more favourable conditions for fast process and product upgrading but hampers functional upgrading.
- Chains characterized by market-based relationships, process and product upgrading tend to be slower (not encouraged by global buyers), but there are greater chances for functional upgrading.
- Finally, chains characterized by even networks offer the ideal conditions for upgrading; they are less likely for developing country producers because of the high level of competences required.

A rather different classification of governance is proposed by Gereffi (1994) under the context of Global Commodity Chains[11] (GCC). The author identifies two types of governance structures: producer-driven and buyer-driven chains.

[11] The Global Commodity Chain (GCC) framework was proposed by Gereffi in 1994. Like the GVC approach, the GCC framework tries to understand how global industries are organized identifying the full list of actors that are involved in the production and distribution of a particular good or service. It tries to map the different kinds of relationships that exist between the different actors involved in the chain. However, the GCC approach does not differentiate between different network forms, and fails to capture the diversity of inter-firm relationships that exist. It is also unable to model how the possibilities for coordination between links in the chain are affected by dynamic processes of technological change and learning at the firm and industry level (Bair, 2009). Therefore, the GVC approach tries to overcome these limitations by delineating the varying governance structures both within, and between different sectors in terms of varying knowledge characteristics (Coe, Dicken and Hess, 2008).

Producer-driven chains are characterized by vertical integration and refer to those industries in which TNCs or large integrated industrial enterprises play the central role in controlling the production system (including its backward and forward linkages). They are more prevalent in capital and technology-intensive industries such as automobiles, aircraft, electrical machinery, software, etc.

Whereas buyer-driven chains highlight the global sourcing networks established by retailers, brand-name merchandisers and marketers and rely a lot on sophisticated logistics and performance trust between numerous contractors. Buyer-driven chains dominate in relatively low-labour intensive activities (e.g. garments and footwear, toys, consumer electronics, etc.) and production is generally carried out by independent Third World factories that make finished goods rather than components or parts under OEM agreements. The specifications and designs are provided by the buyers and the supplier firms have to meet all the requirements.

2.7.4. Case Studies of Upgrading effects in GVC

The previous section outlined the main concepts of the GVC literature, this section aims to examine some relevant empirical papers in the area in four key-sectors – textile and apparel, fresh fruit and vegetables, home-furnishing, and automotive and components sector. We have selected these sectors because producers in low-income countries are increasingly participating in GVC in these sectors, which are regulated predominantly by external global firms. One of the main shortcomings of the GVC approach is that it offers evidence of few countries and industries. Therefore, results cannot be generalized, but they are helpful to understand the governance between the different actors participating in the GVC and the channels for industrial upgrading.

A commonly sector analysed in the GVC literature corresponds to the apparel value chain. This GVC is governed by three types of lead firms: retailers[12], marketers and brand manufacturers established in developed countries mainly the United States and European countries (United Kingdom, Germany, Spain, etc). In a study of the apparel value chain in the North American market, Gereffi and Memedovic (2003) distinguish two models of competition: the East Asian New Industrialized Economies (NIEs), Mexican and Caribbean basin model. Each model offers different opportunities and challenges for industrial innovation and learning. However, the East Asian NIEs[13] countries are generally taken as the archetype for industrial upgrading in developing countries, since firms in these countries became full-range package[14] suppliers for foreign buyers, and developed an innovative entrepreneurial capability. Hence, the East Asian NIEs economies turned from assemblers into Original Equipment Manufacturers and some firms are even pushing beyond the OEM to OBM by integrating their manufacturing expertise to design and sell their own branded goods. One of the key elements for their success is that they build up trust through successful business transactions with the United States' buyers which enabled them to use their OEM expertise internationally via triangle manufacturing[15]. The creation of these global sourcing networks helped East Asian NIEs countries to maintain their competitiveness and to go beyond OEM by shifting to higher-value upstream products (e.g. exports of textiles and fibres rather than apparel).

In the case of Mexico and the Caribbean basin the authors point that production sharing is centred on the region's low wages and proximity to the

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[12] In the United States the five largest retailers are Wal-Mart, Sears, Kmart, Dayton Hudson Corporation and JC Penney which in 1995 concentrated 68 percent of all the apparel sales in the country. In contrast, in the United Kingdom Marks & Spencer and the Burton Group controlled over the 25 percent of the market in 1994 (Gereffi and Memedovic, 2003).

[13] Hong Kong SAR, Taiwan Province of China, Republic ok Korea and China.

[14] Full-package production changes the relationship between buyers and suppliers in a way that it is more beneficial for suppliers because it increases their bargaining power and learning potential for industrial upgrading.

[15] Triangle manufacturing developed, because East Asian manufacturers became intermediaries between the United States' buyers and apparel factories in Asia and other developing regions in order to take advantage of lower labour costs and quotas.

United States. In fact, most of the production is low value-added, which is a direct result of the establishment of the offshore assembly scheme (806/807). Under this scheme companies engaged in production sharing have the incentive to minimize locally sourced inputs, because only components made in the United States are exempt from import duties provided the finished product is shipped back to the US.

For instance, Mexico introduced the Maquiladora programme and domestic suppliers have to use United States' raw materials in order to gain duty-free access to the United States' market. A more detailed discussion of the Maquiladora programme is presented in Chapter 4.

In addition, the Caribbean Basin model has concentrated in the Export processing zones assembly using the 807/9802 trade-regime. Although countries of the Caribbean basin are expanding their position in the United States' market, basically through large assembly plants linked to the production sharing operations of United States' TNCs, these countries are losing ground to Mexican firms that can produce the same products at a cheaper price and with faster delivery times. Hence, countries in the Caribbean Basin have to develop new and stronger networks with United States' retailers and marketers if they want to move up to full-package production.

As we can observe, Mexico and the Caribbean basin countries are facing big challenges and different policies needs to be implemented if they want to compete with the East Asian NIEs. Probably, one of the main obstacles to increasing the integration between the export activity and the local economy has been the 806/807 scheme, since it has limited the benefits of production sharing as a stepping-stone to higher stages of industrialization.

Dolan and Tewai (2001) analyse the horticulture sector in Kenya and the textile/apparel sector in India. Both cases correspond to buyer-driven commodity chains where the product and quality standards are set by the buyers and retailers who also keep control of the brands, retail and distribution. The authors find that the governance structure of these two value-chains offers opportunities for learning and skill acquisition for the producers who participate in the chain. For instance, the close interaction with the buyers has allowed the firms to improve their quality, reliability and innovation. In fact, the imposition of food, safety and environmental standards, have promoted product, process and functional upgrading allowing suppliers in developing countries to reposition themselves in global markets. However, these opportunities do not involve firms outside the chain. This can be a major problem for other small firms who do not have the competences and knowledge to meet the requirements of the global buyers.

Fromm (2007), reaches the same conclusion in a study of 102 small producers participating in agro-food chains in Honduras. The author finds that producers not complying with the standards are excluded from participating in GVCs. However, those firms fulfilling the requirements set by the buyers have implemented product and process upgrading activities and a small number of them have undergone functional upgrading.

The conclusions drawn by Fromm (2007); and Dolan and Tewai (2001), enrich the arguments on the debate of "*winners and losers of globalisation*", which is one of the main concerns in developing countries where there were high expectations to take advantage of GVC as a channel for local upgrading and industrialisation. But as we can see SME have been excluded. This concern has recently been raised by the UNCTAD and in 2010 it published a report in which analyses how to integrate developing countries SME's into GVC. The results aim to draw some policy recommendations to enhance the role of SME's in GVC. The study includes three economic sectors: software,

automotive components sector[16] and the cinema and audiovisual sector. We present only results of the automotive components sector as the analysis focuses on one case study of Mexico.

In the automotive component sector, the report argues that over the last decade TNC car manufacturers have adopted a policy to significantly reduce their number of suppliers to increase their competitiveness. TNCs tend to rely more on global first-tier suppliers that organize the downstream activities of the value chain and that can supply OEM. In this sense, the study finds that in South Africa and Mexico many independent suppliers have not managed to either link with global sourcing partners or upgrade their own capabilities to reach OEM standards. Suppliers in both countries argued that their role in GVC was further limited by three factors: lack of appropriate skilled labour, lack of infrastructure (particularly roads and electricity), and lack of finance to upgrade to meet international standards. In Mexico, most of the second-tier and third-tier suppliers asserted that it was very hard to supply TNCs since in most of the cases they import inputs from abroad[17], using little raw materials produced in the country.

A rather more positive perspective of the upgrading effects of GVC is presented by Ivarsson and Alvstam (2010), who analysed the upgrading opportunities offered by IKEA to its suppliers in China and South East Asia in 2008. The authors show that IKEA, provides its suppliers in China and South

[16] For the case study of the automobile sector, UNCTAD interviewed suppliers of Toyota in South Africa and of Volkswagen in Mexico.

[17] During my fieldwork in Mexico (Aguascalientes) I conducted a few interviews with first-tier and second-tier Nissan's suppliers and I visited Nissan's assembly plant. The results that I obtained from the interviews were similar to the ones of the UNCTAD. For instance, all of the first-tier suppliers I interviewed, expressed that most of their raw materials were imported (e.g. glass for the windshields was imported from United States, steel and painting for the car came from Japan). The few raw materials acquired in Mexico have a very low technological content (eg. packing boxes, screws, etc.). In addition, in an interview with one of the Nissan's managers, I asked the number of Mexican suppliers that they were working with. This person expressed that they were working only with one Mexican supplier which supplied the uniforms for the factory workers. We can observe also a lack of linkages between Mexican firms and Nissan. In fact, one of the interesting points raised by one of the suppliers when I asked about the key factor to establish a supplier relationship with Nissan was that: "*You have to be a Japanese company if you want to make business with Nissan*".

East Asia with significant technological support to improve their products and processes. Moreover, the authors suggest an additional governance structure called "*developmental*" which falls between market and hierarchy. In this structure, GVC are governed by large buyers whose outsourcing strategy is deliberately designed to promote technological upgrading among less capable suppliers. This also is more likely to occur when product specification for products can partly be codified, when the complexity of the business transaction is higher than the capability of the suppliers, and when the lead firm wishes to closely monitor the cost development, product quality, and production processes of the suppliers. However, the results of the upgrading effects to IKEA suppliers cannot be generalized as it is based in one case study. But it is interesting to note that the company has an approach to develop its suppliers.

2.7.5. Learning by Exporting

> *"When local goods are exported the foreign purchasing agents may suggest ways to improve the manufacturing process (Grossman and Helpman, 1991, p. 166)."*

An extensive number of theoretical and empirical papers have attempted to understand the relationship between productivity growth and exporting (Bernard and Jensen, 1999; Bernard and Wagner, 1997; Clerides, Lach and Tybout, 1998; Wagner 2007 and Crespi, Greenaway and Kneller, 2007, Criscuolo and Haskel, 2008). These papers have centred attention to analyse: a) the relationship between productivity and exporting and the direction of the causality in this relationship; b) the self-selection argument which states that more productive firms tend to go into export markets; and c) the "learning by exporting" hypothesis arguing that exporting is a channel for firms and plants to increase productivity by exposing producers to new technologies. In this sense, foreign customers will suggest ways to improve the manufacturing process product design, and the quality of the good.

The evidence is quite clear and shows in most of the cases that exporters have higher productivity, and very often a higher productivity growth than non-exporting firms (see Table 2.9). These results are consistent even after controlling for firms' specific observed characteristics like industry and size. It has also been found that exporters tend to be larger, more capital-intensive, and pay higher salaries than non-exporters, but this may be a cause and not a consequence of their participation in the export markets (Fernandes and Isgut, 2005).

Many authors argue that the strong positive correlation between productivity and participation with the export markets reflects the self selection of better firms into export markets rather than the effect of exporting on productivity (Clerides, et al., 1998; Bernard and Jensen, 1999; Alvarez and Lopez, 2004).

In this sense studies analysing the self selection hypothesis generally find that future export starters tend to be more productive than future non-exporters, years before they decide to export, and very often firms/plants have higher ex-ante productivity growth rates. In other words, the good firms move abroad. These results have been consistent in several empirical studies, eg. Aw and Hwang (1995) on Taiwanese data; Clerides et al. (1998) on data for Colombia, Morocco and Mexico; Bernard and Jensen (1999) on US data; Roberts and Tybout (1997) on a sample of Colombian enterprises; Bernard and Wagner (1997) on German data; Girma et al. (2005) on UK firms, Damijan et al. (2004) on Slovenian data; and Alvarez and Lopez (2005) on data for Chilean plants.

In contrast, evidence regarding the post-entry mechanisms such as learning-by-exporting hypothesis is more mixed. Wagner (2007) provides a review of 54 empirical studies covering 34 countries and finds that exporters are more productive than non-exporters, and that more efficient firms self-select into exports markets. But in the case of the learning-by-exporting hypothesis the author finds that post-entry differences in the performance between export-starters and non-exporters are usually not statistically significant; suggesting

that exporting does not necessary promote learning. This is particularly evident in developed countries[18] where firms are already on the technological frontier, using advanced technology and operate in an efficient context.

Therefore, the learning effect is hard to take place in such environment. While in developing countries the scope for learning through exports is greater. For instance, developing country firms can take advantage of export activity through technology transfers and contracts with more efficient firms, especially if they export to a developed or more competitive market. Recent research by, Blalock and Gertler (2004) for Indonesia; Fernandes and Isgut (2005) for Colombia; Van Biesebroek (2006) for Cote d'Ivorie; De Loeker (2007) for Slovenia have found evidence that an increase in productivity is related to firms' exposure to exporting.

[18] However, this is not always true as Seri and Tomasi (2008) have more recently found evidence of learning-by exporting in Italy. Although Italy is a developed country, its productive system is less competitive than other European countries which are its trade partners. This opens the opportunity for more positive effects resulting from exporting.

Table 2.9 Selective Review or Learning-by-Exporting (LBE) studies using plant-level data

Authors	Sample	Main Results	Evidence LBE
Clerides, Lach and Tybout (1998)	Colombia (1981-1991)	• Labour productivity is higher for exporting firms than for non-exporters • Labour productivity is higher for export starters than for other groups of firms • Productivity improves after firms start to export • More efficient firms become exporters	No Some for Morocco
Bernard and Jensen (1999)	United States 1984-1992	• Firms that become exporters grow faster • Exporters are 12%-19% more productive • Exporters pay higher wages • Exporting plants increase their probability of survival	No
Aw, Chung and Roberts (2000)	Taiwan (1981, 1986, 1991) and Korea (1983, 1988, 1993)	• Total factor productivity is higher for exporters than for non-exporters in both countries.	Some (Taiwan)
Baldwin and Gu (2003)	Canada 1974-1996	• Labour productivity is higher for exporters than for non-exporters and this difference increases over time	Yes
Blalock and Gertler (2004)	Indonesia (1990-1996)	• Firms that become exporters experience a jump in productivity of about 2% to 5%	Yes
Alvarez and Lopez (2004)	Chile (1990-1996)	• Firm that enter into the export markets have higher labour productivity and total factor productivity than non-exporters.	No
Fernandes and Isgut (2005)	Colombia (1981-1991)	• Total factor productivity increases 4%-5% for each additional year a plant has exported. • There is strong evidence of learning by exporting, particularly in a) plants producing in industries that deliver a large percentage of their exports to high-income countries and b) in plants with larger volume of exports.	Yes
Damijan and Kostevc (2006)	Slovenia (1994-2002)	• Perceived learning effects may only a result of increased capacity utilization brought by the opening of an additional market.	No
De Loeker (2007)	Slovenia (1994-2000)	• Export entrants become more efficient only after they start exporting • The productivity is higher for firms exporting their products to high income regions.	Yes

Source: Fernandes and Isgut, 2005; Wagner, 2007; and Martins and Yang, 2009.

We are particularly interested in the third hypothesis, as in our sample many of the supplier firms involved in outsourcing are exporters. For this reason, we suspect that exporting may be another channel for domestic suppliers to gain knowledge and technology transfer from the lead firms. For instance, supplier firms participating in international markets are exposed to more intense competition leading them to improve faster than supplier firms who sell their products exclusively in the domestic market.

2.8. Conclusions

The chapter aimed to present relevant theories that help us to construct a framework to analyse outsourcing from the perspective of the supplier firm. Particularly we wanted to answer these questions: how to measure outsourcing?; what are the characteristics of the supplier firms involved in outsourcing?; and which theories help us to understand likely benefits for the supplier firms involved in outsourcing?. As opposed to most of the available literature on the topic, we tried to address these issues from the perspective of the supplier rather than from the lead firm.

Before reviewing the literature to answer these questions, we presented the concepts of outsourcing, off-shoring and subcontracting. Moreover, we proposed the concept of outsourcing based on the concepts reviewed and in our data available for the empirical analysis.

Then we presented a theoretical conceptualization of outsourcing from a developing country perspective. This conceptualization was proposed by (Taimaz and Kiliçaslan 2005), who suggest three theoretical approaches (dualistic approach, developmental approach and the networks/clusters approach) to understand the main drivers of outsourcing from the perspective of the supplier. We then proposed a fourth conceptualization, based on Coase's theory of transaction costs.

Regarding our first question on the measurements of outsourcing, we found out that outsourcing has been hard to measure. The first attempts to measure the phenomenon used macro-data (trade data), but trade data can lead us to misleading results because it fails to differentiate between assembled goods and components. To overcome this problem, more recent studies use micro data at the firm level which seems to give more accurate results. In this thesis, therefore firm level data will be used to analyse the Mexican case.

In the case of our second question, we reviewed papers related to the characteristics of both lead firms and supplier firms engaged in outsourcing. Evidence in different developed countries suggest that lead firms involved in outsourcing are larger, more productive, invest more in research and development, are exporters and labour costs are higher. For this reason they tend to outsource to reduce production costs. On the suppliers' side, evidence in the Turkish textile industry suggests firms are smaller and subcontracting relations entail unequal power relations as suggested by the dualistic approach.

Finally, to analyse the likely benefits of outsourcing to supplier firms, we propose that the theories of FDI, GVC and Learning by exporting as the frameworks that can provide elements to analyse the channels through which suppliers can gain technology transfer, training and organisational techniques. In the case of spill-overs of MNC to local firms, the evidence shows mixed results suggesting both positive and negative effects. In fact empirical, evidence for industrialized economies tends to be more positive. For developing countries, the likelihood of positive effects depends on specific elements such as the size of the technological gap between the MNCs and local firms, market size, the absorptive capacity of the domestic firms and the local content regulations. Moreover, recent changes in the strategies of MNCs have also reduced the opportunities for many suppliers, as they face tougher competition from follow-source suppliers.

In addition, the theory of GVC helps us to understand the upgrading trajectory of supplier firms involved in outsourcing and the governance structures that are key determinants. One of the concerns is that SMEs can be left outside of participating on value chains because they lack skilled labour, infrastructure and monetary resources to meet international standards.

As many of the supplier firms involved in outsourcing in Mexico are exporters, we decided to include the learning by exporting theory to see if it can contribute to the understandings of the likely benefits of engaging in outsourcing. Evidence is clear and suggests that exporters have higher productivity, are larger, more capital-intensive, and pay higher salaries than non-exporting firms. However, this might reflect the self selection of better firms into export markets rather than the effect on productivity.

To conclude, from the literature reviewed we cannot assume that by engaging in outsourcing suppliers in developing countries will automatically upgrade their technology and skills. The spill-overs or upgrading effects depend upon the decisions of the lead firms or the governance structure of the value chain. So, it will be interesting to see in the case of Mexico what are the characteristics of the firms involved in outsourcing, and to analyse whether these firms are benefiting in terms of technology and knowledge transfer.

Chapter 3 Off-shoring and Outsourcing in the Global Economy

3.1. Introduction

The globalisation process has encompassed a disintegration of the production process across the world. A well known and classical example to illustrate the fragmentation of the production process also known as outsourcing is the production of the Barbie doll described by Tempest, (1996).

The Barbie doll is one of the most profitable and global toys in history and sells at a rate of two per second and this product alone accounted for $1.4 billion in sales for Mattel in1995. Its biggest market is in the United States, but it can also be found in 140 countries around the world. Paradoxically, this toy has never been produced in the United States. The first doll was produced in Japan in 1959, when the country was recovering from the Second World War and Japanese wages were low. As wages increased in Japan, the production of the doll moved to low-wage countries in Asia.

Barbie is designed in the United States, but the body and wardrobe are produced in several countries. The raw materials for the doll (plastic and hair) are obtained from Taiwan and Japan. Assembly used to be done in those countries, as well as in the Philippines, but due to higher labour costs it has now migrated to Indonesia, Malaysia, and China. The moulds for the doll come from the United States, as well as the additional paints used in decorating. Other than labour, China supplies only the cotton cloth used for dresses. Of the $2 export value for the dolls when they leave Hong Kong for the United States, about 35 cents covers Chinese labour, 65 cents covers the cost of materials, and the remainder covers transportation and overhead, including profits earned in Hong Kong. The dolls sell for about $10 in the United States, of which Mattel earns at least $1, and the rest covers

transportation, marketing, wholesaling and retailing in the U.S. The majority of value-added is therefore from U.S. activity.

Hence, the production of this simple product captures the complexity of the world production process. This chapter aims to provide an overview of the phenomenon including the origins, driving forces, its significance in the world economy.

3.2. Origins of Off-shoring and Outsourcing

International outsourcing is not a new phenomenon; its origins go back to the beginning of the industrial revolution or even before it (Arndt and Kierzkowski, 2001). However, during the last decades it has come to the attention of policy makers and academics who noticed that a considerable part of the production process is occurring internationally.

In one of its earliest forms, this phenomenon was based on exploiting the relatively undifferentiated factor advantages of developing countries such as labour and natural resources (Hansen, et al. 2007). In other words, it was driven by comparative advantage and involved the production of primary commodities in developing countries that were exported for further processing to developed economies and finally shipped back (in part) as a processed good to the primary-commodity-producing country. For instance, iron ore was mined in Mauritania, shipped to Europe for processing into iron and steel and then some part of the final processed product was re-exported to Mauritania (Yeats, 2001).

In the 1950s and 1960s, a different form of production sharing between developing and developed countries emerged. The MNCs started to explore different ways of splitting up their processes of production not just in the traditional manner of the division of labour on the shop floor, but in a geographical sense. Hence, "offshore sourcing" where the materials and components of a final product were assembled or processed not in one or different plants in the home country, but in several plants in different countries began to account for a significant proportion of MNC activity. The advantage in relocating production from a developed country to a developing country for the MNC was the significant reduction of labour costs, whereas for developing countries the advantage relies in the creation of jobs.

The US MNCs played a key role in an attempt to remain competitive in relation to Western Europe and Japan. As an example, some American clothing firms started to outsource their production to Colombia, since it offered abundant cheap labour with sufficient skills, relative low costs of transportation, communications access and location in similar time zones, but because of the economic and political instability, American firms decided to substitute to sub-suppliers in East Asia (Jones, et al., 2005). At the same time, other Caribbean, Central and Latin American countries also started to participate into this production sharing scheme including Mexico, Haiti and Jamaica.

A further element facilitating the development of international production sharing was the establishment of the US offshore assembly provision[19] (806/807) since September 1962, later renamed the 9802 provision of the Harmonized System Code (Jones, et al., 2005). The scheme allowed goods to be assembled abroad from U.S. and brought back into the U.S. with duty only on the value added, mainly the (cheap) labour and overhead costs (Sklair,

[19] The United States created the Offshore Assembly Programme (OAP) through the provision of the Tariff Act of 1930. The original idea of the programme was to make easy the manufacturing practices of U.S. steel firms, many of which have plants in Canada and engaged in extensive cross-border shipments of intermediate inputs. Over the years, the program has expanded to include other industries and other countries (Hanson, 1997).

1989; Feenstra, Hanson and Swenson, 2000). The 806/807 provision has played a key role in U.S. multinationals' offshore sourcing strategy for the domestic market. For example, semiconductors, valves, tuners and other components started to be assembled for international electronic firms in Hong Kong, Thailand, Malaysia and Singapore. Wearing apparel and leather goods were also assembled in the Dominican Republic, Jamaica and the Philippines for transnational firms. In addition, many other industries transferred the production of parts of the different stages of the production to developing countries including television and radio receivers, sewing machines, calculators and other office equipment, electrical machinery, power tools, machine tools and parts, typewriters, cameras, optical equipment

For instance in 1969, six categories involving assembly work accounted for three-quarters of the total volume of US imports falling under 807 and 806.30 scheme (see Table 3.1).

Table 3.1 Total Volume of US Imports falling under remission of duty 807 and 806.30 in 1969

Category	Share of the total Volume of Imports
Semi-conductors	26.30%
Television Sets	19.10%
Electronic memory components	10.20%
Textiles	8.60%
Office Machines	8.30%
Toys and Dolls	5.90%

Source: Michalet, 1980.

The main countries where United States outsourced its production were (in order of decreasing importance): Mexico, Taiwan, Hong Kong, Singapore, South Korea, Jamaica, the Philippines and Haiti. In fact, Mexico alone supplied 40% by value of imports covered by the special tariff rate (Michalet, 1980).

As we can see from previous lines, the United States has exerted a significant role by triggering the fragmentation of the production process. However, if

we assert that it has been the only aspect, we will underestimate other elements that have also contributed to the growth of off-shoring and outsourcing. The following section presents the driving forces of off-shoring and outsourcing.

3.3. Driving Forces of Off-shoring and Outsourcing

The increasing trend of outsourcing and off-shoring has been triggered by different factors such as more open economic policies including trade liberalisation in a large number of countries; technical advances in transport and communication and the difference in labour costs between developed and developing countries (OECD, 2007a).

3.3.1. Liberalization Policy Reforms

Liberalization policy reforms such as the reduction of barriers to trade and investment have been considered significant variables that explain the growth of outsourcing (Jones and Kierzkowski, 2001; Yeats, 2001; Ernst and Kim, 2002; Athukorala, 2003; Yi, 2003). Such policies date back to the early 1970s as a response to the breakdown of fixed exchange rates and to cope with persistent stagflation. Since then, further measures to liberalize trade and investment have been undertaken (see Table 3.2).

Probably the most significant reductions of trade barriers were implemented during the Uruguay Round. For instance, developed countries reduced tariffs on a trade-weighted average basis by about 40% on industrial products (excluding oil), bringing their average tariff levels down from 6.3% to 3.8%. By contrast, developing countries reduced their tariffs by 20% on average. This brought average tariffs rates down from 15.3% to 12.3% (Irwin, 2002).

Tariffs have reduced for both developed and developing countries. Probably the formation of the European Union (EU) and the North American free Trade Agreement (NAFTA) accounted for most of the tariff reductions among developed countries (WTO, 2008).

Table 3.2 Evolution of the GATT/WTO international trade framework

Round	No. Countries	Major outcomes
Geneva Round (1947-8)	23	Concessions of 43 tariff lines
Annecy Round (1949)	29	Modest tariff reductions
Torquay Round (1950-51)	32	8,700 tariff concessions
Geneva Round (1950-51)	33	Modest tariff reductions
Dillon Round (1960-1961)	39	Tariff reductions following the formation of the European Economic Community (EEC). 4,400 tariff concessions exchanged
Kennedy Round 1963-67)	74	Average tariff reduction of 35% by developed countries Some 30,000 tariff lines bound Agreement on antidumping and customs valuation Moves to incorporate preferential treatment for developing countries
Tokyo Round (1973-79)	99	Average tariff reductions to one third by developed countries Codes of conduct established for interested GATT members on specific non-tariff measures
Uruguay Round (1986-94)	103 (1986) 117 by end 1993 124 by early 1995	Average tariff reduction of one-third by developed countries Agriculture , textiles and clothing brought into GATT Creation of the WTO Agreements on services (GATS), intellectual property (TRIPs), trade related investment (TRIMs) Most Tokyo round codes improved
Doha (2001-	150 countries	The objective of the round was to make trade fairer for developing countries. Although technical negotiations have look for specific formulas for reducing trade-distorting farm support and tariffs, high-level political discussions have yet to reached and produce a satisfactory compromise among WTO members for future agricultural trade liberalization.

Source: Dicken, 2004 and Hanrahan and Schnepf, 2007.

Table 3.3 reports simple and weighted tariffs on primary and manufacturing products, for selected countries during the last years. It illustrates that the reduction of tariffs has been more substantial in developing countries than in industrialized economies. For instance, while the United States reduced its tariffs on a trade-weighted average basis from 4% in 1989 to 1.9% in 2008; China's weighted average tariffs for manufacturing products decreased from 35.6% to 5.8%; or India's weighted average tariffs for manufacturing products reduced from 70.8% in 1990 to 5.9 in 2008.

Table 3.3 Tariffs for selected countries

		Primary Products		Manufacturing Products	
	Year	Simple Mean Tariff	Weighted Mean Tariff	Simple Mean Tariff	Weighted Mean Tariff
Developed Countries					
United States	1989	2.5	2	5.5	4
	2008	2.5	1	3.1	1.9
Japan	1988 a	8.3	4.4	3.5	2.7
	2008	4.9	1.2	2.3	1.6
Canada	1989 a	4.2	2.6	10.5	6.6
	2008	1.9	0.3	4.1	1.2
Developing Countries					
Brazil	1989	31.5	18.6	44	37.1
	2008	7.9	1.1	13.7	9.3
Bangladesh	1989	79.8	53.6	109	109.9
	2008	15.1	7.3	14.5	13.1
China	1992	36.1	14.1	40.6	35.6
	2008	8.8	2.4	8.7	5.8
India	1990	69.8	34.1	79.9	70.8
	2008	19.5	7.3	8.4	5.9
Korea Rep.	1998	19.3	8.3	18.6	17
	2008	20.7	11.6	6.6	4.8
Philippines	1988	29.9	18.5	27.9	23.4
	2008	6.0	5.2	4.8	2.7
Thailand	1989	30	24.3	39	35
	2008	13.5	2.1	10.4	5.8

[a/] Simple and Weighted tariff rates are most favour nations.
Source: World Development Indicators, 2005 & 2008.

The reduction of barriers to trade and investment indisputably promote the growth of production sharing schemes or outsourcing. For instance, with trade liberalization a domestic firm may choose to purchase the intermediate good from a more efficient foreign producer rather than obtain it from the domestic market. Or it might invest to set up a plant in a developing country

either to produce some parts and components needed for the final good or to perform the assembly of one of the stages of the production process.

Although in the theoretical literature economists argue that reductions of trade barriers are positively correlated with the growth of outsourcing, there is not substantial empirical evidence proving this correlation. Probably the lack of studies in the area is related to the fact that the bulk of the empirical evidence (Rose, 1991; Baier and Bergstrand, 1999) has been devoted to proving the impacts of tariffs on the growth of total trade rather than trade in parts and components.

However, Yi, (2003) develops a non-linear model[20] to assess the response of vertical specialization or outsourcing to changes in tariffs. The empirical study comprises aggregate US trade for selected years between 1962 and 1997. The results show that over 50% of the trade expansion can be explained by increased vertical specialization brought about by tariff reductions. In fact, the author points out that tariff reductions even of modest magnitudes produce large non-linear increases of trade in a model with stages of production.

In the case of investment, Hoon and Ho (2001) analysed the impact of foreign direct investment (FDI) on international fragmentation of production in Singapore. The results show that outsourcing is positively correlated to FDI. In other words, their results show that a 1% increase in FDI increases fragmentation by 0.58%.

[20] The non-linearity of the model is based in two facts. Firstly, tariff rates in the early 1960s have fallen by only about 11%, while trade growth during this period was larger. Secondly, tariff reductions prior to the mid 1980s were larger than after. However, trade growth was smaller in the earlier period than in the latest period.

3.3.2. Transport costs

The physical dispersion of the different stages involved in the production process introduces certain costs, particularly those of communication and transportation. For this reason, along with the restrictive trade policies, spatial separation of production was traditionally bounded to local or national markets (Arndt and Kierzkowski, 2001). The rapid developments and innovations in communication and transportation have reduced the costs and distance that once separated world's nations, and improved the speed, efficiency and economy of coordinating geographically dispersed production processes (Athukorala, 2003).

However, evidence suggests that transportation costs are estimated to be higher than tariffs. For instance, Anderson and Wincoop, (2004) suggest that in 2004 aggregate expenditure for shipping total imports was three times higher than aggregate tariff duties paid.

Three main types of transportation are identified: land transport; ocean transport; and air transport. Gathering data regarding the evolution of transportation costs is complicated due to the lack of data on direct measures of transport costs. But available data suggests that land is the cheapest mode of transport and most used mean of transport for countries sharing a border. For instance, in the European Union, it is estimated that 72 percent of trade volume is shipped through the road network (WTR, 2008). Hummels (2007), estimates that nearly 90 percent of trade between neighbouring countries and the United States occurs via land.

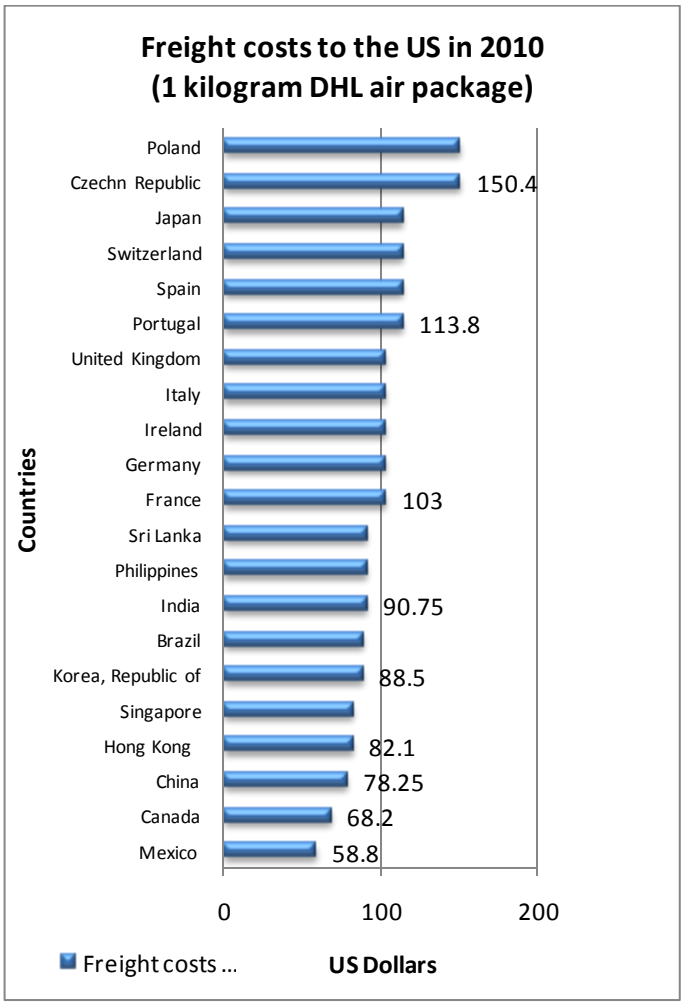
Trade without a common border takes place mainly via the ocean, particularly ocean shipping is the main mode of transportation for bulk commodities like oil, petroleum, iron ore, coal and grain.

Finally, air transport is the third type of transportation mode and the costs are measured in terms of revenue per-ton-kilometre. Evidence suggests that the

price has fallen by 92 percent between 1995 and 2004 and as a consequence the share of trade occurring via air has increased by 11.7 per cent per year from 1975 to 2004 (Hummels, 2007).

Figure 3.1 presents figures of freight costs to the United States in 2010. The data was gathered from the Word Development Indicators (2010), and freight costs are measured using the DHL international U.S inbound worldwide priority express rate for 1 kilogram air package presented in the World Development Indicators (2010). We can observe that the costs for the main trade partners of the States are lower than for other countries. For instance, shipping a package of 1 kilogram by air from Mexico to the United States costs US 58.8 in 2010.

Figure 3.1 Freight costs to the United States in 2010



Source: World Development Indicators, 2010.

Trade costs can either reduce or increase trade of goods. The World Trade Report (2008) states that transport costs and tariffs penalize goods produced in several stages across different countries, because producers need to pay to move their goods at each of the stages of the production process. Hence, a decline in the transportation costs will be beneficial for producers engaged in outsourcing and off-shoring.

Empirical evidence proving the correlation between outsourcing and costs of transportation and communication is reduced and limited to the analysis of trade in final goods. For instance, Baier and Bergstrand (2001), assess the impact of transport costs reductions on total world trade for a panel of 16 OECD countries from 1958 to 1960 and from 1986 to 1988. In the model, the effect of transportation costs reductions on trade growth is captured by the changes in the gross CIF-FOB factors. Their results show an approximately 8-9% of the growth of trade could be explained by transportation costs reductions.

In addition, a recent study by Jones, Kierzkowski and Lurong (2005), tests the hypothesis that reductions of service links[21] costs encourage the growth of international fragmentation of production (IFP). The data model comprises data from 1990 to 2000 and includes all world regions. Business telephone charges are used as a proxy to service links. The results show that service link is negatively correlated to IFP. In other words, lower service links prices promote trade in general, and benefit particularly trade in parts and components.

[21] A service link is a combination of activities, such as transportation insurance, telecommunications, quality control, and management coordination which guarantee that the different stages of production interact properly.

3.3.3. Labour Costs

One of the main elements that contributed to the early development of global production is labour costs or the significant gap in wage rates among developed and developing countries (Yeats, 2001). Wage differentials have acted as incentives for firms in developed countries to move unskilled labour intensive manufacturing processes to low wage countries. Comparisons of manufacturing labour costs are published on a frequent basis by the U.S. Bureau of Labour Statistics (BLS) covering data of 25 OECD countries and six non-OECD economies (Brazil, Hong-Kong, China, Israel, Singapore, Sri Lanka, and Chinese Taipei). China and India were not included, but in recent publications estimates for both countries were included (BLS, 2010). Table 3.4 illustrates average hourly compensation costs for production workers in the manufacturing sector from 1975 to 2008.

In 1975 wages in Mexico were 77 percent below those in the U.S., whereas Hong Kong and Taiwan were 88 percent and 94 percent below respectively. By using these foreign labour sources, U.S. corporations not only enhanced their own profitability from domestic sales, but also increased their ability to compete in third markets due to lower overall production costs. According to a study by Mckinsey, (2003) every dollar spent on off-shoring to India leads to USD 1.12 – 1.14 in benefits back home in the U.S. The benefits can be in terms of lower consumer prices and lower costs for businesses.

Table 3.4 Average hourly compensation costs[1/] for production workers in manufacturing, by selected regions and countries

1975-2008, U.S. Dollars

Region/country	1975	1980	1985	1990	1995	2000	2005	2008
Americas								
United States	6.19	9.67	12.76	14.88	17.24	19.73	23.6	26.65
Brazil	-	-	-	-	-	3.5	4.16	6.93
Canada	6.4	9.02	11.39	16.62	16.8	16.78	24.29	29.78
Mexico [2/]	1.43	2.16	1.55	1.54	1.43	2.16	2.65	3.12
Europe								
Czech Republic	-	-	-	-	2.54	2.85	6.07	10.35
Germany	-	-	-	-	26.17	19.62	28.64	36.07
Ireland	4.21	7.71	7.43	14.49	16.83	15.35	27.77	35.79
Poland	-	-	-	-	-	2.81	4.49	8.26
Portugal	1.7	2.21	1.64	4.01	5.73	4.85	7.76	9.83
Spain	2.47	5.75	4.55	11.1	12.47	10.46	17.56	23.67
United Kingdom	3.28	7.35	6.08	12.18	13.55	16.68	24.7	27.86
Asia								
China [3/]	-	-	-	-	-	0.57	0.73	1.36
Hong Kong [4/]	0.75	1.5	1.73	3.22	4.81	5.45	5.65	5.91
Japan	2.95	5.43	6.24	12.52	23.34	21.69	21.31	23.15
Korea, Republic of	0.33	0.98	1.26	3.8	7.55	8.54	13.2	14.2
India [5/]	-	-	-	-	-	0.81	0.91	-
Philippines	-	-	-	-	0.89	0.69	0.83	1.31
Singapore	0.85	1.56	2.58	3.83	7.74	7.34	7.39	9.83
Sri Lanka	0.28	0.22	0.28	0.35	0.48	0.48	0.54	0.68
Taiwan	0.39	1.04	1.51	3.91	5.98	6.17	6.43	6.95

[1/] Hourly compensation costs include basic wages, overtime pay for holiday and night work, costs of living adjustments, bonuses, vacation pay, commuting expenses, cash value of payments, in-kind severance pay, retirement and disability pensions, health insurance, income guarantee insurance, sick leave, life and accident insurance, occupational injury and illness compensation, unemployment insurance, social insurance and taxes on payrolls or enrolments.

[2/] For Mexico, NAICS 31-33 excludes NAICS 324 Petroleum and Coal Products Manufacturing

[3/] Due to data availability, 2000 data corresponds to 2002.

[4/] Due to data availability, 2000 data corresponds to 2003.

Dash means data not available.

Source: US Department of Labour, Bureau of Labour Statistics, 2010

Table 3.4 and Figure 3.2 show labour costs over in 1975, 1985, 1995 and 2008. Labour costs range from USD 0.68 per hour in Sri Lanka, USD 0.91 in India, USD 1.36 in China and USD 3.12 in Mexico to over USD 49.54 in Norway. The most important OECD countries such as United States, Japan, Canada, France and the United Kingdom have hourly costs between USD 20 and USD 30 and hour. Switzerland and Germany have the highest level of hourly labour costs among major OECD countries in 2008, at over USD 35 an hour. Large wage differentials also exist within the OECD regions, for example between central and eastern European and Western European countries, and between Mexico and the United States.

In 2008 we can observe that wage gaps of Taiwan and Hong Kong reduced with respect to those in the United States. However, in the case of Mexico the wage gap increased, and Mexico's wages are 88 percent below those in the United States. One of the main problems for Mexico over the last years has been the tough competition from China. Despite that Mexico's wages are low compared to the Unites States, China's hourly labour costs are 95 percent below those of the U.S.

These figures should be treated with some caution since they are averages across the whole of manufacturing and are therefore affected by the specific industry mix. Some industries may have higher wage levels than others (U.S. Department of labour, 2010). In addition, these numbers are averages and wages for high-skilled jobs in China for instance might be considerably closer in relative terms to those of the OECD countries (OECD, 2007a).

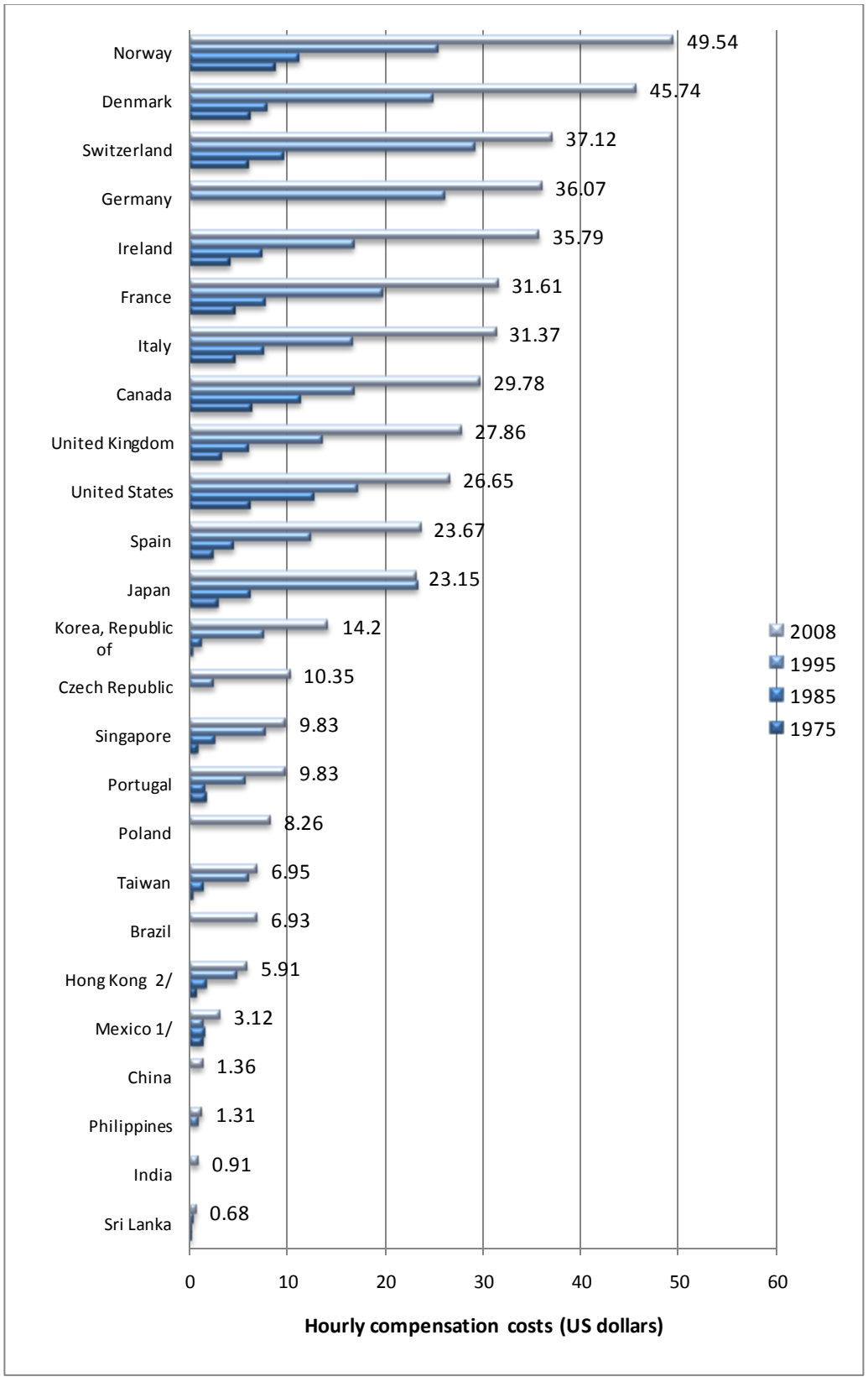
Production sharing in Europe seems to be driven by similar economic incentives (e.g. wage differentials). To remain competitive in international markets, producers in high labour cost countries of Europe moved some of their more labour intensive production and assembly segments to neighbouring countries with cheaper labour costs. Aside from lower labour costs, factors such as labour skills, education, technical training, adequate transportation and financial infrastructure were also essential in determining

the magnitude and direction of outsourcing and off-shoring activities in Central Europe. Finally, European firms have also used offshore processing to have access to central Europe markets (Yeats, 2001).

Thus, the first waves of offshore sourcing to developing countries were to a big extent focused on low value added activities related to mass production, while high value or capital intensive activities such as design, R&D or marketing remained in developed countries (Hansen, 2007).

Recent trends report that firms in India are now also outsourcing higher-value added activities such as software development. Thus, not only labour intensive segments of the production process are outsourced but also more advance functions including business services, IT and even R & D are now being sourced (UNCTAD, 2004).

Figure 3.2 Geographical variations in hourly compensation costs in manufacturing



Source: based of US Department of Labour Statistics
http://www.bls.gov/news.release/ichcc.t08.htm

3.4. Significance of off-shoring in the global economy

Although outsourcing has increased at a rapid pace and has shown a dynamic performance, it has been difficult to draw precise figures of its magnitude. One of the drawbacks to capture its significance is that outsourcing decisions are normally taken at micro-level of plant or firms, while official data is generally collected at the sectoral and national level.

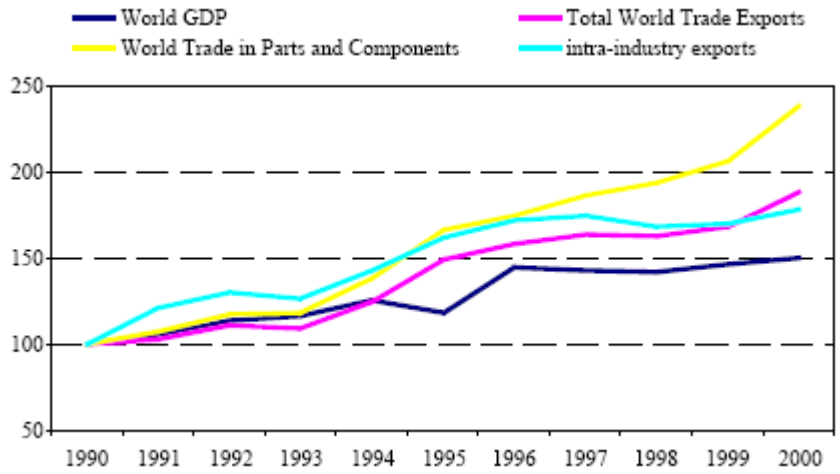
For instance, in the case of the firm level data most of the times firms are reluctant to provide details on their sourcing decisions (OECD, 2007a). Sectoral and national trade level data has also different problems since current statistical concepts do not allow separating or making a differentiation between import statistics and a firm's decision to substitute a product or service produced in house by an imported product or service (WTO, 2005). Also, trade data does not differentiate between components and assembled products. Identification of trade in parts and components is crucial, since it reflects the items that are shipped from one country to another for further processing[22] (Yeats, 2001; Jones et. al, 2005).

Despite of the weaknesses of the data many studies have tried to measure the magnitude of the phenomenon at the global level using both trade data, in intermediate goods (see Yeats, 2001, Lall et al. 2004, Jones et al. 2005) and input-output tables (Hummels, et al, 2001; and OECD 2007a and 2007b). This section presents data on the significance and evolution of the phenomenon based on previous empirical evidence (see Appendix 1 for a summary of the models on measurements of outsourcing).

[22] Revisions to the Standard International Trade Classification (SITC Rev. 2 and 3) have increased the numbers of categories containing parts and components within individual product groups and now make to somewhat easy to identify trade in parts and components.

Figure 3.3 compares the growth of income and trade in parts and components from 1990 to 2000. During this period world GDP expanded yearly by 3.7%, while world trade increased at a faster rate, averaging 6.5% a year. By comparison, trade in parts and components increased 138%, shifting from $355 billion to $846 billion which represents an average rate of growth of 9.1% per year (Jones, Kierzkowski and Lurong, 2005).

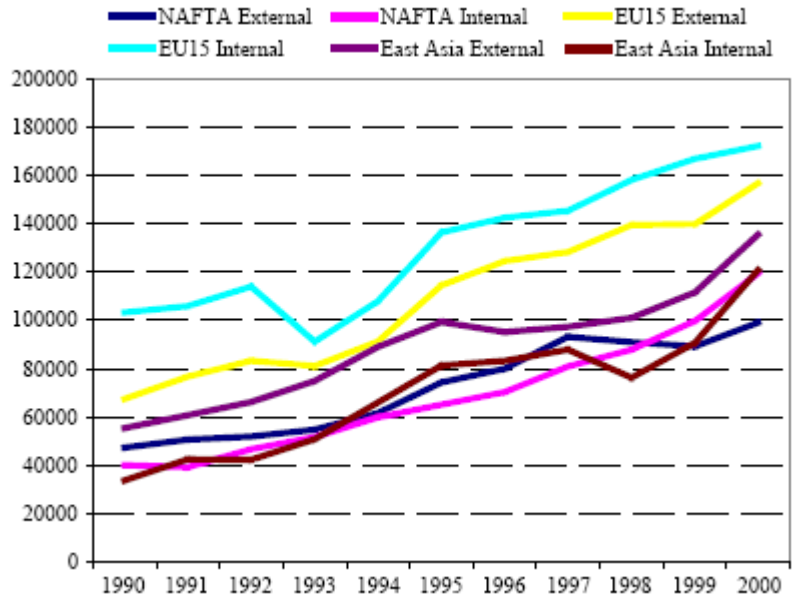
Figure 3.3 Global Income and Trade 1990-2000



Source: Jones, Kierzkowski and Lurong (2005).
Notes:1990 is the base year.

Looking at the regional trends of trade in parts and components Figure 3.4 illustrates that EU 15 has been the most important actor as compared to East Asia and NAFTA. From 1990 to 2000 EU 15 extra-regional trade increased by an annual average rate of 8.8%, while intra-regional trade expanded at 5.2%. By comparison, East Asia intra-regional trade grew at 13.6% and 9.3% for the inter-regional trade. Finally, NAFTA's intra-regional trade raised 11.5% on average per year and inter-regional trade surged 7.6%. These trends suggest that although trade in parts and components is greater in the EU 15, East Asia's trade in parts and components has grown at a faster pace. In fact, if this trend continues it is more likely that East Asia takes the leading role.

Figure 3.4 Trade in parts and components by regions (Millions of US Dollars)



Source: Jones, Kierzkowski and Lurong, 2005.
Notes: East Asia includes the following countries: Japan, Brunei Darussalam, Cambodia. Hong Kong , Indonesia, Lao P.D. Rep., Malaysia, Mongolia, Philippines, Taiwan, China, Thailand and Vietnam.

Trade in parts and components can give us an idea of the extent of the phenomenon, but as previously discussed there are problems and limitations. A recent study by the OECD (2007b), presents a calculation of indices of foreign outsourcing using input-ouput[23] tables and trade in parts and components. The index measures the share of intermediate inputs that are imported and is constructed as follows:

$$OI_i = \sum_i \left[\frac{purchases\ of\ inputs\ j\ by\ industry\ i}{total\ inputs\ used\ by\ industry\ i}\right] \times \left[\frac{M_j}{D_j}\right]$$

Where:

M_j are the imports of goods or services j
D_j is the domestic demand for goods or services j
$D_j = Y_j - X_j + M_j$
with Y_j is the production of goods or services j
X_j are the exports of goods or services j

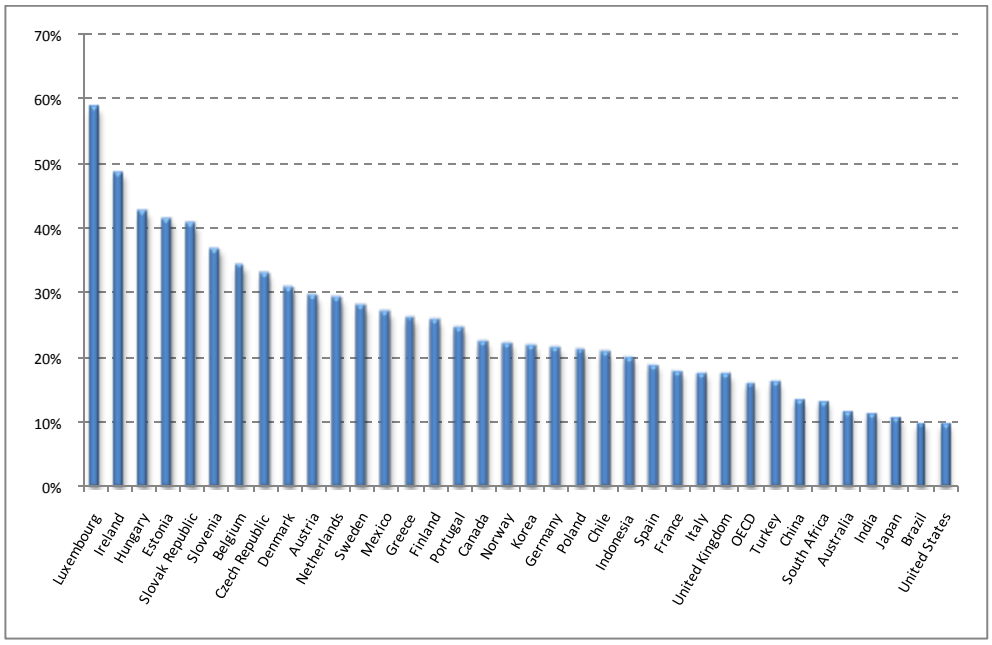
[23] Input-output tables offer complementary insights as they provide information on the value of intermediate goods and services.

The index captures the idea that the more imports of goods or services j are purchased by industry i for its production, the more the important is the outsourcing practice of industry i.

Figure 3.5 shows the index of outsourcing abroad for the manufacturing and services sector in OECD countries in 2005. The figure indicates that the practice of outsourcing abroad is significant. According to the OECD (2010), off-shoring or outsourcing abroad has increased in almost all countries over 2000 to 2005. In countries like Luxemburg, Ireland, Hungary, the Slovak Republic and Estonia, the sourcing practices of intermediates abroad has increased significantly. In fact, these countries have the highest shares of outsourcing abroad (e.g. Luxemburg 59%; Ireland 49%; Hungary, 43%; and Denmark, 31%). Countries with a lesser degree of outsourcing are Spain (19%), Italy (18%), United Kingdom (18%) and the United States (10%). Surprisingly Japan is the country whose manufacturing industry outsources the least abroad (11%). This does not mean that firms do not practice outsourcing, but it could indicate that outsourcing inside Japan is highly developed (OECD 2007b).

An interesting point to highlight is the relationship between the size of the country and the outsourcing pattern, since firms in small countries such as Luxemburg, Slovenia, Belgium and the Czech Republic are more likely to rely on foreign suppliers than firms in big countries like the United States.

Figure 3.5 Index of outsourcing abroad in selected OECD countries, 2005.



Source: OECD, 2010.

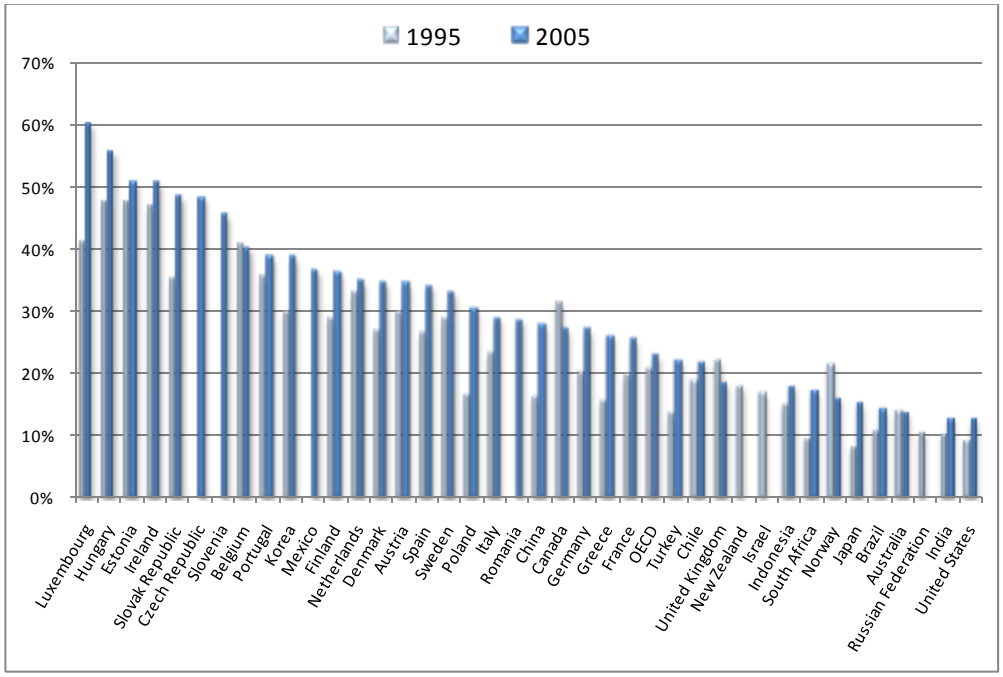
Another proxy commonly used by researchers (e.g. Hummels, Ishi and Yi, 2001) to capture the extent of outsourcing is the import content of exports[24]. With the growth of global production sharing or GVC, imports and exports are increasingly moving together because companies' production processes are characterised by sequential production and movements back and forth. Hence, exports are gradually more composed of intermediate inputs imported from abroad. For instance, in 2005 the import content of exports also called vertical specialisation in trade represented on average 23 percent of total trade among OECD countries (OECD, 2010).

During the same year in countries such as Luxemburg, Hungary, Ireland and Estonia, the import content of exports exceeded 50 percent. Conversely, the United States, the Russian Federation, Australia, Brazil and India imported considerably less through vertical trade than other countries (see Figure 3.6). Within the group of emerging economies China and Indonesia show a larger dependence on imported intermediates. This trend for China reflects the

[24] See Appendix 3.1 "Methodologies used to measure outsourcing" to have a more detailed description of this measure.

increasing international production sharing within the information and communication technologies industries, in which the more labour-intensive segments are carried out in emerging countries while the more skill-intensive activities remain clustered in developed countries (Srholec, 2007).

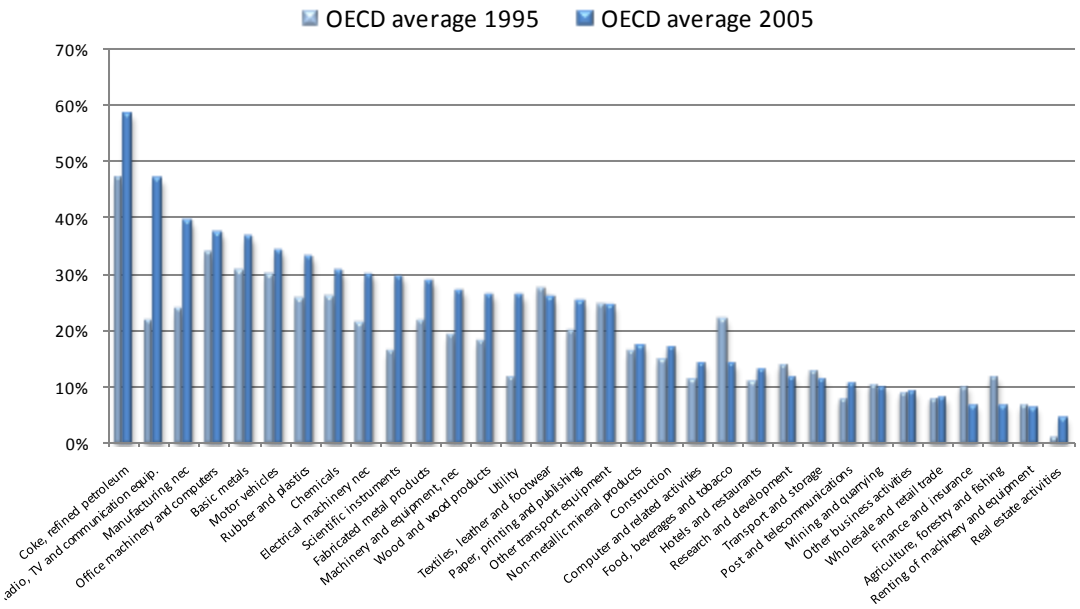
Figure 3.6 Import content of exports by country



Source: OECD, 2010

Figure 3.7 shows the import content of exports by industry in 2005 and we can distinguish two different trends. Firstly, the import content or exports is particularly high in more basic industries which rely heavily on primary goods such as coke, refined petroleum, basic metals, chemicals, and rubber and plastics. Secondly, there is a trend showing a rather high import content of exports in more technology intensive industries that produce modular products. Parts and components are commonly produced in one country and then exported to be assembled in a different country. This international division of labour is found in electrical machinery, radio/television and communication equipment, office and accounting, computing machinery and motor vehicles.

Figure 3.7 Import content of exports, by industry



Source: OECD, 2010.

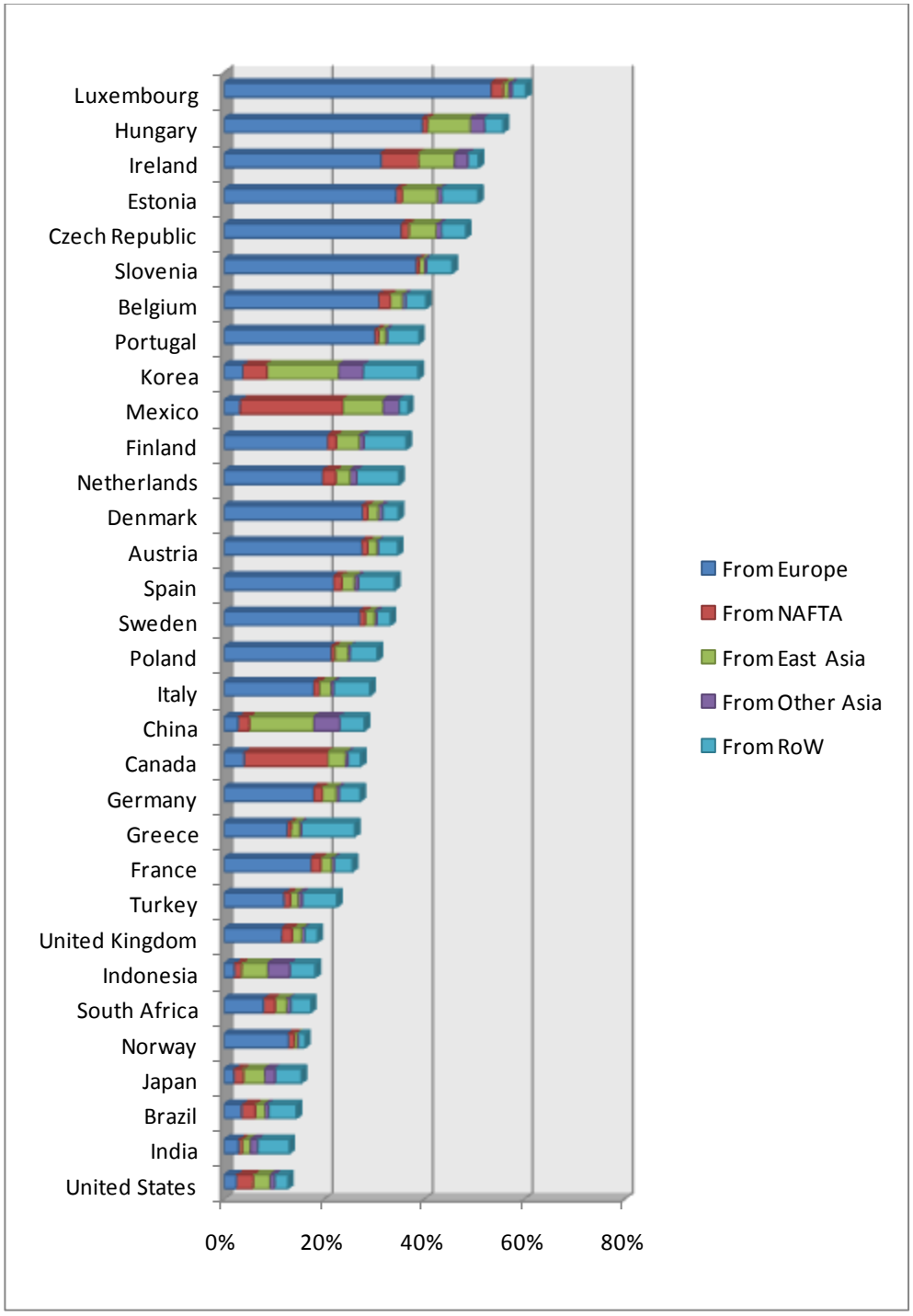
Countries tend to source intermediate inputs particularly from neighbouring countries. Figure 3.8 shows the import content of exports by partner countries. We can observe that the import content of exports of most of the European countries rely largely on other European countries. In countries like Czech Republic, Hungary and Luxemburg more than three-quarters of the intermediate goods embodied in exports are sourced in Europe. This trend is different for Ireland, since it sources lot of inputs from the NAFTA region. This is likely to be explained by the significant presence of U.S. multinationals in the country.

Within the NAFTA region, Canada and Mexico are heavily oriented towards other NAFTA countries and more than 50 percent of the import content of exports comes from the NAFTA partners. Unlike Mexico and Canada, for the United States its NAFTA partners have less importance due to the large share of East Asian countries (Korea, Japan, China and Chinese Taipei).

In Japan, China and Korea the majority of intermediates embodied in exports come from countries within the region. A triangular trade pattern in this

region has emerged in which parts and components are produced by more developed countries like Japan, Chinese Taipei and Korea, and then exported to emerging countries like China where further assembly takes place (De Backer and Yamano, 2007).

Figure 3.8 Import content of exports with partner countries



Source: OECD, 2010

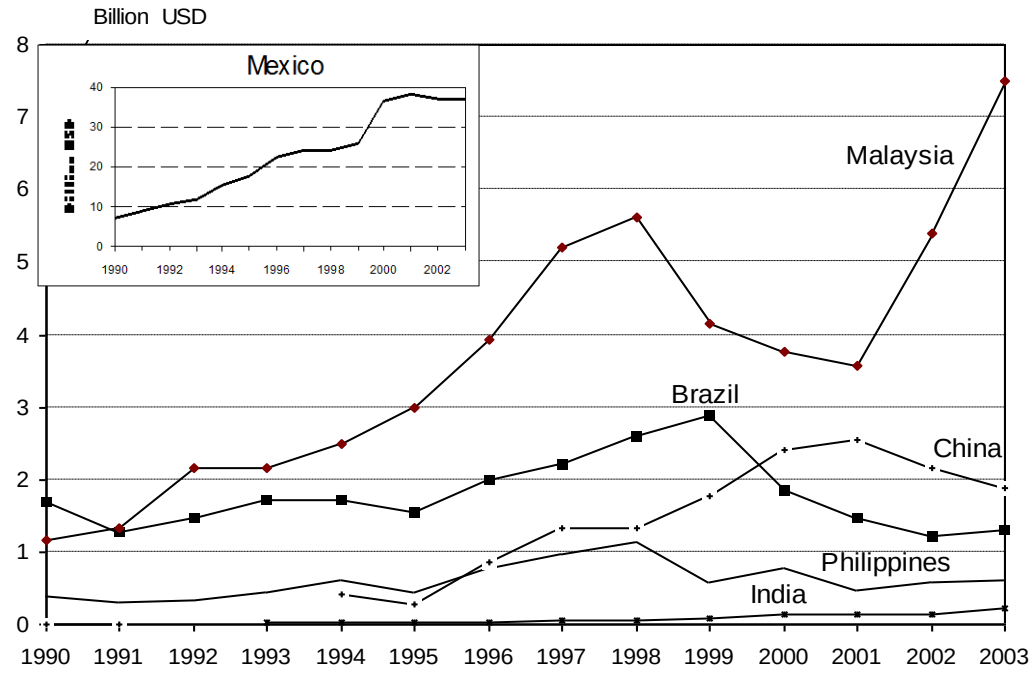
In the case of developing countries there are limited studies of the magnitude of sourcing activities both abroad or domestically[25]. However, we can grasp a general idea of the magnitude of the phenomenon by looking at trade statistics such as: a) exports from developing countries, b) intra-firm imports of parent companies in developed countries and c) import penetration rates.

According to Yeats (1998), statistics show that over 40% of total manufactured exports of Mexico, Jamaica, Haiti, Dominican Republic and El Salvador engage assembly operations using components manufactured in a foreign country.

The second approach to have an idea of the magnitude of sourcing in developing countries is to look at intra-firm imports, since in theory a significant share of the imports attributable to international sourcing involve intra-firm imports. Figure 3.9 presents intra-firms imports of American parent companies originating from their foreign subsidiaries in selected developing countries from 1990 to 2003. The country with the highest share of intra-firm imports is Mexico whose imports rose from 9 billion dollars to 40 mbillions. This shows that intra-firm imports originating from American subsidiaries in Mexico are more substantial that those originating from China and the other countries. It also indicates that distance is important, since manufacturing activities are relocated more to Mexico than elsewhere (OECD, 2007a).

[25] Taymaz and Kiliçaslan (2005), have an empirical study of the textile and engineering industries in Turkey from the perspective of both firms receiving and offering outsourcing.

Figure 3.9 Imports of goods by U.S. parent companies originating from their foreign subsidiaries

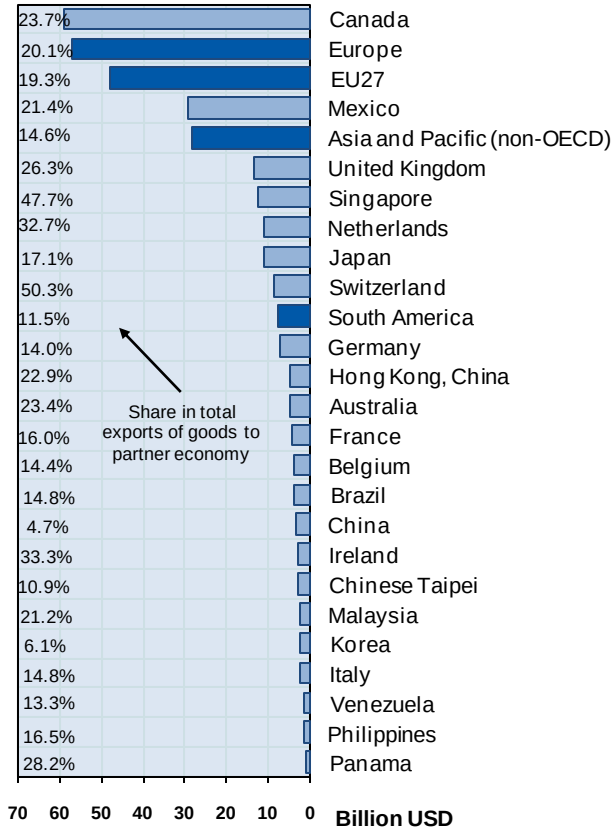


Source: OECD, 2007a.

Figure 3.11 show intra-firm exports of goods from U.S. parent companies abroad and intra-firm imports of goods to U.S. parent companies from affiliates abroad in 2007. In general terms, the most important intra-firm trade of U.S. parent companies was with Canada and Mexico. According to the OECD (2007), about 48 percent of US imports from American affiliates in Canada and 60 percent from Mexico were from the automobile industry.

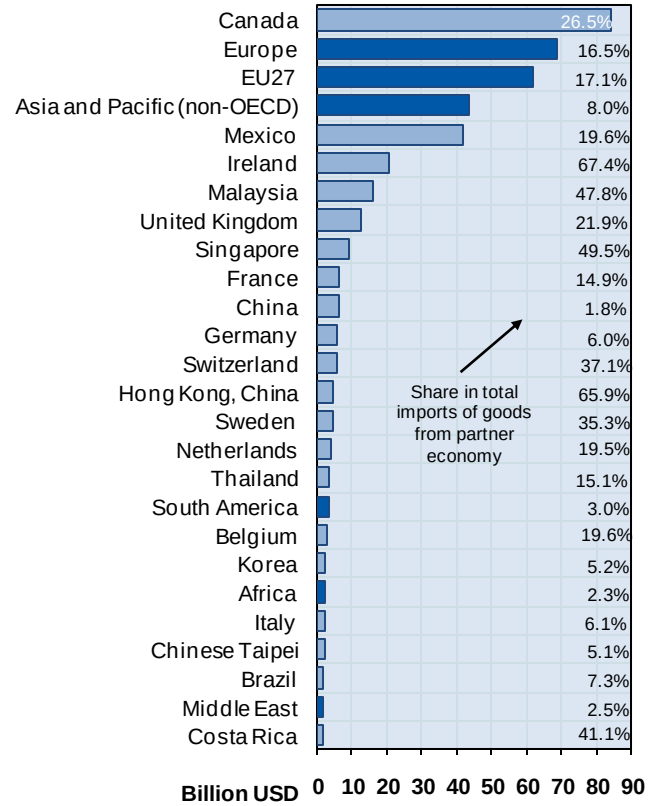
During the same year U.S. imports from affiliates in China reached USD 6 billion, representing 1.8 percent of total imports from China. Approximately 59 percent of the imports from U.S. affiliates in China comprised computers and electronic products. In fact, a great part of the U.S. high technology imports from China come from Chinese firms or from their own affiliates.

Fig. 3.10 Intra-firm exports of goods from US parent companies abroad by partner economy, 2007



Source: OECD, 2010.

Fig. 3.11 Intra-firm imports of goods to US parent companies from affiliates abroad by partner economy, 2007



Source: OECD, 2010.

However, there are two problems using intra-firm imports, firstly they capture only a part international sourcing activities; secondly they may not reflect the nature of the goods imported. For instance the textile imports coming from U.S. subsidiaries abroad will not necessarily be made by firms in the same group whose activity is textiles, but rather by wholesalers and distributors.
The third alternative method mentioned above is the import penetration rates which are defined as follows:

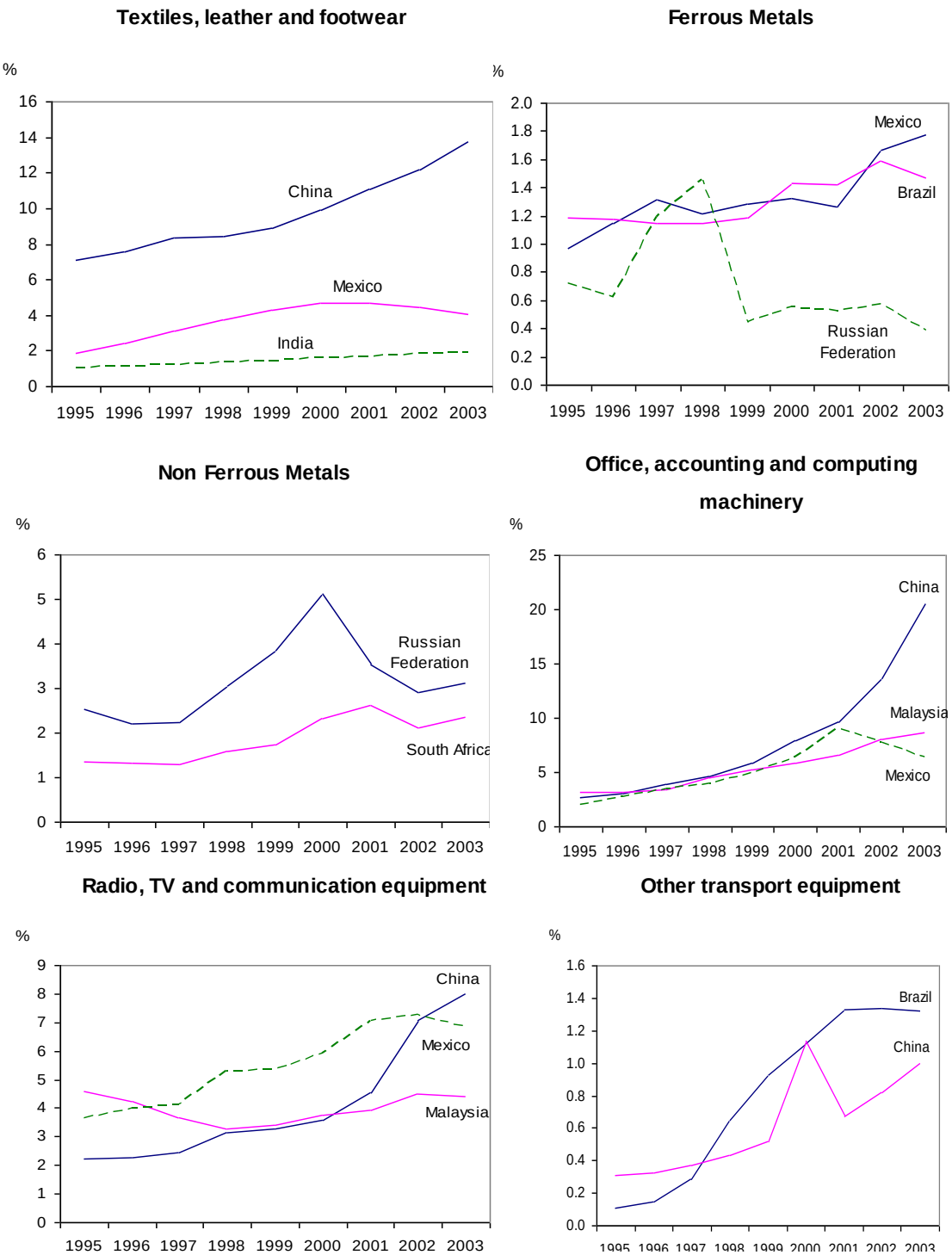
$$Import\ penetration = \frac{total\ imports\ of\ goods\ and\ services}{total\ demand\ for\ goods\ and\ services}$$

Figure 3.12 shows that import penetration rates of the United States with developing countries have increased, reflecting the increase of foreign dependency of the United States. It might have increased due to sourcing activities of US firms into developing countries. However, we can not assert import penetration rates capture sourcing activities accurately, actually it only help us to see the trends of the phenomenon.

In the textiles, leather and footwear industry China's export share to the US climbed from 7.11 percent in 1995 to 13.73 percent in 2003. Although Mexico's share rose from 3.64 percent in 1995 to 6.82 percent in 2003, there is a drop of 13 percent in the last year[26]. The other two industries in which China has an increasing growth rate are office, accounting and computing machinery increasing from 2.70 percent in 1995 to 13.60 percent in 2003; and Radio, TV and communication equipments rising from 2.21 percent to 8 percent during the same period. In these two industries we can also observe an upward trend of Mexico from 1995 to 2002 and afterwards a drop. In the case of Malaysia in the Radio, TV and communications equipment industries there is a downward trend from 1995 to 1999 and then a modest increase in the import ratios in the following years.

[26] This slowdown in the industry has opened up concerns in the Mexican government as well as in the firms involved in the sector. In July 2008, it was announced by the Ministry of Economy that there will be prepared an analysis of the situation and threats to the industry as well as the measures to overcome the crisis of the industry in recent years.

Figure 3.12 Import Penetration Rates in the United States



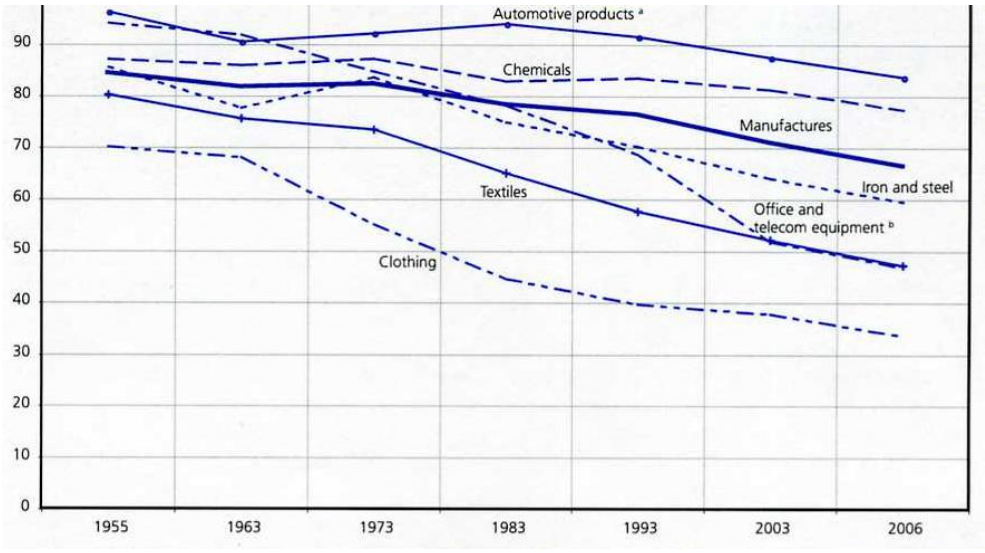
Source: OECD, 2007a.

As we can observe in the previous chart international sourcing is present in sectors like clothing, automobile and textile and it has gained more significance in a number of developing countries like China, India, Malaysia, Brazil and Mexico.

3.5. Global Dispersion of industries

The global dispersion of production has been reflected in the changes in the share of industrial and developing countries in world manufactures of exports (see Figure 3.13). Evidence suggests that between 1955 and 2006, industrial countries faced a decline in the share of manufactured exports of clothing, textiles and office and telecom equipment (from 1955 onwards); of iron steel and chemicals (from 1973), and around 1983 for the automobile industry (WTO, 2008).

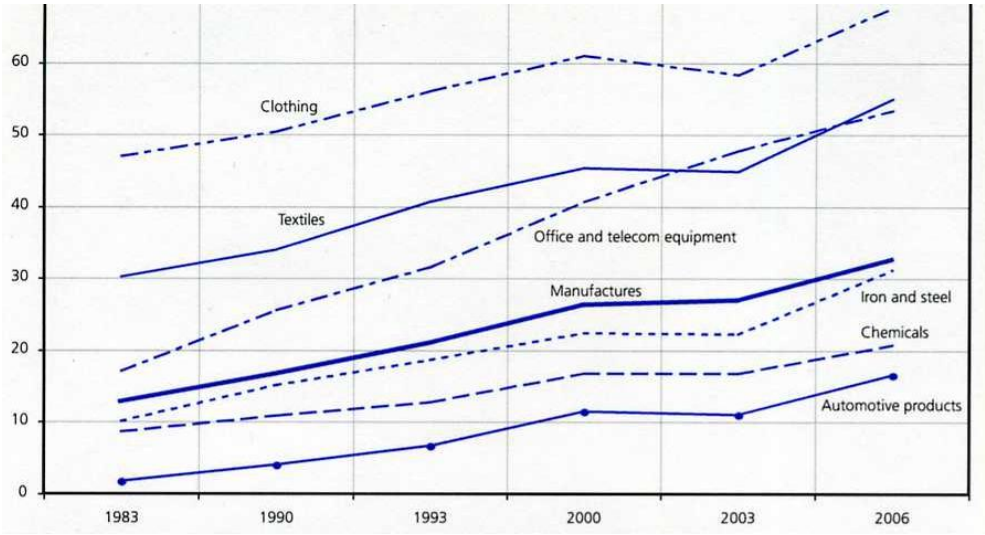
Figure 3.13 Share of industrial countries in world manufactures exports by product group, 1995-2006.



Source: WTR, 2010, pag.18.

In contrast, the decline of the industrial countries has been the mirror image of the relative rise of a highly diverse group of developing countries that in 2008 accounted for more than two-thirds of world clothing exports and more than one-half of the world exports textile and office and telecom equipment (see Figure 3.14. Moreover, for all manufactured goods, developing countries' share is significantly higher their share than in 1955 (WTO, 2008).

Figure 3.14 Share of developing economies in world manufactures by product group, 1983-2006.



Source: WTR, 2010, pag.25.

The phenomenon has open up an opportunity for developing countries to capture the production of certain segments of the production process rather than supply the whole product (Jones and Kierzkowski, 1990). As a consequence, some countries have developed or consolidated competitive advantages in specific types of products, categories of technology or particular market segments.

3.6. Conclusions

In recent times world production processes have become complex phenomenon which has given rise to and increasing wave of off-shoring and outsourcing. Although off-shoring and outsourcing are not a new entry in global economy but during last few decades fragmentation in production processing has increased and has opened opportunities for developing countries to participate by supplying parts and components. Initially these processes were determined by comparative technical advantage of developed countries but with the passage of time many other factors like liberalization policy reforms, transportation costs, decline of trade costs, the gap in wages across different countries and the advances in telecommunications technologies became the base of outsourcing between developed and developing countries.

It is difficult to pinpoint the significance of outsourcing in the global economy because of unavailable of data. Recent studies using trade data show that the practice of outsourcing abroad is significant and has risen in recent years. Finally, micro-level data of plant or firms have emerged to provide more accurate evidence. However, evidence is limited and is focused in developed countries

Chapter 4 The Integration of Mexico to global production networks and the role of Maquiladoras

4.1. Introduction

The increasing integration of the world market has brought with it the disintegration, or so called fragmentation, of the production process (Venables, 1999). International fragmentation of production leads to the establishment of international production networks, which are linked with an increasing importance of world trade in intermediate goods (Hummels et al., 2001). It is widely recognized (Hanson, 1994; Arndt, 1997; Feenstra, 1998) that fragmentation is driven by the persistence of factor price differentials across countries which, at the same time, creates incentives for firms in developed countries to move unskilled intensive manufacturing to low wage countries.

In the case of Mexico, the growth emergence as a sourcing location was triggered by the economic opening and liberalisation of its FDI regimes and its proximity to the United States. This chapter aims to present the evolution of the implemented trade liberalisation policies that make Mexico an attractive location for foreign firms to source their production. The following section introduces the Maquiladoras, which is the main industry involved in outsourcing and off-shoring according to Bergin et al., 2009. The final part presents the conclusions of this chapter.

4.2. Trade Liberalisation in Mexico

During the 1980s, Latin American[27] countries introduced trade liberalisation strategies as part of their Structural Adjustment Programmes. The implementation of these programmes was accompanied by macroeconomic and other structural reforms to tackle problems of both external disequilibrium (deficit in the balance of payments) and domestic disequilibrium (high inflation and disparities in the distribution of income) caused by the Import Substitution Industrialisation (ISI) (Villarreal, 2006). The basis of this policy shift was the assumption that market forces would spontaneously lead to an optimal reallocation of resources (Melo, 2001).

Import Substitution Industrialisation (ISI)[28] was the trade policy implemented in Mexico from the early 1950s to 1985 . This strategy consisted of the protection of Mexico's industrial sector through a set of tariff and non-tariff barriers in order to promote the creation of new industries and to encourage the development of those already operating.

However, after the 1982 debt crisis, the collapse of oil prices and the cut-off from external financing, the government decided to implement structural adjustment reforms.

The reforms were based on frequent adjustments of the exchange rate, fiscal tightening, privatization of state-owned companies, de-regulation of financial markets, liberalisation of foreign investment regulations and, after 1985, trade liberalisation[29].

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[27] Chile is the exception, since it implemented a continuous process of trade liberalisation since 1973 under a dictatorial regime.

[28] During ISI the three main forms of trade controls applied were: import tariffs, import licensing restrictions and official reference prices. However, import licensing was the key form of trade control and was based mainly in response to the balance of payments situation.

[29] There were also external pressures on the Mexican government from the International Monetary Fund (IMF) and the World Bank (organisms on which Mexico relied for financial aid) to adopt a more outward-oriented trade policy.

By mid-1985 Mexico embarked upon a fast and comprehensive trade liberalisation programme, and the first policy reforms were implemented. These reforms comprised the removal of quantitative import restrictions on intermediate inputs and capital goods, and the replacement of import licensing by tariffs. In this first stage, liberalisation fell heavily on intermediate and capital goods, because many of these goods were not produced, or not produced in sufficient quantities, in Mexico.

In 1986, Mexico negotiated its membership of the General Agreement on Tariffs and Trade (GATT). Under this agreement, Mexico promised to continue with the replacement of direct trade controls by tariffs, followed by tariff reductions and a system to assess anti-dumping and countervailing duties was introduced (Ros, 1994).

However, agriculture and some manufacturing sectors (automobiles, pharmaceuticals and electronics) were temporarily excluded from license removal because these sectors were under special industrial promotion programmes. By 1987, quantitative import restrictions on consumer goods were removed and, in the following years, export subsidies were eliminated.

Table 4.1 shows some indicators of trade liberalisation in Mexico from 1985 to 1989. It illustrates the drastic changes in the licensing system in that, from June 1985 to December 1989, the share of imports covered fell from 92.2% to 19.8%, whereas the share of the domestic production value covered by official reference prices dropped from 18.7% to 0% and the production-weighted tariff average decreased from 23.3% to 12.5% in the same period.

Table 4.1 Mexico's indicators of Trade Liberalisation

Indicator	1985		1986		1987		1988	1989
	June	Dec	June	Dec	June	Dec	Dec	Dec
1.Domestic production value covered by import licensing (%)	92.2	47.1	46.9	39.8	35.8	25.4	21.3	19.8
2.Domestic production value covered by official reference prices (%)	18.7	25.4	19.6	18.7	13.4	0.6	0.0	0.0
3.Production-weighted tariff averages (%)	23.5	28.5	24.0	24.5	22.7	11.8	10.2	12.5

Source: Kate 1992; and Weiss, 1992.

Along with the measures undertaken to reduce and eliminate import restrictions, a programme to promote manufacturing export industries, particularly the Maquiladora[30] industry, was launched (the following section will provide a more detailed description of the Maquiladoras and their evolution). This programme comprised three facilitation programmes (all known by their Spanish acronyms):

- Programme of Temporal Imports to Manufacture Export Goods (PITEX): the programme started in 1985 and gave duty rebates to firms with high levels of imported inputs embodied in exports.
- Highly Exporting Firms Programme (ALTEX): this was created in 1986 and enabled firms to make at least 40 percent of their total sales in the export markets to benefit from very simplified and fast export and import formalities; and, most essentially, to quickly recover the ad valorem tax on domestic inputs (Melo, 2001).
- Finally, the Joint Committee for Export Promotion (COMPEX): established in 1989, this was designed to overcome bureaucratic barriers for the export producing firms.

In addition, in 1989 a new bilateral agreement between Mexico and the United States was signed to encourage more trade and investment between the two countries, and to improve the country's risk assessment and visibility. This agreement can be considered as the predecessor of the North American Free Trade Agreement (NAFTA).

However, the government started to consider the possibility of negotiating a more comprehensive trade agreement between Mexico, the United States and Canada. A considerable part of this new agreement was reintroduced from the USA-Canadian trade deal of previous years, but NAFTA consisted of

[30] The term Maquiladora refers to an assembly plant in Mexico, especially one along the border between the United States and Mexico, to which foreign materials and parts are shipped and from which the finished product is returned to the original market free of duty. Duty is paid only on the Mexican value added.

features and procedures with more depth and extension than the U.S-Canada trade agreement (Ybarra-Yunez, 2003).

During the 1990s, the following steps towards Mexico's integration to the global markets were based on a foreign economic policy looking for liberalisation of trade and investment. In 1992, the North American Free Trade Agreement (NAFTA) was signed and came into effect on January 1, 1994. NAFTA is a complete rules-based agreement between Canada, the US and Mexico. The agreement eliminated many tariffs immediately, while other tariffs were committed to fall to zero over a five- to fifteen-year period, with most tariffs and quantitative restrictions eliminated in 2004. For example, Table 4.2 illustrates the reductions of the import licenses system, from 1990 to 2002. It shows that by 2002 only 0.58% of the imports required a licence whereas, in the same year, the weighted average tariff was 3.1%.

Table 4.2 Mexico's indicators of protection

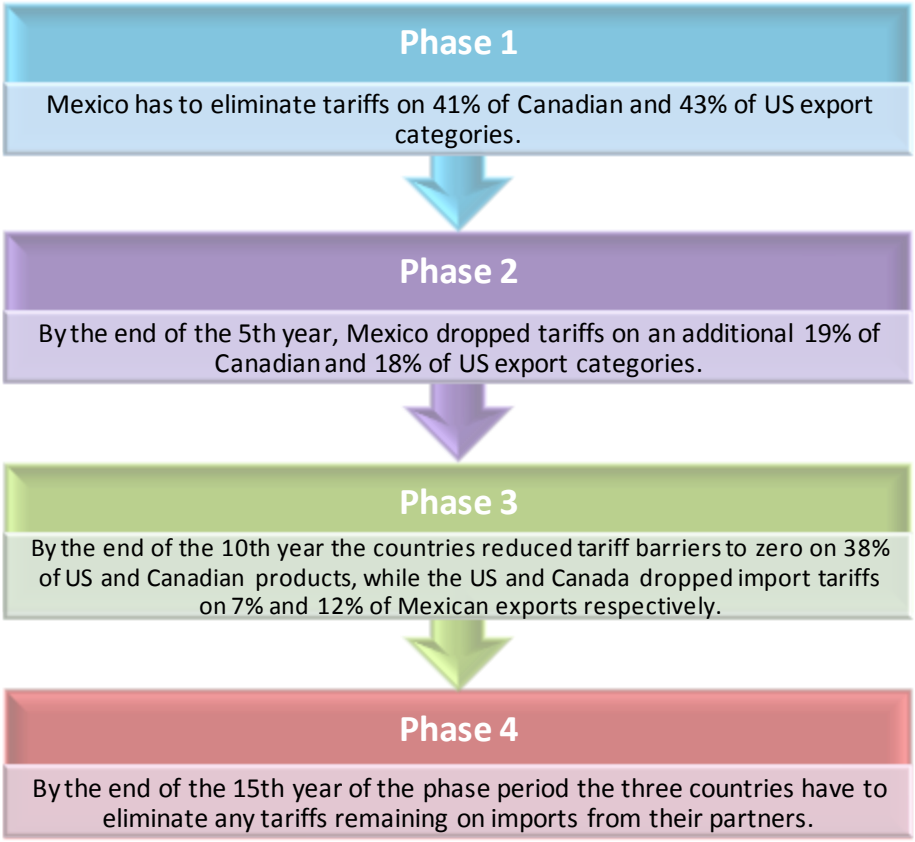
Year	Fraction of imports subject to licenses (%)	Tariff Averages (%)	Weighted Tariff Averages (%)
1990	1.7	13.1	10.5
1991	1.7	13.1	11.2
1992	1.6	13.1	11.4
1993	1.6	13	11.6
1994	1.2	12.4	5.7
1995	0.55	13.7	3.4
1996	0.63	13.3	2.9
1997	0.67	13.3	2.6
1998	0.64	13.2	2.6
1999	0.6	16.1	2.9
2000	0.61	16.2	3
2001	0.6	16.3	3.2
2002	0.58	16.4	3.1

Source: Tornell and Esquivel, 1997; and Mexican Ministry of Economy.

NAFTA represented the beginning of the removal of the remaining barriers to trade and investment. The complete elimination of the tariffs was phased in four periods over fifteen years and, in 2009, there were no tariffs on traded goods (see Figure 4.1). The main assumption was that NAFTA, along with the drastic reforms and rapid unilateral trade liberalisation initiated in the second

half of the 1980s, would encourage local and foreign investment in the production of tradable goods. In turn, this would encourage Mexico as an export platform to the United States (Moreno-Brid et al., 2005).

Figure 4.1 Schedule of Tariff Reduction under NAFTA



Source: Clement et al., 1999, p. 264.

Rules of origin were also designed to keep benefits and preferential treatment of the free trade within North America. These rules applied specifically to automobiles and auto parts, computers and textiles (Clement et al., 1999). Some of the examples of strategic items are listed in Table 4.3:

Table 4.3 Rules of origin for selected products

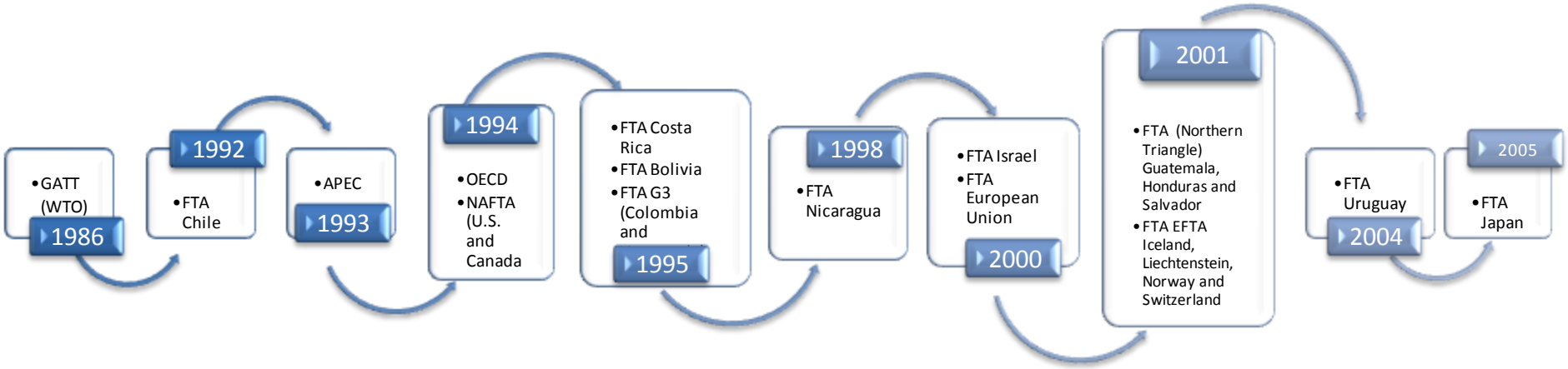
• In the auto sector, 62.5 percent of automobile parts and components are required to be sourced from NAFTA parties. • Ninety percent of circuit board assemblies must be packed in NAFTA countries. • Photocopiers, printers, and fax machines must be sub-assembled in North America (this is approximately equivalent to 80 percent domestic content requirement). • Televisions tubes must be produced within NAFTA to qualify for preferential status.

Source: Gallagher and Zarsky (2007).

The core of the plan was the manufacturing sector, and the goal was to build a strong and internationally competitive manufacturing sector fuelled by FDI. In fact, during the 1990s, ten countries captured 80 percent of the FDI flows going to developing countries. In order of importance, the most significant recipients were China, Brazil and Mexico which together received 58 percent of all developing countries' FDI (UNCTAD, 2002).

NAFTA has not been the only agreement implemented in Mexico; over the last two decades, the country has been very active in signing multiple free trade agreements (FTAs) both with developed and less developed countries, and has joined several international organizations. Figure 4.2 illustrates chronologically the dates and agreements that Mexico has signed.

Figure 4.2. Chronology of Mexico's Free Trade Agreement and Adhesion to International Organisms



Source: México Negociaciones Comerciales Internacionales, 2004 (Secretaria de Economía)
* In 1992 Mexico signed an Economic Cooperation Agreement with Chile, but the original agreement was complemented to constitute a Free Trade Agreement in 1999.

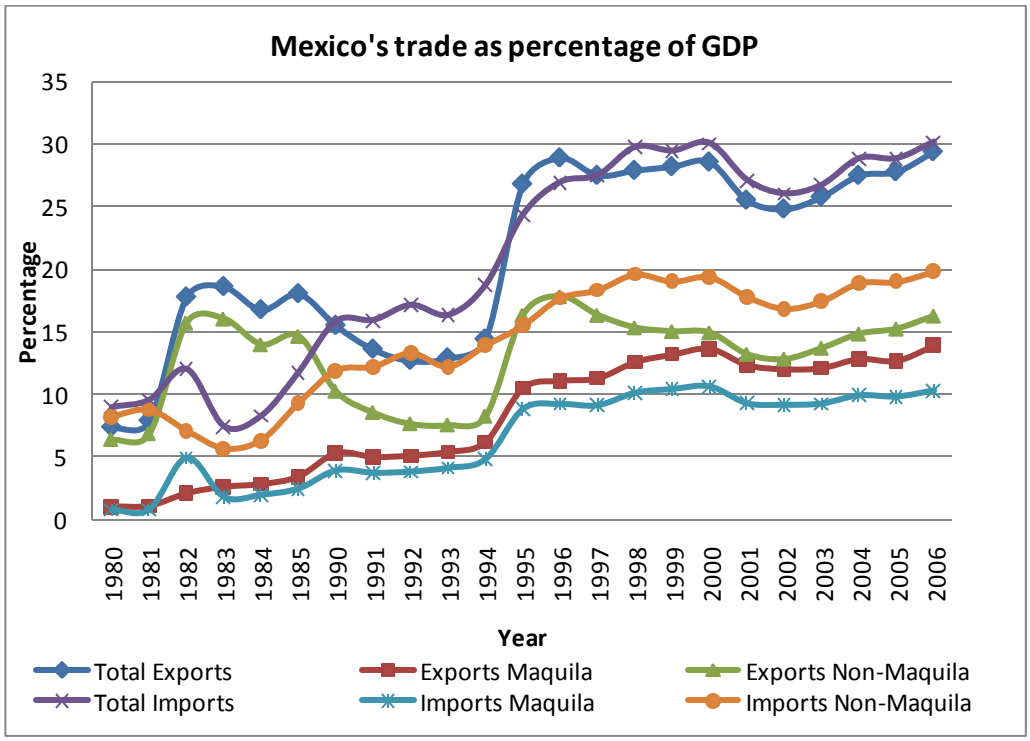
As a consequence of its liberalisation policies, Mexico has shown a dynamic performance in the export markets. For instance, from 1985 to 1994, the country ranked fifth among countries with the largest increases in their share of world manufacture exports. During 1994 and 2001, it moved to second place, just behind China (Moreno-Brid et al., 2005).

NAFTA influenced the expansion of Mexico's exports to a great extent; however, two related elements also contributed to this export expansion. Firstly, the collapse in 1995 of the Mexican domestic market due to the Tequila crisis forced domestic firms to seek external markets in order to survive. The second factor was the depreciation of the peso with respect to the dollar (a drop of 45% in real terms) during the same year, resulting in a severe foreign exchange crisis (idem).

Mexico's export boom started during the late 1980s, before NAFTA was implemented, and it opened an exceptional window for exports to the US (see Figure 4.3). In 1994, total exports represented 14.4 percent of Mexico's real GDP and, by the year 2006, this figure had doubled reaching 29.39 percent.

Between 1983 and 2006, exports rose at an annual average rate of 9.3 percent. After NAFTA came into effect, there was a significant growth in Mexico's exports, and the Maquiladoras have been a vital force behind this export boom. Maquila exports in 1980 represented 1.03 percent of total GDP and by 2006 they represented 13.9 percent.

Figure 4.3 Mexico's Foreign Trade (percentage of GDP)

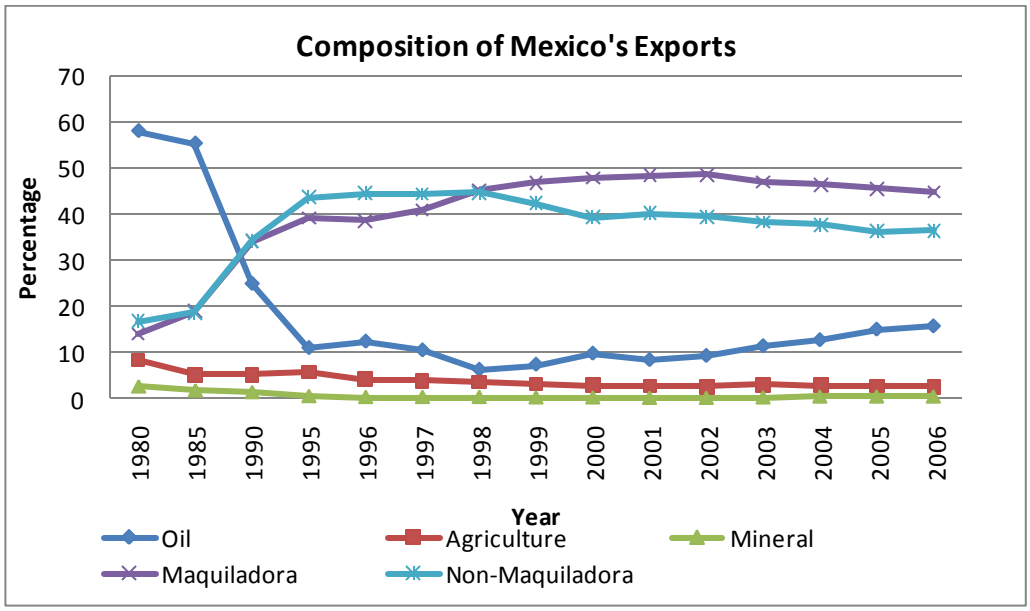


Source: Romero, 2009.

The dynamic export performance of Mexico is reflected in the drastic change in the composition of exports (see Figure 4.4). For instance, in 1980 oil exports accounted for 58 percent of total exports and, by 2005, they have decreased until they represent only 15 percent. In contrast, the manufacturing sector increased from 31 percent in 1980 to 81 percent in 2006.

Despite the rapid growth of exports, particularly in the Maquiladora industry, the value added of the sector is very small. In 2006, the Maquiladoras contributed less than 3 percent to the total value added. This is one major problem, which reflects the fact that rather than promoting a greater integration with local suppliers of raw materials, Maquiladoras use imported raw materials. Therefore, their contribution to the Mexican economy is limited.

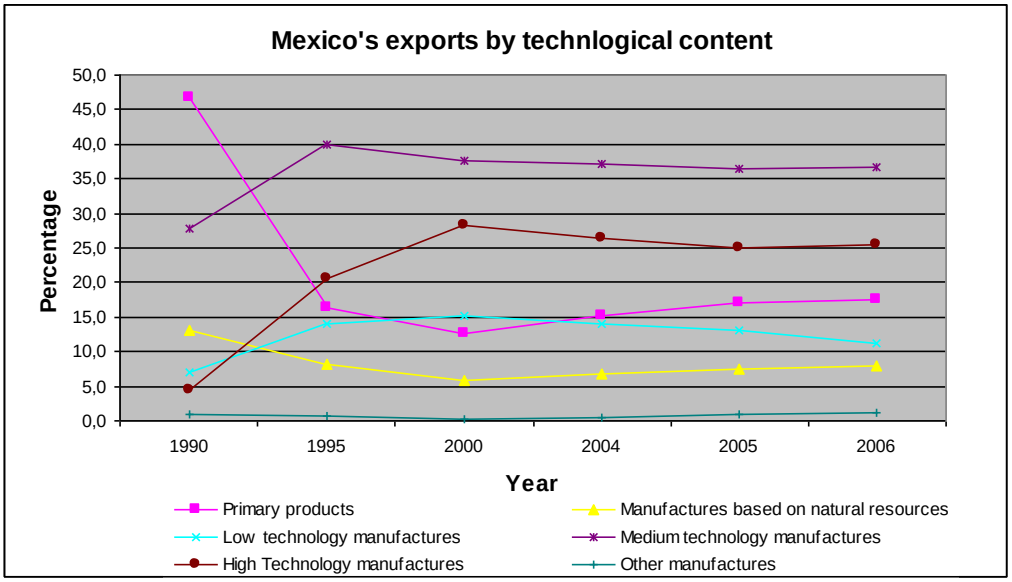
Figure 4.4 Composition of Mexico's Exports (percentage or total exports).



Source: Romero, 2009.

In terms of the technological content of the types of goods exported, Figure 4.5 shows the evolution of Mexican exports from 1990 to 2006. It is interesting to note that, in 1990, primary commodities concentrated 47 percent of the exports and, by 1995, it decreased to 16 percent. On the other hand, medium and high technology manufactures have shown a more dynamic performance. In 1990, they represented 32 percent of the total exports and, by 2006, they reached 62 percent. Therefore, it can be observed that most of the Mexican exports are medium and high technology manufactures.

Figure 4.5 Mexico's exports by technological content



Source: CEPAL, División de Comercio Internacional e Integración, sobre la base de cifras oficiales obtenidas de UN Comtrade, United Nations Commodity Trade Statistics Database, DESA/UNSD.

More disaggregated data is shown in Table 4.4, which includes the twenty products that concentrate more than 50 percent of total exports from 1980 to 2007. It is interesting to note that there has been a change in the share of the different products over time. As an oil producing country, crude petroleum ranks in the first position in Mexico comprising 13.8 percent of the total, although the exports of crude petroleum have reduced drastically over time, from 60 percent of the share of total exports in 1980 to 13.8 in 2007. Other products have increased their participation, such as television broadcast receivers and parts for motor vehicles among the most important. The change in the structure of total exports can be an indicator of the activities in which supplier firms engaged in outsourcing are concentrated. The table shows that most of the categories which have a high share of exports are those related to global value chains, for example motor vehicles, televisions and electrical equipment.

Table 4.4 Mexico: Exports of the 10 Leading products (SITC, REV. 1), by their percentage share each year [a/]

Code	Description	1980	1985	1990	1995	2000	2007
33101	***Crude petroleum***	**60.9**	**57.2**	**33.9**	**9.3**	**8.9**	**13.8**
7241	***Television broadcast receivers, whether or not combined with gramophone or radio***	...	...	...	3.7	3.5	**8.0**
7321	***Passenger motor cars (other than buses or special vehicles), whether or not assembled***	...	...	**9.9**	**9.5**	**9.9**	**6.9**
73289	*Other parts for motor vehicles other than for motorcycles*	1.3	1.1	1.4	2.8	3.5	4.5
72491	*Electrical line telephone and telegraph equipment*	...	...	...	...	...	4.4
7323	*Lorries and trucks (including ambulances, etc.), whether or not assembled*	...	...	...	2.3	2.9	3.3
7143	*Statistical machines, e.g., calculating from punched cards or tape*	...	...	1.3	...	4.9	3.2
7231	*Insulated wire and cable*	...	...	...	4.3	4.0	3.0
7222	*Electrical apparatus for making and breaking or for protecting electrical circuits (switchgear, etc.)*	...	...	...	2.6	3.1	2.3
7221	*Electric power machinery*	...	...	...	2.2	2.8	1.9
0011	*Bovine cattle (including buffaloes)*	...	0.8	1.3	...	...	...
0111	*Meat of bovine animals, fresh, chilled or frozen*	...	...	...	...	...	...
0313	*Crustacea and molluscs, fresh, chilled, salted or dried*	2.6	1.6	...	...	...	...
0544	*Tomatoes, fresh*	...	0.8	1.6	...	...	...
0545	*Other fresh vegetables*	1.1	...	1.7	...	...	...
0611	*Raw sugar, beet and cane (not including syrups)*	...	...	...	...	...	...
0711	*Coffee, green or roasted, and coffee substitutes containing coffee*	2.9	2.4	1.4	...	...	...
2631	*Raw cotton, other than linters*	2.0	...	...	...	...	...
28311	*Ores and concentrates of copper*	1.1	...	...	...	...	...
3320	*Petroleum products*	1.6	7.4	2.4	...	...	...
3411	*Gas, natural*	4.0	...	...	...	...	...
51252	*Polyacids and derivatives*	...	0.7	...	...	...	...
68111	*Silver, unwrought or partly worked, but not rolled*	2.4	1.7	...	...	...	...
7115	*Internal combustion engines, other than aircraft*	...	7.1	5.3	3.5	...	...
72499	*Other telecommunications equipment*	...	...	...	2.6	4.0	...
	Average share of leading products (%)	**79.9**	**80.8**	**60.2**	**42.8**	**47.5**	**51.3**

[a/] Starting from 1992, the data include goods processed under Maquila arrangements.

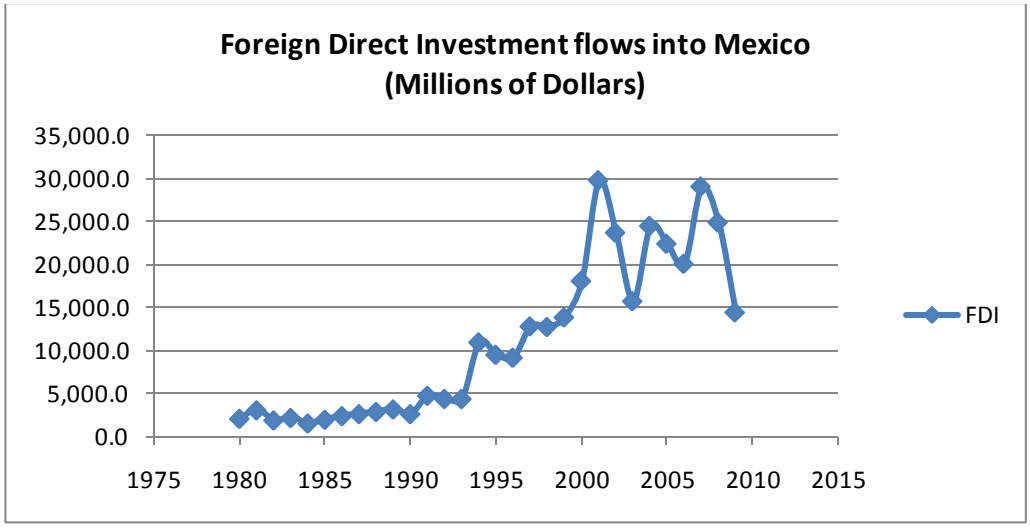
Source: ECLAC, División de Comercio Internacional e Integración, Comtrade, United Nations.

4.3. FDI liberalisation in Mexico

Mexico's trade liberalization policies were increased by Mexico's integration into NAFTA which, at the same time, comprised policies and obligations pertaining to direct investment in Chapter 11 of the NAFTA agreement. Thus, after Mexico joined NAFTA it registered substantial and permanent higher inflows of FDI.

During the 1980s, or the pre-NAFTA period, a great part of this foreign investment was received in the stock market[31] and from 1994 to 2002, Mexico received $12.3 billion of FDI on average each year (Figure 4.6). Twenty-eight percent of the FDI was received in the form of mergers and acquisitions, while 72 percent was Greenfield investment (Gallagher and Zarski, 2003).

Figure 4.6 Mexico's Foreign Direct Investment Flows



Source: Secretaria de Economía.

[31] For example in 1993 Mexico received approximately US$17 billion in foreign investment, of which nearly 70% went into the stock market

In an empirical work based on an error correction model, Ramirez (2003) tries to identify the variables that influenced the surge in the FDI flows after the implementation of NAFTA. This author found that the debt conversion programme in 1986-1990 and the liberalisation of FDI rules from 1991 to 1994 were positively correlated with the surge of FDI flows into Mexico. Conversely, the economic and political turmoil had a negative relationship.

Table 4.5 illustrates the sectoral distribution of FDI from 1980 to 2003. The data reveals that, in the first period of liberalisation, there was not a remarkable increase in the FDI flows. By contrast, in 1994 FDI flows increased 167% as compared to the previous year. FDI flows have been directed mainly towards Greenfield investment in the manufacturing sector, particularly to sectors where there is a strong participation of transnational corporations (TNC's) devoted to export-oriented production such as Maquiladora industry.

By 2001 the figures show an important surge in FDI in the services sector which is a result of the US$12,500 million acquisition of the biggest Mexican bank, Banamex, by Citygroup. From 1994 to 2002, Maquiladoras received 32 percent of manufacturing FDI of which 72 percent flowed into the automotive, electronics and apparel assembly sectors.

However, from 2002 onwards there is a drop in the FDI flows into Mexico which can be attributed to the recession in the United States market and the apparent end of the cycle of privatization. This downturn was strongly felt in Mexico whose international competitiveness was also threatened by an appreciated currency which led to a loss of over 200,000 jobs in the Maquila industry and to the shift of several plants[32] from Mexico to Asia.

[32] The production of footwear, apparel, furniture and some electrical and electronic goods were some of the activities which moved operations from Mexico to China.

Table 4.5 Sectorial distribution of FDI flows into Mexico, 1980-2003

(Millions of Dollars)

Year	Total	Industry	Services	Commerce	Mining	Agriculture
1980	**1,622.60**	1,286	131	118	87	1
1985	**1,729.00**	1,166	435	110	18	0
1990	**3,722.40**	1,193	2,203	171	94	61
1991	**3,565.00**	964	2,138	388	31	45
1992	**3,599.60**	1,101	1,700	751	9	39
1993	**4,900.70**	2,321	1,731	760	55	35
1994	**10,630.00**	6,195	4,327	1,247	98	10
1995	**8,337.00**	4,851	3,398	1,012	79	9
1996	**7,823.00**	4,814	2,891	739	84	33
1997	**12,079.00**	7,298	4,640	1,868	131	10
1998	**8,325.00**	5,003	3,244	1,038	49	29
1999	**13,565.00**	9,137	4,207	1,409	138	83
2000	**17,507.00**	9,879	7,338	2,432	199	92
2001	**27,059.00**	5,492	21,478	2,224	29	61
2002	**18150**	7,582	10,234	1,739	242	93
2003	**13773**	6,204	7,484	1,394	75	11
2004	**18361**	9,290	9,185	1,175	142	15
2005	**13745**	7,292	5,955	2,539	-7.7	5.2

Source: Secretaria de Economía

Opponents of the FDI flows (Cypher and Dietz, 1997) state that FDI flows in developing counties constitutes a small portion of capital formation in only a few cases. Consequently, rather than contributing to the country's capital formation, they constitute a potential source of drain in the form of remittances of profits and dividends to the parent corporations.

In fact, if profits and dividends are subtracted from FDI flows and the net figures are expressed as a proportion of fixed capital formation by 2000 the net contribution of FDI to Mexico's gross fixed capital formation represents only 8% (Ramirez, 2003). In this sense, Gallagher and Zarski (2003) found that the FDI dependent on export oriented manufacturing is susceptible to financial instability and loss of competitiveness in Mexican industry.

Table 4.6 shows that in the manufacturing sector 49 percent of the FDI has been concentrated in the Metal products, Machinery and Equipment sectors which include autos and electronics.

Table 4.6 FDI in Mexican Manufacturing by Industry, 1994-2002

Sector	Total	%
Food, Beverages and Tobacco	9,999	18
Metal products, Machinery and Equipment	26,603	49
Chemicals, Petroleum and coal derivatives, rubber and plastic	7,342	13
Non-metallic Minerals Products	574	1
Basic Metal Industries	2,730	5
Manufacturing Total	**54,632**	**100**

Source: Gallagher, 2004.

4.4. The Role of Maquiladoras in Off-shoring and Outsourcing

Off-shoring and outsourcing has grown over the last fifteen years and has become an important part of the trade relationship between the United States and Mexico. US firms tend to export parts and components to Mexico for further assembly or process into final goods, re-importing the finished products. US firms generally specialise in R & D, component production, marketing and other headquarters activities, whereas Mexican Maquiladoras tend to specialize in assembly. This type of production has become very important for both countries and from 2000 to 2003, the United States was the source country for 73.4 percent of the inputs imported by Maquiladoras in Mexico, and Maquiladoras exports back to the U.S. were equal to 5.3 percent of U.S industry shipments (Bergin et al., 2009).

This production model started in the mid 1960s when Mexico established what was called the export processing zone (EPZ). This phenomenon has been driven by MNCs and it is not exclusive to Mexico. For instance, Frobel et. al. (1981) estimated that in 1975 there were approximately 79 EPZs in 39 countries, with 750,000 employees.

Maquiladoras are in-bond assembly factories offering industrial or service processes that involve the transformation, elaboration, or repair of merchandise of foreign origin, temporarily or permanently imported for its later export. The legal regime of the Maquila in Mexico states that the company must register formally in the Ministry of Economy to grant temporary import of inputs, machinery, and equipment necessary for assembly, transformation provided that the importer posts a bond guaranteeing the export of the finished goods and duty is paid only on the Mexican value added (De la Garza Toledo, 2007; Gallagher et al., 2007).

During the last twenty years the Maquiladoras have gained an important role in the Mexican economy and contributed enormously to export and employment growth. However, over the last decade, Maquiladoras have also been facing one of the most serious crises in their history which has negatively affected their employment, and the reduction of FDI (Carrillo and Lara, 2005). The following section describes the history and evolution of the Maquiladora industry.

4.4.1. Evolution of the Maquiladora sector

The development of the Maquiladora can be summed up in three phases: 1) the installation, adjustment and recovery from 1965 to 1984; 2) the boom period from 1985 to 2000 and; 3) the crisis period from 2000 to date.

Phase 1: Installation, adjustment and recovery (1965-1984)

The early stages of the Maquiladora emerged in 1965 as a combination of policies of the US and Mexico. In the US, the offshore assembly production programme also known as the "806/807" made it possible to export and import components duty free, except on imported value added.

In Mexico, the Border Industrialisation programme granted assistance to investors to establish industrial units on a twenty kilometre strip parallel to

the international border line or to the coast line. It granted tax-free importations of raw materials, parts, components, machinery tooling equipment, and everything else needed for the transformation or processing, assembly, finishing of products to be entirely exported (Sklair, 1989). This programme allowed foreign firms to enter into the Mexican market with 100 percent of their own capital, whereas only 49 percent of foreign capital was allowed in the manufacturing industry. The Maquiladora programme was introduced to tackle the unemployment problems in Mexico's northern border produced by the cancellation of the "Bracero Programme"[33] in 1964.

The Maquiladora programme had three main objectives: a) to create jobs on the northern border of Mexico; b) to reduce migration to the United States; and c) to promote manufacturing export industries.

Until 1967, the majority of the Maquiladoras were small enterprises, subsidiaries of small and medium corporations, and their operations consisted of simple assembly of parts and components supplied by the lead firm.

Table 4.7 shows that during the 1st phase of the Maquiladoras, the number of plants increased from 72 establishments in 1967 to 672 in 1984, whereas the number of employed rose from 4,000 employees to 199,684 during the same period.

[33] The Bracero Programme was originally a temporary contract labour programme initiated in 1942, designed to supply the shortage of labour in the US, providing work authorization for Mexican farmers.

Table 4.7 Maquila Industry Plants, employees, labour costs, and value added, 1967-1988.

Year	No. Establishments	No. Employees	Labour costs	Value added
1967	72	4,000	n.a	925
1968	112	10,927	n.a	975
1969	149	15,900	n.a	973
1970	160	20,327	n.a	1035
1971	205	28,483	16,460	1,227
1972	339	48,060	17,388	1,820
1973	400	64,330	17,808	2,415
1974	455	75,977	32,082	2,610
1975	454	67,214	36,153	4,015
1976	448	74,496	44,579	5,424
1977	443	78,433	57,731	7,118
1978	457	90,704	66,006	10,000
1979	540	114,365	76,030	14,543
1980	620	119,546	87,816	17,729
1981	605	130,973	111,809	23,957
1982	585	127,048	192,998	46,588
1983	600	150,867	311,055	99,521
1984	672	199,684	504,418	194,756

Source: Sklair, 1989.

Phase 2: The Boom (1985-2000)

During this period the Maquiladora industry became the most successful case of Mexico's export-led industrialisation model that faced a boom period when Mexico joined NAFTA in 1994. Most of the exports are channelled to the United States, thus Maquiladora plants tend to locate along Mexico's northern border to take advantage of the cheap labour and transportation costs and proximity to the US market. Table 4.8 shows that, from 1990 to 2006[34], more than 70 percent of the Maquiladora establishments were located in the northern states, specifically in Chihuahua, Baja California, Tamaulipas, Coahuila and Sonora.

[34] Although this second phase finished in 2000, data until 2006 is included.

Table 4.8 Total number of Maquiladora establishments and share of Maquiladoras in northern border and other states.

Year	Total Establishments	Northern Border states [1/]
1990	1,703	85.8
1991	1,914	84.3
1992	2,075	84.1
1993	2,114	83.4
1994	2,085	82.4
1995	2,130	79.4
1996	2,411	77.8
1997	2,717	77.1
1998	2,983	75.4
1999	3,297	73.4
2000	3,590	72.5
2001	3,630	72.3
2002	3,003	72.0
2003	2,860	72.4
2004	2,810	73.2
2005	2,816	73.6
2006	2,810	74.1

Notes:
[1/] Northern Border States include Baja California, Coahuila, Chihuahua, Sonora and Tamaulipas

While the Maquiladora programme is one of the instruments designed by the government to promote exports, it accounted on average for more than 50 percent of Mexico's manufacturing exports from 1990 to 2007 (see Table 4.9).

However, one of the problems is the low value added, which hardly reached 3 percent during the same period. This reflects the fact that, far from promoting integration of assembly plant with local suppliers, the Maquiladora programme has relied solely on imported raw materials.

Paus and Gallagher (2008) argue that the potential for spill-overs in Mexico has been constrained because MNCs strategically decided to import their inputs, rather than source them locally, and because Mexican firms lacked much of the absorptive capacity necessary to capture spill-overs that were available.

Table 4.9 Participation of Maquiladora exports in total exports and value added as percentage of GDP.

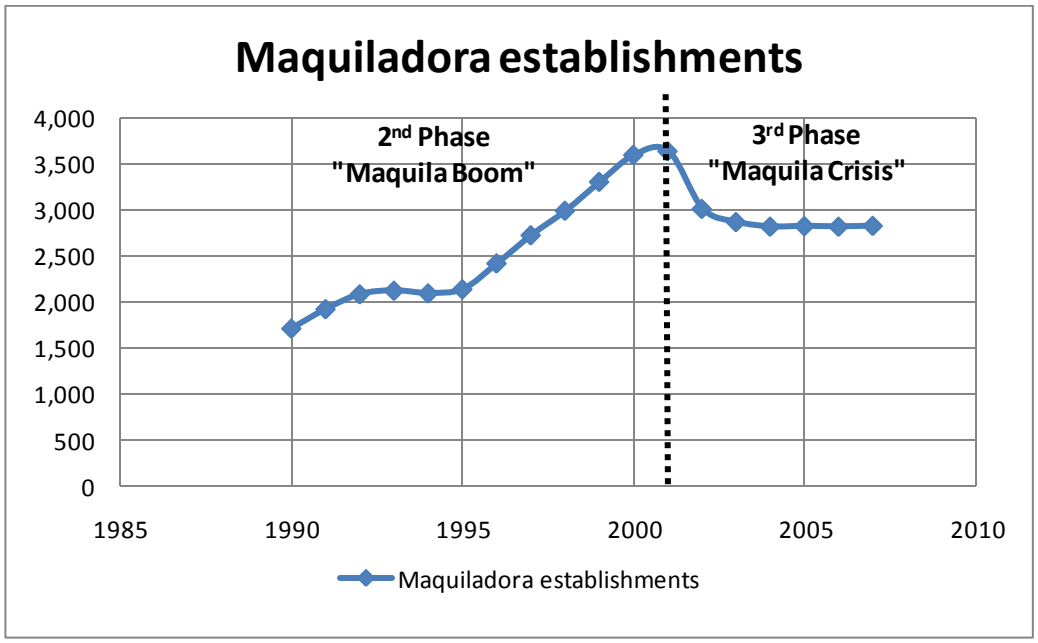
Year	Participation of Maquiladora exports in total Manufacturing exports	Value added of Maquiladoras as percentage of GDP
1990	49.9	1.4
1991	50.1	1.3
1992	52.7	1.3
1993	53.2	1.3
1994	52.7	1.4
1995	47.3	1.7
1996	46.4	1.9
1997	48	2.2
1998	50.3	2.5
1999	52.5	2.8
2000	54.9	3.1
2001	54.6	3.1
2002	55.1	2.9
2003	55.1	2.9
2004	55.1	2.8
2005	55.6	2.8
2006	55.2	2.9
2007	55.7	2.8

Source: INEGI, Encuesta de la Industria Maquiladora de Exportacion (various issues).

Phase 3: The Crisis (2002-)

The last phase of the Maquiladora evolution corresponds to the crisis period. The crisis was not only a result of the economic recession in the U.S. nor of the competition from China, but it also resulted from structural limitations in the sector's main production models. For instance, from 2001 to 2007 the number of Maquiladora establishments dropped from 3,630 to 2,819 (see Figure 4.7). De la Garza (2007) and Carrillo (2007) raised concerns about the Maquiladora crisis, questioning whether this model is an acceptable route for growth of the economy and dignified jobs, and if it has reached its limits.

Figure 4.7 Number of Maquiladora establishments



Source: INEGI.

De la Garza (2007) states that this crisis was generated because of the economic crisis of the US, the competition from other countries with lower wages than Mexico, such as China and the Caribbean countries; and finally by the growth of Maquila wages in recent years.

The problem is that Maquiladora production has relied largely on cheap wages and has not generated the channels to promote linkages between local suppliers. The lack of linkages with local suppliers is due to the legal rules established by the government for Maquiladoras that bound them to importing raw materials.

However, more positive points of view exist, advocating that Maquiladoras were not only limited to assembly but also incorporated more sophisticated processes based on automated technology, new forms of organisation, better qualified workers and an increase in the share of technicians (Carrillo and Hualde, 1998; Carrillo and Lara, 2005; Carrillo and Zarate, 2009). These authors assert that there are other advantages apart from low wages such as the proximity to the United States, infrastructure in Mexico, energy costs, educated workforce, abundance of labour and social peace.

For instance, Carrillo and Lara (2005) and Carrillo and Hualde (1998) propose a thesis of three generations of the Maquila, based on the firms' trajectories, summarised in Table 4.10 In principle, the authors suggest that the first generation of Maquiladoras are based on intensive manual work; during the second generation, it is based on rationalization of work and is characterised by the implementation of the Japanese system of production known as 'lean production[35]'. The third generation is based on intensive use of knowledge and, more recently, they have proposed a fourth generation where firms have to develop non-material activities for the coordination of a huge range of activities, agents and units of production interconnected in the value chain.

The above-mentioned authors also point out that, although there is a distinction between the different types of plants, different generations or companies co-exist in the same period. In other words, this concept is not static or stagnates in the same period of study: on the contrary, the generations co-exist and mix, but with the prevalence of one generation.

[35] Lean production is an assembly-line methodology developed by Toyota and the manufacturing of automobiles. It is also known as the Toyota production system or just-in-time. It is characterised because components are delivered in small, very frequent batches, minimal stocks are held, quality control is 'built in' at all stages, minimal warehousing space and staff is required, it uses a minimal number of suppliers within a tiered supply chain, and it encourages suppliers to locate close to customers (Dicken, 2007).

Table 4.10 Typology of Maquiladoras based on generations of companies

a. First Generation Maquiladoras ("Assembly in Mexico")
The source of competitiveness relies on the relatively low salaries and the intensification of labour. The reference period in which they emerge and develop: 1965–1981, from the beginning of the Border Industrialisation Program to one year before the economic crisis (1981). Foreign traditional assembly plants, unrelated, from the point of view of production, from national industry; with scarce technology, high dependence on the decisions of the corporate and main customers, and essentially based on intensive manual labour performed by young women with rigid job positions and activities that are repetitive and monotonous (Carrillo and Hualde, 1998).
b. Second Generation Maquiladoras ("Made in Mexico")
Period: 1982–1994 with the start of the quest for quality up to the signing of the North American Free Trade Agreement (NAFTA). Plants with capital originating from a greater range of sources aimed at manufacturing, with incipient development of local suppliers of components and direct and indirect services; with a higher level of technology and automation; with a gradual, albeit timid, process of autonomy in corporate decisions and, centrally, with a large trend towards the streamlining of production and work (Carrillo and Hualde, 1998). More men are incorporated, including qualified workers, technicians and engineers. Work is performed in teams under the functional flexibility scheme (greater responsibility, commitment and involvement). The new activities of engineers make it possible to acquire knowledge and local and regional professional degree courses are consolidated. The main concern is to improve quality standards and cut delivery times and rework sources, delays, dead time and inventory. Competitiveness comprises of a combination of quality, delivery time, unit costs and labour flexibility. Companies capable of giving a rapid response to the increasing fluctuation in demand (Carrillo and Hualde, 1998). The management bodies are run increasingly by Mexicans (Contreras, 2000).
c. Third Generation Companies ("Created in Mexico")
Plants with a greater presence of TNCs focusing on design, research and development. (Carrillo and Hualde, 1998) Vertical integration, both intra-company or kereitzu and inter-company (ties with domestic suppliers and trade between maquiladoras), emerges (Koido, 2003; Lara 1998). Clusters are formed around technical centres, assembly plants, suppliers of components, indirect suppliers such as machining or plastic injection workshops, and suppliers of services (Carrillo and Hualde, 2002; Lara, 2002). A greater level of technology and prototype development. There is a substantial increase in autonomy in decision-taking. Highly skilled work, with high levels of responsibility and discretion that privileges knowledge and creativity in both design and manufacture. In other words, engineering and technological capabilities, the relative salaries of skilled staff, along with communications and the proximity of assembly and manufacturing plants (Carrillo and Hualde, 1998; Lara and Carrillo, 2003). Top level management becomes increasingly Mexicanized, although there is still a mixture of foreigners and nationals (Contreras, 2000; Dutrenit and Vera-Cruz, 2002).
d. Fourth Generation (coordination from Mexico)
The coordination of manufacturing, research, purchasing and services becomes the central axis of this generation of Maquiladoras. An example of this type of firm is Delphi technical centre located in Juarez that coordinates approximately 57 plants and almost 75,000 employees in Mexico.

Source: Carrillo and Lara, 2005, p. 260.

4.5. Conclusions

Over the last two decades Mexico has implemented a comprehensive number of reforms to liberalise trade and investment with the hope of achieving economic growth. These reforms facilitated the emergence of Mexico as an attractive sourcing location for the United States, and the Maquiladoras played an important role in this.

As a result of these liberalisation reforms, Mexico's trade flows and FDI have expanded. Particularly, much of the growth in exports can be attributed to the Maquiladoras that represent nearly 50 percent on average of the total manufacturing exports from 1990 to 2007.

Despite the good performance of the Maquiladoras as one of the main drivers of exports, the value added of the Maquiladora firms accounts for a small portion of the total value added, and this may reflect the lack of integration between the Maquiladoras and local firms. Some authors have an optimistic point of view of the development of the Maquiladoras, while others are more sceptical arguing that the Maquiladoras' advantage is merely based on low wages.

For this reason, this thesis aims to fill the gap in the literature by testing the characteristics that are associated to supplier firms engaged in outsourcing, and this is presented in the next chapter. The intention is also to test whether suppliers engaged in outsourcing benefit from this type of production in terms of more in-plant training and higher investment in R & D or improvements in organizational techniques.

Chapter 5 Research Methodology and Data Description

5.1. Introduction

The aim of this chapter is to describe the methodology used and data employed in this research. The first two sections present the research questions, research process and choice of methods available. It also explains data management techniques used for this research along with illustration of data used.

5.2. Research Questions

International sourcing has been analysed from the point of view of lead firms in developed countries, but much less is known about its significance and implications for supplier firms in developing countries. Hence this thesis wants to contribute to the understanding of the phenomenon from the perspective of the supplier.

In Chapter 2 of the Literature Review, we formulated research questions to be answered in the process of this research. The three questions were:

1. How significant is outsourcing in the Mexican Manufacturing Industry?
2. What are the characteristics of the supplier firms involved in outsourcing in the Mexican Manufacturing Industry?
3. Does the engagement in outsourcing increases R & D, training and improves the organizational techniques of the supplier firms involved in outsourcing?

A series of propositions can be derived from question 3. The research questions are as follows and are analysed in Chapter 7:

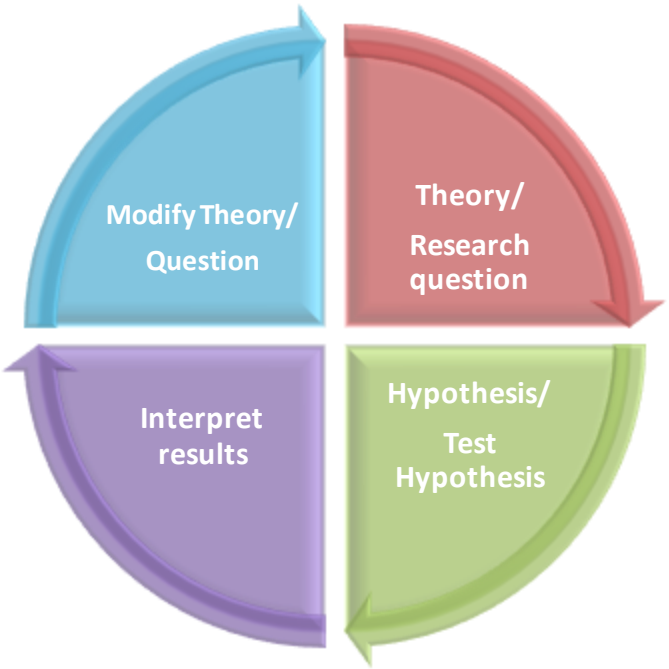
d. Does outsourcing foster R & D activities of supplier firms involved in outsourcing?
e. Does outsourcing encourage in-firm training of supplier firms involved in outsourcing?
f. Does outsourcing promote better organizational techniques of supplier firms involved in outsourcing?

This chapter answers questions 1, 2 and 3 using descriptive data. Econometric techniques are carried out to answer questions 3 and 4 and the detailed methodology for each question is presented in Chapters 6 and 7.

5.3. Research Process and choice of methods

The classic research process model usually starts with choosing theory, generating hypothesis, testing the hypothesis and interpreting the results (see Figure 5.1). This process is a cyclical, where the results of one study feedback into the system and inform future research (VanderStoep and Johnson, 2008).

Figure 5.1 Classic Research Process



Source: VanderStoep and Johnson, 2008.

Once we understand the basic research model, the debate arises of whether to choose qualitative or quantitative research approaches to test the hypothesis. Quantitative methodology uses a deductive form of logic where theories and hypothesis are tested in a cause-and-effect order. Concepts, variables and hypothesis are chosen before the study begins and remain fixed throughout the study. Conversely, in a qualitative methodology inductive logic dominates. Categories and concepts emerge from informants, rather than being identified a priori by the researcher (Creswell, 1994:7).

The advantage of quantitative research is that the findings from the sample under analysis reflect more accurately the overall population from which the sample was drawn. However, one of the disadvantages is that it can give a superficial understanding of participants' thoughts and feelings or firm's behaviour in our case.

Qualitative research is preferred if the researcher desires a more narrative understanding. The main advantage is that it provides richer and more in-depth understanding of the population under study. However, the main disadvantage of qualitative research is that sample sizes are usually small and non-random. Therefore, the findings can not be generalized to the entire population from which the sample was drawn.

From the previous arguments it is evident that each approach has its own advantages and disadvantages. Ideally, quantitative and qualitative research methods can be employed, but practically speaking, limitations of time and resources constrain such an exhaustive research. In our case, at first we aimed to use a mixture of these two methods, but because of time and resources limitations we decided not to use mixed approaches.

According to Giroud (2003), the criteria to take into account when choosing research methods is that the research questions must drive the methodology. In this thesis, the research questions involve casual relationship concepts like "measure"; "characteristics", and "increase". Since our concepts are measurable or at least we can draw measurable indicators, we consider that quantitative research is more appropriate to answer our research questions. In addition VanderStoep and Johnson, (2008) state that if a large, accurate sample that will generalize to the larger population is available, quantitative research would be preferred.

When we started this project and raised the research questions, the following step was to figure out how to measure outsourcing, and how this abstract concept can be translated in something measurable. By reviewing different theoretical models and empirical papers summarized in Chapter 2, we identified a set of variables that helped us to identify and construct variables that moved our research from an abstract concept into one that can be measured.

The next challenge faced, was to identify possible secondary data sources containing not only detailed information of the different firm characteristics, but also and most importantly an indicator of outsourcing practices. Mexico's statistical office provides detailed records of these indicators in different surveys which are described in the following section. Table 5.1 summarises the questions to research, the approach, methods, variables and type and source of the data.

Table 5.1 Summary of Research Methodology

Research Question	Approach	Methods	Variables	Type and source of the data
Chapter 5. 1. How significant is outsourcing in the Mexican Manufacturing Industry?	Country-case Includes all industries in the manufacturing sector	Quantitative (Descriptive)	Outsourcing ratio	Secondary Data (EIA and System) and (ENESTYC
Chapter 5. 2. What are the characteristics of the supplier firms involved in outsourcing?	Country-case Includes all industries in the manufacturing sector	Quantitative (Descriptive)	**Independent Variables:** Ownership, Export propensity, Size of the firm, Subsidiary status, Share of imported raw materials, skills and Industry dummy	Secondary Data (ENESTYC)
Chapter 6. 3. What are the characteristics of the supplier firms involved in outsourcing in the Mexican Manufacturing Industry?	Country-case Includes all industries in the manufacturing sector	Quantitative (Probit & Tobit Models)	**Dependent:** Probability of outsourcing **Independent:** Size of the firm Export propensity Ownership status Age of the firm Productivity Wages Share of imported raw materials Dummy for investment in R & D Skills of the workers Dummy for unionization Subsidiary status Industry dummy	Secondary Data (ENESTYC)
Chapter 7. 4.Does outsourcing foster R & D activities of supplier firms involved in outsourcing?	Country-case Includes all industries in the manufacturing sector	Quantitative (Probit Model)	**Dependent:** Probability that a firm invest in R & D **Independent:** Outsourcing ratio Ownership of the firm Export propensity Size of the firm Industry dummy	Secondary Data (ENESTYC)
Chapter 7. 5.Does outsourcing encourage in-firm training of supplier firms involved in outsourcing?	Country-case Includes all industries in the manufacturing sector	Quantitative (Probit Model)	**Dependent:** Probability that a firm performs in-plant training **Independent:** Outsourcing ratio Ownership of the firm Export propensity Size of the firm Industry dummy	Secondary Data (ENESTYC)
Chapter 7. 6.Does outsourcing promote better organizational techniques of supplier firms involved in outsourcing?	Country-case Includes all industries in the manufacturing sector	Quantitative (OLS)	**Dependent:** Number of organizational techniques implemented by the firm **Independent:** Outsourcing ratio Ownership of the firm Export propensity Size of the firm	Secondary Data (ENESTYC)

The contribution of this thesis is twofold. Firstly, to find out for the first time in the Mexican context the characteristics of supplier firms engaged in outsourcing relationships. Secondly, to test if supplier firms involved in outsourcing are more likely to invest in R & D, perform more in-plant training and implement better organizational techniques. The importance of these questions for policy is clear, if outsourcing is a source of upgrading and technology transfer in developing countries, then policy makers should promote it. Likewise, if it is not having these positive effects, policies should be designed to create the conditions under which upgrading and technology transfer are possible for suppliers in developing countries.

Although our results cannot be generalized in the context of developing countries, they take a significant and manageable slice of the phenomenon in the world economy.

5.4. Data collection and description

During the last decade there have been an increasing number of studies using micro-level data (e.g. Clerides, et. al, 1998; Baldwin and Gu, 2003; Alvarez and Lopez, 2005; Haskel, et. al., 2007; Crespi et. al., 2008; etc). Micro-level data analysis has been possible due to the efforts of statistics offices in different countries to collect firm and household level data.

In the case of Mexico the National Institute of Statistics, Geography and Informatics, (INEGI by its Spanish acronym) has a long experience of collecting firm level data. For this thesis, data from different sources is used to analyse outsourcing in Mexico: the Annual Industrial Survey (EIA); the National Accounts System for the Export Maquiladora establishments and the National Survey of Employment, Wages, Technology and Training (ENESTYC).

This thesis shows a general outsourcing ratio using aggregate data to have a general overview of annual trends of outsourcing in the Mexican Economy

from 1994 to 2006. For this purpose we use data from the Annual Industrial Survey (EIA) and the National Accounts System for the Export Maquiladora establishments (SCNM). These data are easy to access through the INEGI's website. The EIA and SCNM are used since the data is collected on a yearly basis and the same firms are followed over time. Hence, we can have yearly estimations of outsourcing ratios rather than calculations for the different waves of the ENESTYC which is the main survey that we are using for our firm-level analysis in Chapters 6 and 7. The EIA contains economic information such as production, wages, use of intermediate inputs, outsourcing practices (in and out), exports, imports, wages, among other variables. The SCNM show detailed information of the total gross production and its components for the Maquiladora establishments. One of the limitations of both surveys is that they do not offer detailed data regarding training practices, technology used, and unionization.

In this sense, the ENESTYC which is a special supplementary survey of the EIA, includes detailed quantitative and qualitative questions regarding training and technology used and outsourcing practices among other variables. As it was mentioned before, the econometric regressions in the empirical chapters primarily rely on data from the ENESTYC.

Because of the confidentiality of the data, INEGI granted me access to the database provided all the analysis was performed at their offices. Therefore, I spent several months at INEGI, in Aguascalientes working with the data with the support of several INEGI analysts. The close interaction with INEGI's analysts was an enriching experience because it helped me to understand the information and limitations of the data.

For the Annual Industrial Survey and the National Accounts System for the Maquiladora establishments a brief explanation is provided as the data is only used to calculate the outsourcing ratios in this Chapter. For the ENESTYC more attention is devoted and we present its content, sampling methodology, the procedures used for data cleaning and deflating procedure of the data.

5.4.1. Annual Industrial Survey (EIA)

The Annual Industrial Survey (EIA) is carried out yearly, and the data refers to the previous calendar year. It is the main and oldest survey covering the Mexican manufacturing sector[36]. The first wave of the EIA dates back to 1963, and included 622 plants spread over 29 classes of activity. Then the number of firms and manufacturing activities were expanded (Table 5.2).The diversification and growth of the Mexican economy has led to a diversification of the manufacturing activities in Mexico and an increase of the number of firms. As a result, in 1993 the EIA faced a further expansion covering 205 classes of activity and 6,867 firms which were subsequently followed over time. Specific analysts in the INEGI offices in Aguascalientes, Mexico, follow up the plants over time, and double-check inconsistencies or sudden changes in the plant, in many cases by calling the establishment on the phone. Thus, the quality of the data in the EIA is better than in surveys with less regular contact between the INEGI analysts and the survey respondents (Verhoogen, 2008).

Table 5.2 Historical evolution of the EIA

Year	No. manufacturing activities covered	No. of firms covered
1962	29	622
1976	57	1,338
1987	129	3,218
1994	205	6,867

Source: INEGI, 2005

The unit of observation is the plant described as "the manufacturing establishment where the production takes place" and each plant is classified in its respective class of activity based on its principal product (at 6 digit level

[36] The EIA excludes Maquiladora firms but their information is collected in a separate survey (Encuesta de la Industria Maquiladora e Exportacion).

based on the CMAP 94[37] (Mexican Classification of Activities and Products). The CMAP is organized in 6-digit industries called "clases", 4 digit industries called "ramas".

The sampling method is deterministic and aims to capture the most representative classes of activities and the larger establishments. The most important activities which jointly represent 85 percent of the total manufacturing output are included. All plants with more than 100 employees are included automatically, despite the 85 percent threshold has already been reached.

For the highly disaggregated classes (for instance activities with small size plants and a high number of manufacturing establishments), whenever the normal sampling procedure specify that more than 120 plants have to be surveyed to reach the 85 percent threshold, the number of firms is kept to a maximum of 120. In fact, in these highly disaggregated sectors the actual coverage is approximately 60 percent of the total manufacturing output of the respective class. Similarly, for highly concentrated classes (activities with a reduced number of large plants where industrial concentration is very high), when the 85 percent threshold is reached by including less than 15 plants, all the plants are included (Iacovone, 2008).

As we can observe from the sampling method, the EIA is skewed towards large firms. For instance, while in 1993 the Industrial Census covered 106,748 plants, the EIA only covered 6.5 percent of the plants sampled in the Census, but it represented 85 percent of the total manufacturing output.

The EIA contains information on employment, total hours worked, wages, total production value, revenues from domestic maquila services, domestic and export sales, costs of intermediate goods and materials (both national

[37] The CMAP 94 comprises 9 sub-sectors, 50 "ramas" or branches and 309 6-digits classes. The EIA covers all the subsectors and ramas but only 205 classes.

and imported), costs of packing, expenditure for technology transfers, R & D expenditure, other revenue, inventories, and capital assets and investment.

The survey identifies plants producing under subcontract (domestic outsourcing). Participants in the Maquiladora program are not included in the EIA. Hence, to gather data for the Maquiladora firms INEGI implemented a survey called Survey of the Export Maquiladora Industry (Encuesta de la Industria Maquiladora de Exporetacion, EIME). But the aggregate data on total gross production is calculated and published in the National Accounts System of Mexico: production, wages, employment and productivity of the export Maquiladora industry are described in the following section.

5.4.2. National Accounts Systems of Mexico (NASM): Production, Wages, Employment and Productivity of the Export Maquiladora Industry

To calculate the outsourcing ratios at the national level, we need aggregate data of the gross total production not only from all the manufacturing activities but also for the firms involved in outsourcing. As we are considering Maquiladora production as a proxy for outsourcing, the data to calculate the outsourcing ratios is obtained from the National Accounts Systems of Mexico: Production, Wages, Employment and Productivity of the Export Maquiladora Industry (NASM) published by INEGI. For the elaboration of the NASM INEGI gathers the information of nearly 3,000 establishments from The Export Maquiladora Survey (Encuesta de la Industria Maquiladora de Exportacion, EIME) and calculates production, wages, and employment and productivity indicators of the Export Maquiladora Industry. The data is classified according to Mexico's National Accounts System codes to make it compatible with the information of the other manufacturing industries. The data for the Manufacturing and Maquiladora activities are reported separately.

The NASM contains the following information:

- Total gross production at current and constant prices
- Employment
- Annual average wages by type of worker
- Productivity rates
- Intermediate consumption (national and imported)
- Gross value added at current and constant process
- Balance of trade

The data are presented disaggregated by industrial activity, by branch of economic activity "rama" at the national level, and disaggregated by state.

5.4.3. ENESTYC (National Survey of Employment, Wages, Technology and Training)

The ENESTYC is a firm level survey is based on a representative sample of manufacturing establishments in 54[38] manufacturing activities and has five waves with many of the questions referring to the previous calendar year. The survey was conducted in 1992, 1995, 1999, 2001 and 2004 with many of the questions referring to the previous calendar year. The survey included 5,071 establishments in 1992, 5,242 in 1994; 6,840 in 1999; 8,181 in 2001 and 9,920 in 2004.

The survey is designed to cover firms of all sizes at four-digit of the manufacturing using the CMAP (Mexican Classification of Activities and Products) classification in the first four waves and is derived from the EIA (Annual Industrial Survey). The last survey changed the classification from CMAP to NAICS (North American Industrial Classification). This change makes

[38] Although the ENESTYC includes 54 industries, for this analysis we exclude two sectors 3511 Basic Petrochemicals; and 3550 Oil Refining since outsourcing practices are null.

it difficult to compare the data with previous surveys, but INEGI has a table of concordance.

It is implemented through the joint efforts of INEGI (National Institute of Statistics, Geography and Informatics) and the Ministry of Labour, STPS (Secretaria del Trabajo y Prevision Social). Unlike the EIA the ENESTYC includes maquiladora establishments. In fact, from 1999, due to the fast growth of export Maquila activities in Mexico, INEGI decided to include a separate section of the ENESTYC devoted exclusively to Maquiladora establishments. In the 1999 wave a total of 589 Maquiladora establishments were surveyed and in 2001, the sample included 675 establishments.

The present study includes data from the 1992, 1999 and 2001 ENESTYC surveys. We do not include in our analysis data from the 1995 and 2004 waves of the ENESTYC. In 1994 the Survey was an annex questionnaire of the Industrial Annual Survey (EIA) and the data does not include export Maquiladora establishments.

Finally, the last wave of ENESTYC was not included either, since at the time that I conducted the fieldwork the results were not released.

5.4.3.1 Coverage and sampling structure

The sampling frame in each year was stratified by total employment, with plants with 100 or more employees sampled with certainty, and a sample of plants with less than 100 employees chosen randomly. In 1995 two samples were drawn, the first was probabilistic comparable to the samples in 1992, 1999 and 2001, but Maquiladora plants were excluded. The second sample was a follow-up sample for the 1992, and all respondents to the 1992 survey that could be traced were included. Only a few Maquiladoras were included through this follow-up sample (Verhoogen, 2008).

The Survey was designed as separate cross-sections, not as a panel, but since large establishments have been sampled with certainty, it is possible to trace them and construct a panel with around 906 firms. We did not use the panel for our empirical analysis because Maquiladora establishments were not included. Since Maquiladora is one of our proxy variables of outsourcing,

Finally, many questions changed in the questionnaires between waves, but several key variables are comparable across years.

5.4.3.2 Content

The ENESTYC contains quantitative and qualitative variables and covers the following topics:

- ***Characteristics of the establishment****:* includes information such as the main product produced, years of operation, ownership of the firm (domestic or foreign), and subsidiary status.
- ***Production and organization:*** contains information on the implementation of new methods of organization (e.g. Just in Time, Total Quality Control, etc.) and their impact on productive aspects and employment structure; value of production and fixed assets; share of installed capacity, costs for materials and supplies; expenses in subcontracting and Maquila services requested to other establishments; and expenses on waste and/or rework.
- ***Market:*** this section of the survey collects information of the main effects of NAFTA on the competitive level of the products produced in the establishment in comparison with domestic and imported products; production revenues and income from subcontracting services; forms of organization with other companies for the purchase of materials, machinery and equipment, for training or research activities; destination of products (domestic or foreign market); and origin market of the raw materials (percentage).

- ***Quality control technology:*** in this section of the ENESTYC establishments are asked if they have implemented any quality control method (e.g. ISO 9000); quality assurance procedures; if they have acquired new machinery and equipment; conditions of the machinery and equipment acquired (new or used); and the effects of the acquisition of machinery and equipment on the production and employment structure. Finally firms have to answer if they have carried out any research and technological development activities.
- ***Employment:*** this section gathers data on the number of workers in different occupational levels by gender, level of education and age of the workers; unionisation; type of contract; hours worked; existence of vacancies and job profile required to cover the vacancy; terms covered by the collective contract and by the law, as well as the characteristics of the staff recruitment.
- ***Wages:*** salary categories and the variation between the highest and lowest category; benefits and payments for the different occupational levels; and overtime worked by occupational level and gender.
- ***Training:*** the existence of the Joint Committee of Training, number of workers trained and the duration of the courses; type of agents who provided the training; firms are also asked if they have knowledge of the training programs offered by the government.

As we can note, the ENESTYC contains very detailed information of the establishments. However, one of its drawbacks is that sometimes it is difficult to validate and homogenise the answers of the respondents since it comprises both qualitative and quantitative data. For example, the survey has two related questions regarding R & D practices adopted by firms. In one of them, firms have to answer whether or not they invest in R & D. In the second question, firms have to specify the amount of money invested in R & D. The problem arises because many of the firms answering that they have invested in R & D, did not answer the amounts invested in R & D. Hence, it is hard to validate the data or to make inferences if they are really investing in R & D.

Despite these inconsistencies the information included in the survey is very rich and comprehensive and at least we can have a glance of firms' behaviours and practices.

The reason why we selected the ENESTYC as the main source of data for our empirical analysis is because it elicited information regarding outsourcing practices, both contracting out and being subcontracted by a third firm. Hence, we can take this second variable as s proxy for outsourcing and relate it with other firm specific characteristics to understand more about the nature of the phenomenon and the likely benefits for supplier firms involved. We are particularly interested in the analysing the phenomenon from the perspective of the supplier firms, since as far as the author knows, there is limited research on this area.

5.5. Data Management

Each plant surveyed by the ENESTYC was assigned an identifier composed of its 4-digit class of activity and additional 6-digit code "folio". Jointly these two codes allow us to identify each plant and merge the data from the Manufacturing and Maquiladora surveys of the ENESTYC. The following sections describe the process of data merging, deflating of variables, cleaning of data.

5.5.1. Merging the Maquiladora and Manufacturing surveys

For each of the waves of the ENESTYC consists of three different files for the Manufacturing and three for the Maquiladora Surveys. Since questions of the Maquiladora and Manufacturing survey are compatible, the two databases were merged. Table 5.3 shows the total sample size after merging the databases in 1999 and 2001.

Table 5.3 Number of firms after merging the files

Year	Manufacturing	Maquila	Total
1999	6,840	589	7,429
2001	8,181	675	8,856

Source: Author's calculations with data from ENESTYC 1999 and 2001.

5.5.2. Deflating variables

All the variables reported in the ENESTYC are in current nominal values, so it was necessary to transform them into constant 1994 pesos. In order to do this transformation we basically used two different deflators: producer prices index and consumer prices index. The deflators were obtained from the Mexican Central Bank (BANXICO).

The total revenues were deflated using the producer prices expressed in 1994 Mexican pesos. Similarly Maquila Income and Outsourcing income series are deflated using the same producer-price index.

Labour costs: the wage bill of the three different categories was deflated to 1994 pesos by the main consumer price index published by the Mexican Central Bank.

5.5.3. Data Cleaning

The following establishments were removed:

- Establishments that report zero or missing values for total revenue, average employment and average weekly hours worked.
- When we calculated productivity there were establishment with exaggerated figures either too high or too low productivity levels due to inconsistencies in the data (e.g. the value added was too high and the firm had only one or two employees) were removed. To remove these observations first we plotted a scatter diagram to identify potential outlier points, and then we checked these cases to remove them from the data.

After the data cleaning procedure we finish with the following number of firms for the econometric analysis (see Table 5.4)

Table 5.4 Total number of firms after cleaning procedure

Year	Number of firms
1992	4,882
1999	6,096
2001	6,888

Source: Author's calculations with data from ENESTYC 1992, 1999 and 2001

5.5.4. Definition of Variables

To start building up the variables used for our empirical analysis we used the following variables from the ENESTYC:

- **Total revenues**: Total sum of annual sales' income, fixing and maintenance's income, concession of patents and trademarks' income, income received for Maquila and outsourcing services and other income. We are using total revenue, because we do not have

disaggregated information on production. The survey only includes total output, and to measure the ratio of outsourcing we need disaggregated information on maquila. Thus, using revenues is more convenient because the information is disaggregated and we can identify and weight outsourcing on total revenues. As for the Maquila Survey, revenues are more disaggregated and we can identify the part of the sales channelled to the domestic market as well as to the foreign market.

- **Maquila Income**: Monetary amount received by the firms for the production, assembly or any other transformation done to raw materials of a third party. Firms reporting this type of income are registered in the Maquiladora programme.
- **Subcontracting Income**: Total amount of money obtained by the firm for its specialized services offered in the production of the one or any of the different stages of the production process which are part of its core activities. It is based on the firm's competitive advantage as compared to other firms, which allow it to increase its technical experience and productive efficiency
- **Foreign ownership status*:*** The survey distinguishes three types of ownership: private, foreign and public. However, most of the firms in the survey are private and foreign. We created a dummy variable which takes the value of 1 if plant has 10 percent or more foreign ownership, 0 otherwise.
- **Exports:** is the ratio of total exports to output.
- **Size of the firm**: The survey classifies firms into four categories according to the number of employees, micro (from 1 to 15 workers), small (16-100), medium (101 to 250) and large (more than 250 workers).

- **Wages and employment** The survey distinguishes four categories of wages and employment[39]:
    - General production workers
    - Specialized production workers
    - Administrative, technical and clerks and
    - Managers

However, Verhoogen (2008), points that these categories are not very accurate and can led to a significant amount of noise in the data, particularly in the distinction between general and specialized production workers. The problem is that some plants report all their general production workers under the specialized production workers category and the latest under the general production workers. For this reason, the author suggests that it is better to aggregate specialized and general production workers into one category (blue collar). Therefore we aggregated wages and employment into three categories in the present analysis:

- Managers
- White collar: which comprises the administrative, technical and clerks and
- Blue collar: includes general production workers (unskilled blue collar) and specialized production workers (skilled blue collar).

[39] Data are expressed in average yearly employment.

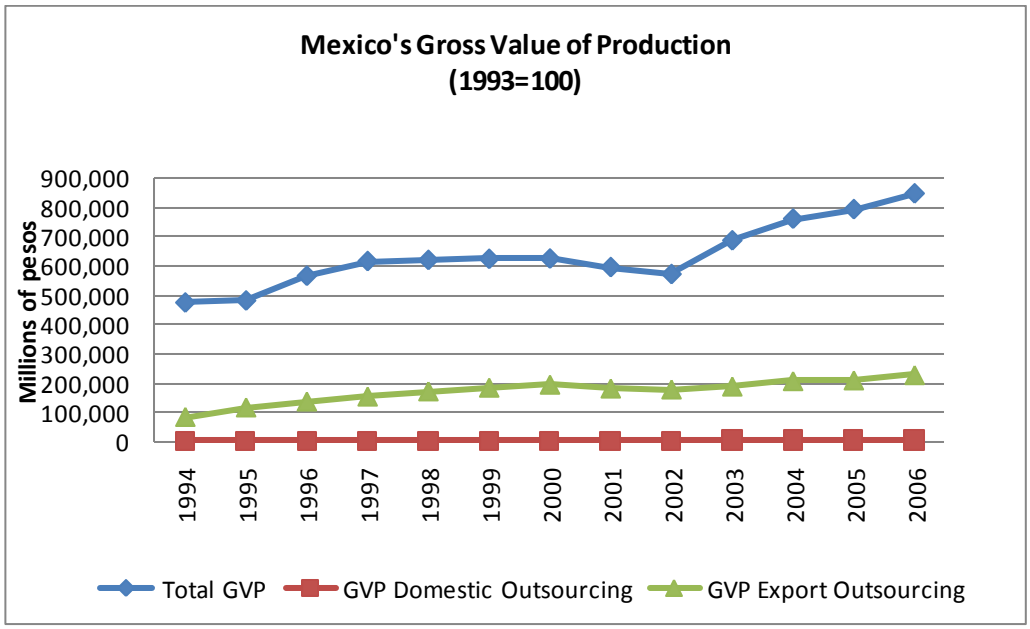
5.6. Significance of Outsourcing in the Mexican Manufacturing Industry

Previous chapters show trends in the significance of outsourcing at the global level using trade statistics, but the question of how significant outsourcing is in Mexico, has not been addressed yet. This section presents trends of outsourcing intensity in the Mexican manufacturing Industry and summary statistics at the firm level showing the number of supplier firms participating in outsourcing and some of the main characteristics of firms engaged in outsourcing. We present trends at the national level using data from the EIA and National Accounts System, and at the firm level using the ENESTYC.

The EIA and National Accounts System of Mexico for Maquiladora firms are used to paint a broad picture of trends of outsourcing intensity from 1994 to 2004. Figure 5.2 shows Mexico's total gross value of production (GVP) compared with domestic and foreign outsourcing GVP. We can observe that after Mexico joined to NAFTA in 1994 there is a slow but steady growth of the GVP until 2000. From 2000 to 2001 the entire industrial activity in Mexico including the Maquiladora entered into a crisis. In the case of the Maquiladoras, from 2000 to 2003 personnel occupied dropped 17.7 percent and the number of Maquiladora establishments decreased 20.5 percent. However, from 2004 we can observe a recovery. According to Toledo (2007), the causes of the crises can be explained by three primary factors:

1. Decrease of the demand for Maquila products due to the economic recession in the United States
2. Competition from other low wage countries such as China and Central American countries that have provoked the closure of plants in Mexico and their relocation to other countries.
3. The growth of Maquila wages in Mexico over the last years has reduced the sector's profit margin.

Figure 5.2 Mexico's Gross Value of Total Production vs. Outsourcing GVP



Source: Author's calculations with data from ENESTYC 1992, 1999 and 2001

The author argues that with exception of the first argument, all of these causes suggest that Maquiladoras competitive advantage is based on low wages, and when this advantage is reduced or eliminated, foreign Maquiladoras are more likely to leave the country or close the plants to relocate their production into a cheaper location.

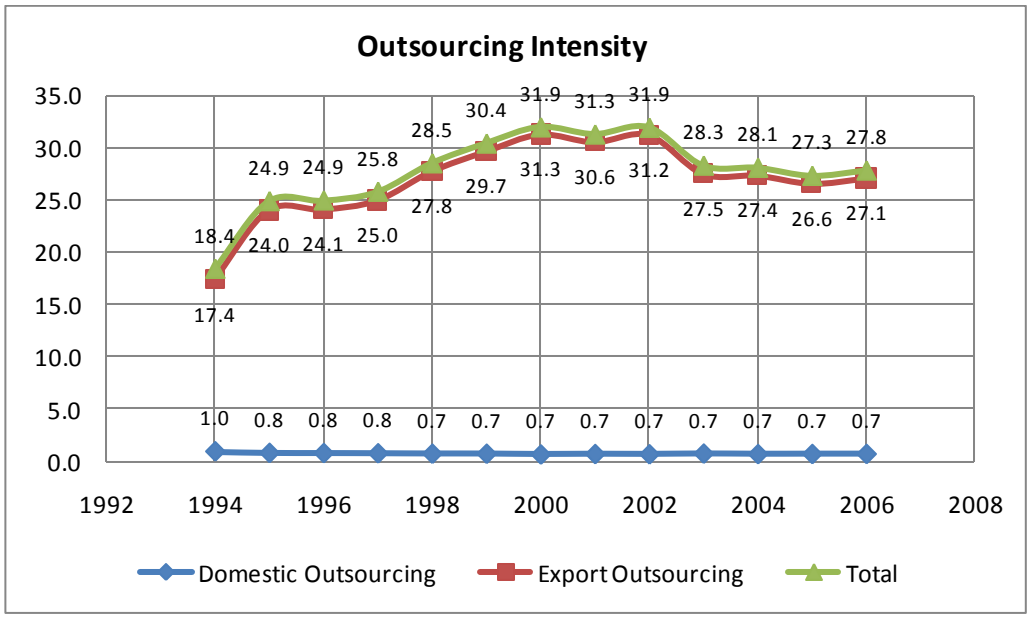
To measure the magnitude of the outsourcing production and answer our first question we take as a proxy of outsourcing the variable Maquiladora gross value of production (GVP), and the ratio is calculated as follows:

$$Outsourcing\ ratio = \frac{GVP\ domestic\ Maquila + GVP\ export\ Maquila}{Total\ Gross\ Value\ of\ Production}$$

Figure 5.3 shows outsourcing ratios intensities from 1994 to 2004 in the Mexican Manufacturing sector. During this period outsourcing ratios show an upward trend especially in the production devoted to foreign markets. In 1994, 18.4 percent of total production in the Mexican manufacturing sector was produced by local suppliers involved in outsourcing. By 2004, we can observe that nearly one third of the total production was subcontracted. It is interesting to note that suppliers involved in outsourcing are more exposed to the export markets. This is because United States firms have used Mexico as one of their most important off-shoring destination to carry out particular stages of their production (Bergin, et. al. 2009).

We can also distinguish in Figure 5.3, two different periods of the outsourcing model in Mexico. During the first period, that we can call the “boom period”, spanning from 1994 to 2000 the average annual growth rate of outsourcing was 10 percent, whereas in the second stage called the “crisis period”, the average annual growth rate was minus 2 percent.

Figure 5.3 Outsourcing Intensity Ratios



Source: Author'd calculations from Industrial Annual Survey (EIA) and National Accounts Systems of Mexico data.

In 2006 we can observe that the outsourcing intensity is starting to improve, but there is still no certainty that this type of production model will be able to recover the role held in the 1990s (De la Garza, 2007).

Bergin, et. al. (2009), suggest that this type of production entails excessive volatility and to some extent is driven by the business cycles of the US economy. For instance, Dickerson (2005), published in the business section of Los Angeles Times that the Mexican car industry is highly susceptible to fluctuations in demand of American Brand Automobiles. In this sense, the Big Three's (General Motors, Ford and Daimler Chrysler) shrinking U.S. market jeopardized one of Mexico's main industries, and drove to a decline in the production volume, exports and employment from 2001.

The present thesis unfortunately does not explore this crisis period because of data availability, instead we offer an analysis of the period when outsourcing through the Maquiladora scheme became a central part of the economic export model in Mexico.

To have a closer picture of this type of production model, the following part of the thesis presents statistics from the ENESTYC. As was previously mentioned, this survey offers more detailed description of firms and most importantly it identifies outsourcing and off-shoring practices under subcontracting and Maquiladora income.

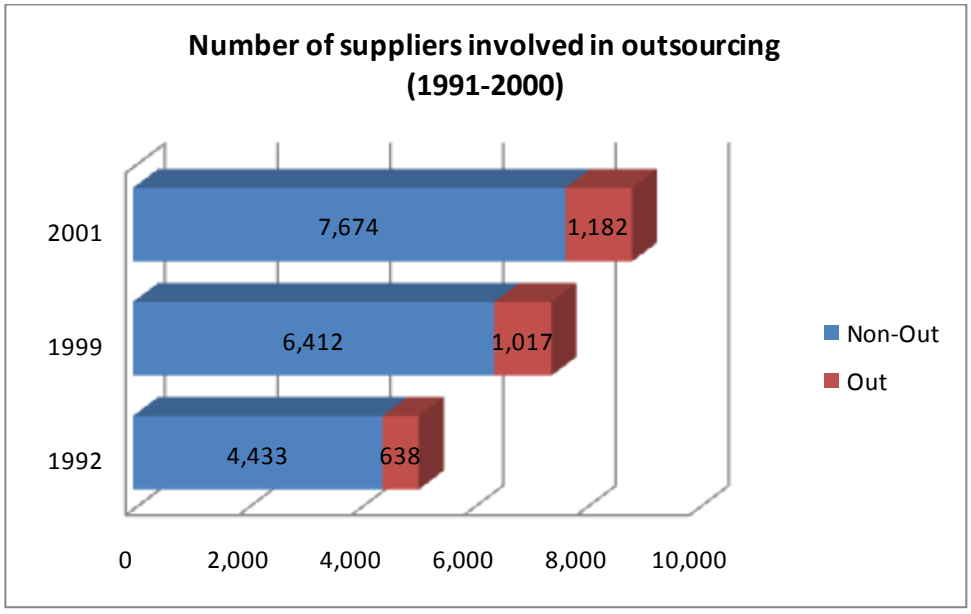
In order to measure outsourcing using the ENESTYC data, we take as proxy variable the share of total revenue received by firms for performing other firm's production, assembly, or any transformation at any of the different stages of the production process to total revenue. This revenue is reported in the survey as Maquiladora and subcontracting income. *Although there may be limitations of this empirical measure; with the available data this is the best approximation to capture the extent of outsourcing and off-shoring in the Mexican manufacturing industry.*

Once we calculated the outsourcing ratios we create a dummy variable to identify non-outsourcing suppliers from the outsourcing ones. The non-outsourcing firms are those whose outsourcing ratios range from 0 to 59 percent, whereas outsourcing firms are those whose ratios are greater than 60 percent. This percentage has been selected since the number of supplier firms engaged in outsourcing gradually increase from this point. In addition, when we scatter the ratio of outsourcing with other independent variables such as foreign ownership and exports we can observe an upward trend from this cut-off point. A detailed discussion of this cut-off point is provided in Chapter 6.

Taking this measure for outsourcing, we calculated the total number of firms participating in outsourcing as suppliers in 1992, 1999 and 2001 (see Figure 5.4). In 1992 we can observe that only 638 of the firms surveyed were engaged as suppliers in outsourcing, in 1999 the number of firms increased to 1,017 and by 2001 the number reached a total of 1,182 firms. It is important to highlight that Maquiladora firms play a key role in as supplier firms involved in outsourcing and off-shoring. In 1999 nearly 50 percent out of the 1,017

firms involved in outsourcing correspond to Maquiladoras and by 2001, Maquiladoras represent 66 percent of the total number of supplier involved in outsourcing. In 1992 we cannot distinguish how many firms were involved in outsourcing, because the data of the survey does not allow identifying the number of firms registered as Maquiladoras.

Figure 5.4 Number of Supplier Firms Engaged in Outsourcing



Source: Author's calculations from ENESTYC 1992, 1999 and 2001.

If we cross the information from Figure 5.3 we can conclude that in 2000 31.3 percent of Mexico's GVP was produced under outsourcing agreements by 13 percent of Mexican supplier firms. Although, these figures provide a general overview of the significance of outsourcing in Mexico, we aim to go further, and explore the characteristics of supplier firms engaged in outsourcing. For this reason, we propose a simple typology of firms, based in some firm-specific characteristics that have been found to be relevant in the literature review Chapter 2.

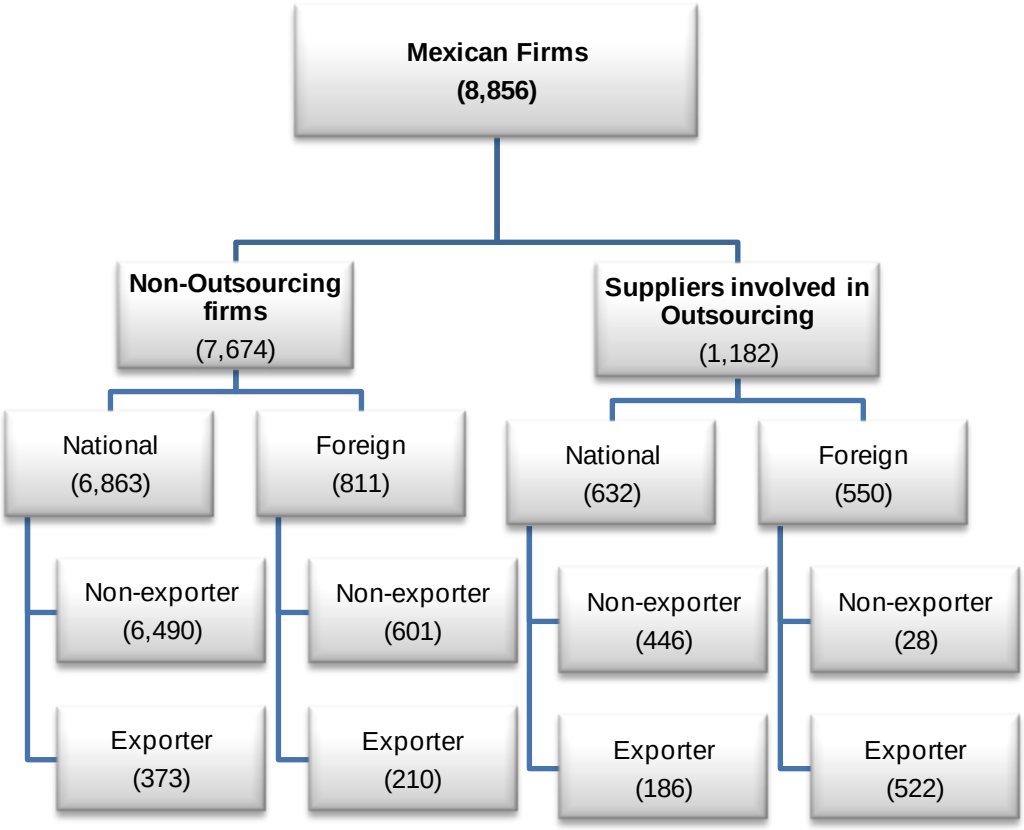
For this classification, we distinguish whether the firm is involved in outsourcing or not, whether is a national or foreign firm and finally whether is an exporter or not.

Figure 5.5 shows a diagram with the proposed typology of non-outsourcing and outsourcing firms. To illustrate the distribution of firms we added the numbers to each of the categories using data from the 2001 ENESTYC survey. One interesting thing to note is the concentration pattern of the supplier firms involved in outsourcing. We can distinguish that supplier firms are concentrated into two main groups. Firstly, we have a significant number of firms that are national and non-exporters. Secondly, there are a large number of firms that are foreign and exporters. Hence, most of national suppliers involved in outsourcing do not export their products, whereas the foreign firms are the ones exposed to the foreign markets.

Probably one of the obstacles for national firms to become exporters is the large entry sunk costs. Research on exporting plants in other countries has found that the sunk costs of becoming an exporter are quite high. For instance, Das et. al (2007),found in Colombia that among small producers, average entry costs range from $430,000 U.S dollars for leather producers to $412,000 U.S. dollars for knitting mills. For large producers, the average cost of entering into a foreign market is lower, ranging from an average of $344,000 U.S. dollars for basic chemical producers to $402,000 U.S. dollars for knitting mills. The authors also argue that the lower costs for large firms may reflect differences in the types of goods they are exporting and/or the market they serve. Size advantages may also result from existing contracts and distribution channels among large plants or from larger office operations.

Our data on the outsourcing plants do not allow us to calculate the sunk costs, besides this is not an issue that we are interested in addressing in this thesis. We are interested in analysing the characteristics of the firms involved in outsourcing and to identify the different groups in which these firms are concentrated in order to draw inferences for the econometric analysis of the following chapters.

Figure 5.5 Typology of firms in the recipient country, 2001.



Source: Author's creation with data from ENESTYC, 2001.

The typology proposed in Figure 5.5 is simplified to the extent that not all the characteristics of the supplier firms concerned in outsourcing and the contractual agreements entailed in the relationship are taken into account. In reality the typology can be more complex, however because of limitations of data, we are not able to distinguish some relationships that can not be considered as outsourcing. Some these examples are listed below:

- Suppose that a MNC in the U.S. relocates the production of some its parts and components to its Mexican subsidiary which is registered as a Maquiladora. In this case both firms are vertically integrated and the exports of the parts and components from the Maquiladora to its parent company in the U.S correspond to intra-firm trade rather than outsourcing.

- Suppose that Wall Mart in the U.S. buys power replacement cables for computers from a Mexican Maquiladora firm. Although the firm in Mexico is registered as a Maquiladora, by no means the contractual relationship corresponds to outsourcing.

Despite all these drawbacks, this thesis provides a broad picture of the phenomenon in the Mexican Manufacturing industry.

The following section presents descriptive statistics of variables that can be related to the characteristics of the supplier firms involved in outsourcing. These descriptive data help us to identify the likely characteristics of the suppliers firms involved in outsourcing that will be considered in our next empirical chapters.

5.7. Characteristics of the supplier firms involved in outsourcing

In Chapter 2 we reviewed empirical studies of the characteristics of the firms involved in outsourcing from the perspective of both the lead and supplier firms. A different set of variables were found to be positive and significant. For instance, from the perspective of the lead firm labour costs, labour productivity, size of the firm, market changes, skill requirement, product innovation, R & D, industry size, export propensity, age, market competition, foreign ownership and agglomeration were found to be significant and positively correlated to the firm's decision to outsource. Conversely, from the supplier's perspective, the number of hours worked, the number of firms operating in the same sector, advertisement expenses, the number of female workers, and the share of expenditures on communication services to total sales revenue were found to be positive and significant.

Taking into account previous studies, with the data available in the ENESTYC, we selected the following set of variables to explain the possible characteristics of the firms involved in outsourcing: foreign ownership, export propensity, size, subsidiary status, labour skills, and dummies for each of the industries to explore different pattern of concentration of the suppliers involved in outsourcing. Hence, this section aims to answer the following questions:

1. Are foreign or national firms more likely to engage in outsourcing as suppliers?
2. Do exporting supplier firms more easily engage in outsourcing?
3. Do subsidiary firms tend to be more involved in outsourcing?
4. What is the size of the supplier firms involved in outsourcing?
5. Are supplier firms involved in more labour or capital intensive activities?
6. What kinds of industries concentrate a larger number of supplier firms engaged in outsourcing?

Hence the aim of this section is to explore potential variables that can explain different characteristics of firms involved in outsourcing. This is a merely exploratory analysis, which will help us to draw some helpful inferences for the econometric analysis of the next chapter.

5.7.1. Ownership status

Ownership status is among one of the main characteristics that we are considering in our analysis. According to the developmental approach explained in Chapter 2, outsourcing opens up channels to suppliers in developing countries to integrate into global production networks. Hence, if the developmental approach holds, we would expect a significant number of more domestic firms rather than foreign firms engaged in outsourcing.

However, Sturgeon and Lester (2003), identify a new global supply-base model started to develop, where lead firms are increasingly relying on large suppliers and contract manufacturer in their country of origin to support their global operations. For instance, in the case of the automobile industry during the 1990s there was a wave of new assembly and supplier plant construction in emerging markets such as China, India, Thailand, Vietnam, Brazil, Mexico and East Europe. As the number of production locations increased, automakers looked to streamline operations on a global scale, particularly in vehicle design and component sourcing. The globalisation of the motor vehicle industry changed the relationship between automakers and their largest suppliers. In this relationship first tier-suppliers are in charge of the module design; second tier component sourcing, and provision of local content in emerging markets. In order to supply automakers with modules on a worldwide basis first-tier suppliers started to expand geographically. Companies like Bosch, Johnson Controls, Lear, Magna, Siemens Automotive, TRV, Yazaki, and others are an example of this wave of geographic expansion. (Sturgeon and Lester, 2003). Thus, considering this example we can also expect that firms engaged in outsourcing as suppliers might be foreign owned.

Empirical evidence is limited, and it has focused on developed countries. In Japan Kimura (2002), finds that foreign-owned share is positive related to the probability of using subcontractors and negative to the probability of working as subcontractor (Kimura, 2002). So, the question of whether foreign firms might have greater presence than domestic firms as suppliers in the context of developing countries is still open.

Table 5.5 shows the total number of outsourcing and non-outsourcing firms by ownership status in the Mexican Manufacturing Industry. We can observe nearly 43 percent of suppliers engaged in outsourcing are foreign in 1992; 49 percent in 1999; and 47 percent in 2001. Hence, the proportion of domestic firms involved in outsourcing is greater than the proportion of national firms for the three years of the analysis.

Table 5.5 Outsourcing and Ownership status

Ownership Status	1992		1999		2001	
	Non-out	Out	Non-out	Out	Non-out	Out
National	3,703	363	5,690	518	6,863	632
Foreign	730	275	722	499	811	550

Source: Author's calculations from ENESTYC, 1992, 1999 and 2001.

5.7.2. Export propensity

There are several reasons to expect suppliers involved in outsourcing to be more likely to export their output. Firstly, the GVC approach emphasizes that value chains promote inter-firm networks, by which developing-country producers through foreign buyers are able to access foreign markets (Bair Dussel-Petters, 2006).

Secondly, the development of the production-sharing scheme "806/807" (discussed in Chapter 3), where U.S. firms were able to export parts and components to lower-wage locations such as Mexico and other countries in the Caribbean basin for assembly and re-import on a duty free basis opened opportunities to developing country suppliers to export their products. For Mexico, the implementation of NAFTA in 1994 reinforced and promoted a higher degree integration and trade between Mexican, U.S and to lesser extent Canadian firms.

For these reasons, we expect that supplier firms involved in outsourcing are more likely to export their production. Table 5.6 reports export propensity ratios for non-outsourcing and outsourcing firms. We consider a firm as an exporter if at least 50 percent or more of its total production is exported.

Results suggest that with exception of 1992, firms involved in outsourcing as suppliers tend to export more than non-outsourcing firms. In 1999 and 2001; approximately 60 percent of the firms involved in outsourcing exported more than 50 percent of their production. During 1992 we can not observe a significant number of supplier firms engaged in outsourcing exporting their

production, for two reasons. Maquiladora firms are not included in the survey and also because Mexico's export boom took place after joining to NAFTA (see Table 5.6).

Table 5.6 Outsourcing and export propensity

Export Status	1992		1999		2001	
	Non-out	Out	Non-out	Out	Non-out	Out
Non-exporter	4,169	613	5,877	410	7,091	474
Exporter	264	25	535	607	583	708

Source: Author's calculations from ENESTYC, 1992, 1999 and 2001.

5.7.3. Size

Size of the firm is another important variable exerting some influence over owners/managers of the firms to disintegrate their production and contract out some segments, or to suppliers willing to receive other firms' production. The dualistic approach expresses that lead firms in developed countries outsource to reduce production costs and to smooth production cycles at the expense of small suppliers. In this sense, the dualistic approach suggests that primarily small firms assume the role of suppliers in the outsourcing relationship. Empirical results by Taimaz and Kiliçaslan (2005), support this argument finding in the Turkish textile industry that large high wage firms tend to subcontract a large part of production and small firms receive the contracts.

In the case of the Mexican Manufacturing industry, this argument does not hold and results suggest that more than 70 percent of the suppliers involved in outsourcing are large and medium firms for the three waves of the survey (see Table 5.7).

Table 5.7 Size of non-outsourcing and outsourcing firms

Firm size	1992		1999		2001	
	Non-out	Out	Non-out	Out	Non-out	Out
Large	1,491	273	1,732	588	1,729	721
Medium	1,426	197	1,768	219	1,904	213
Small	908	99	1,119	92	1,659	105
Micro	608	69	1,793	118	2,382	143

Source: Author's calculations from ENESTYC, 1992, 1999 and 2001.

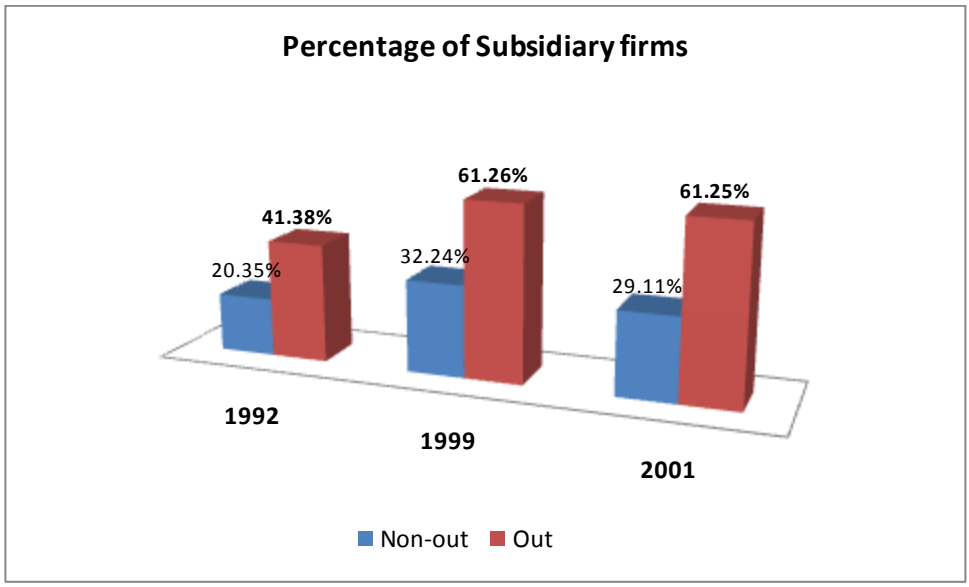
The limited participation of small and micro firms in outsourcing might suggest that these types of firms are not able to engage in outsourcing due to high sunk costs that they have to face to start supplying lead firms; or they may not be able to fulfil the quantity and quality standards set by the lead firms. Another explanation can be that lead firms bring their own suppliers from their home countries which may be large firms.

5.7.4. Subsidiary status

Multinational firms most of the time develop large networks among their affiliates that source factories all over the world (Gereffi, 1999). According to Cusmano et. al. (2010), being part of a group is important for international outsourcing because firms are integrated in a larger network of providers and potential clients. The authors find strong evidence that groups subsidiaries rather than headquarters are driving international outsourcing activities. Also, after interacting subsidiary status and foreign ownership, it is found that foreign owned subsidiaries affect positively the probability of international outsourcing. Hence, we would expect a positive relationship between the subsidiary status and the probability of engaging in outsourcing as supplier.

Descriptive data for the Mexican Manufacturing Industry confirms Cusmano et. al, research findings. Figure 5.6 shows that in 1992; 41.38 percent of the total number of supplier firms involved in outsourcing were subsidiaries and in 1999 and 2001, approximately 61 percent of the total number supplier firms involved in outsourcing were subsidiaries.

Figure 5.6 Percentage of Subsidiary Firms



Source: Author's calculations from ENESTYC, 1992, 1999 and 2001.

Table 5.8 shows more disaggregated figures of subsidiary firms by ownership and exporting status. Data shows that during 1992 and 2001 more than 40 percent of the supplier firms engaged in outsourcing are foreign subsidiaries and between 39.73 and 42.97 are foreign subsidiaries producing for the export markets.

Unfortunately, one of the limitations of the data is that it is impossible to distinguish whether these subsidiaries are operating under vertical integrated or arm's length market transactions. If their production corresponds to vertical integration and trade happens through intra-firm transactions. This type of production can not be considered as outsourcing, and we might be over estimating the magnitude of the phenomenon. But as it was mentioned in previous lines, we can not distinguish in detail the type of transaction that firms are engaged in. This is one of the shortcomings of this analysis.

Table 5.8 Subsidiary status

Year	*Non-outsourcing*				*Outsourcing*			
	National		Foreign		National		Foreign	
	Non-exp.	Exp.	Non-exp.	Exp.	Non-exp.	Exp.	Non-exp.	Exp.
1992	**12.34**	0.38	5.64	1.99	10.50	0.00	**29.15**	1.72
1999	**21.62**	1.82	6.60	2.20	11.01	6.29	0.98	**42.97**
2001	**19.53**	1.58	5.89	2.11	11.34	8.04	2.12	**39.76**

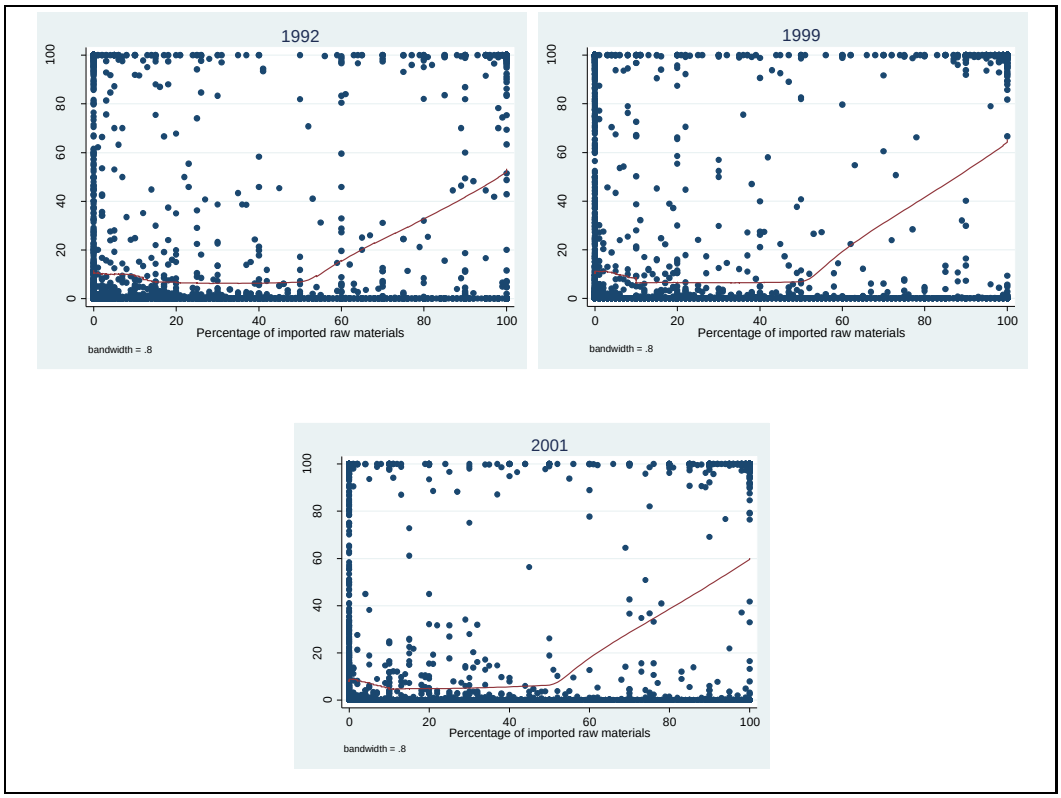
Source: Author's calculations from ENESTYC, 1992, 1999 and 2001.

5.7.5. Share of imported raw materials

We also include the variable share of imported raw materials because the legal regime of the Maquiladora firms provides tax exemption for the raw materials imported. Since our main proxy for outsourcing transactions is Maquiladora's production we propose that the share of imported raw materials is an important characteristic of the supplier firms involved in outsourcing.

Figure 5.7 scatters the relationship between these two variables and shows a positive relationship between the ratio of imported raw materials and outsourcing. We can also appreciate that firms with higher outsourcing ratios are more likely to have higher shares of imported raw materials used in their production.

Figure 5.7 Relationship between the ratio of outsourcing and the share of imported raw materials used by supplier firms involved in outsourcing



Source: Author's calculations from ENESTYC, 1992, 1999 and 2001.

Table 5.9 shows that over the three waves of the survey, more than the 48 percent of the supplier firms engaged in outsourcing imported more than 50 percent of their raw materials.

Table 5.9 Percentage of firms importing more than 50 percent of their raw materials

Year	Non-outsourcing	Outsourcing
1992	16.2	49.7
1999	11.9	48.0
2001	11.5	51.4

Source: Author's calculations from ENESTYC , 1992, 1999 and 2001.

5.7.6. Skills

Human capital seems to be a good and highly significant predictor of outsourcing behaviour in developed countries (Tomiura 2005; Cusmano, 2010) and in developing countries (Taimaz and Kiliçaslan, 2005).

In developing countries Taimaz and Kiliçaslan, (2005), find in the Turkish textile industry that firms employing less skilled labour are more likely to engage in outsourcing as subcontractors.

Taking into account these arguments, we selected the variable years of schooling to describe the skills of the labour employed by the non-outsourcing and outsourcing firms.

To test the statistical differences of the means of the skill intensity of labour use in outsourcing and non outsourcing firms the t-test is conducted at the 1 per cent. Difference in skill intensity of labour use in outsourcing suppliers compared with non-outsourcing firms is always statistically significant[40].

In addition, Table 5.10 shows during 1992 and 1999 58.2 percent and 49.2 percent of the employees of suppliers firms involved in outsourcing were unskilled having less than 6 years of schooling. By 2001, we can observe a significant increase in the years of schooling of the employees working with outsourcing firms as 52 percent of them had from 7 to 12 years of schooling. However, compared to non-outsourcing firms, it seems that suppliers engaged in outsourcing contract labour with lower years of education. Probably because the activities in which they concentrate are low-value added activities which require minimal skills.

[40] Independent t-tests were conducted and significant differences in years of schooling are found between non-outsourcing and outsourcing firms. In 1992, $t(5055)=9.32$, p=0.00 (two-tailed); 1999, $t(7393)=9.33$, p=0.00 (two-tailed); and in 2001, $t(8522)=7.98$, p=0.00 (two-tailed).

Table 5.10 Percentual distribution of employees by schooling category

Years of schooling	1992		1999		2001	
	Non-out	Out	Non-out	Out	Non-out	Out
0-6 years	**43.2**	**58.2**	26.3	**49.2**	31.5	40.5
7-12 years	46.0	34.5	**61.7**	45.1	**58.0**	**52.9**
more than 12	10.8	7.0	12.0	5.7	10.6	6.6

Source: Author's calculations from ENESTYC, 1992, 1999 and 2001.

5.7.7. Concentration of outsourcing activities by industry

Concentration ratios of outsourcing are calculated at the industry level to observe from a sectoral perspective a pattern of specialization of and also identify inter-industry variations in outsourcing intensity. The outsourcing ratio in industry i is calculated as follows:

$$Outratio_i = \frac{\sum_{j=1}^{N} Outsourcingincome_j}{\sum_{j=1}^{N} Totalrevenue_j}$$

where i corresponds to the industry; and j denotes the firm.

The logic behind outsourcing is that firms in developed countries tend to source abroad to cut costs by contracting out activities to firms that operate with lower costs or labour abundant countries where market wages are lower (Girma and Görg, 2004). Results confirm that labour intensive industries are the ones with higher outsourcing ratios (see Table 5.11).

In particular, with outsourcing ratios higher than 40 percent in at least two waves of the survey are: Textile, Fabric Finishing and Fabric Coating Mills (3213); Wearing and Apparel manufacturing (3220); Machinery and equipment and electric accessories (3831); Electronic equipment (ratio, T.V and communication) (3832); Transport equipment and part/except autos and trucks (3842); and Instruments and precision equipment manufacturing (includes surgical equipment) (3850).

Industries with low outsourcing intensity ratios are more concentrated on the Food (31), Paper (34); Chemicals (35); Clay, Glass and Cement (36) and Basic Metals (37).

Table 5.11 Outsourcing ratios by industries

	Industry	1992	1999	2001
3111	Meat Products	2.53	5.52	7.59
3112	Dairy Products	0.51	0.50	0.45
3113	Processing and preserving of foods/exclude meat and milk	1.39	5.25	7.19
3114	Grain Mill products, starch products and cereals	0.17	6.16	1.76
3115	Bread	2.14	2.01	1.05
3116	Tortillas and Nixtamal Milling	2.52	1.47	0.51
3117	Edible oils and fats	1.25	3.80	0.73
3118	Sugar	0.44	0.16	0.11
3119	Cocoa, chocolate and confectionary	1.86	2.98	2.74
3121	Other human feed products	1.56	0.22	0.17
3122	Prepared animal feeds	0.47	0.24	0.34
3130	Beverages	1.11	1.45	0.68
3140	Tobacco Products	0.49	1.88	0.62
3211	Fibre, Yarn and Thread Mills	0.73	0.08	**15.99**
3212	Fabric Mills	**11.34**	5.75	**13.36**
3213	Textile, Fabric Finishing and Fabric Coating Mills	**8.28**	**58.77**	**66.87**
3214	Textile Furnishing Mills	**8.31**	**16.36**	**19.57**
3220	Wearing Apparel Manufacturing	**29.83**	**48.30**	**42.34**
3230	Leather and fur products/except footwear	**8.36**	**28.56**	**21.56**
3240	Footwear/excludes plastic and rubber products	3.23	6.21	7.92
3311	Products of Wood and Carpentry/except furniture	2.94	5.48	**19.50**
3312	Wooden Containers and other wood products and cork/except furniture	3.83	**19.23**	**17.96**
3320	Furniture mostly of wood/includes mattresses	3.39	**20.78**	**16.45**
3410	Pulp, paper and paper products	0.79	9.24	0.99
3420	Publishing and printing and related industries	**9.03**	2.24	4.37
3512	Basic chemicals, excludes basic petro chemicals	1.02	1.94	1.18
3513	Synthetic or artificial fibres	5.50	0.46	0.62
3521	Pharmaceuticals	1.73	2.20	3.01
3522	Chemical Products	1.90	0.57	4.22
3540	Coke, includes other coal and oil derivatives	0.07	0.22	0.77
3550	Rubber Industry	2.97	7.25	**21.01**
3560	Plastic Products	7.72	**15.80**	**25.72**
3611	Ceramics and Pottery	0.57	**22.31**	**43.13**
3812	Metallic frames, tanks and industrial boilers	**78.77**	3.75	0.90
3813	Metallic furniture	5.14	4.71	**20.96**
3814	Other metallic products/except machinery and equipment	3.38	**16.23**	**16.81**
3821	Machinery and Equipment for specific purposes	4.68	12.92	3.04
3822	Machinery and equipment for generic purposes	4.66	8.03	**27.39**
3823	Machinery and equipment for offices and informatics	7.79	**14.14**	**19.53**
3831	Machinery and equipment and electric accessories	**16.09**	**56.51**	**64.02**
3832	Electronic equipment (radio, tv and communication)	**14.61**	**75.40**	**86.16**
3833	Devices and accessories for domestic use/except electronics	3.90	**30.56**	**36.20**
3841	Automotive industry	0.58	6.06	6.97
3842	Transport equipment and parts/except autos and trucks	**11.83**	8.60	**52.03**
3850	Instruments and precision equipment manufacturing (includes surgical equipment, excludes electronics	**16.21**	**37.97**	**60.39**
3900	Other manufacturing industries	6.81	**31.38**	**57.82**

Source: Author's calculations from ENESTYC , 1992, 1999 and 2001.

5.8. Conclusions

This chapter presented the methodology used in this research, and argued that a quantitative research approach appears to be more suitable to answer the research questions. The ENESTYC survey is used since it is an extremely rich database that provides a large sample of detailed firm-level data that allow the development of econometric models as methods of analysis. Despite the limitations of the data highlighted in the chapter, inferences of the significance of outsourcing and characteristics of the supplier firms in Mexico can be drawn. Our main findings are listed as follows:

Ownership status: the results suggest that the proportion of domestic firms involved in outsourcing is greater than the proportion of national firms for the three years of the analysis.

Export propensity: the results show that with exception of 1992; firms involved in outsourcing as suppliers tend to export more than non-outsourcing firms.

Size: the results suggest that more than 70 percent of the suppliers involved in outsourcing are large and medium firms for the three waves of the survey.

Subsidiary status: our results show that in 1992; 41.38 percent of the suppliers involved in outsourcing were subsidiaries and in 1999 and 2001, the number increased to approximately 61 percent of the total number supplier firms were subsidiaries

Share of imported raw materials: results show that firms with higher outsourcing ratios are more likely to have higher shares of imported raw materials used in their production. Over the three waves of the survey, more than the 48 percent of the supplier firms engaged in outsourcing imported more than 50 percent of their raw materials

Labour skills: results suggest that suppliers engaged in outsourcing contract labour with lower years of education. Probably because the activities in which they concentrate are low-value added activities which require minimal skills.

Industry dummy variables: results show that supplier firms involved in outsourcing tend to concentrate in labour intensive industries such as textile and wearing apparel manufacturing, plastic products and basic metals.

However, a more comprehensive analysis is conducted in the Chapters 6, in order to test the joint predictive power of the selected variables.

Chapter 6 Characteristics of Outsourcing from the supplier's perspective: Evidence from the Mexican Manufacturing Industry

6.1. Introduction

Outsourcing has been undertaken by an increasing number of firms over the last two decades. However, empirical investigations analysing the firm's decision to outsource has focused on the buyer's position on developed countries (e.g. Antras and Helpman (2004); Tomiura (2005); Girma and Görg (2004); Görg, Hanley and Strobl (2004); Diaz-Mora (2006 and 2008) and Holl (2008). From the empirical and theoretical evidence available to date, we can understand only one aspect of outsourcing. The present study provides further new empirical evidence focuses on the characteristics of outsourcing from the perspective of the supplier. This analysis concentrates on the Mexican manufacturing sector using firm level data for 1992, 1999 and 2001.

One of the limitations to analyze the characteristics of outsourcing from the supplier's perspective is the lack of theoretical and empirical evidence related to the topic. To identify the characteristics of outsourcing in less developed countries (LDC), Chapter 2 presented an extensive review of variables that were included in previous empirical work and that may help us to identify possible variables related also to the characteristics of suppliers in developing countries and Chapter 5 presented a descriptive analysis of these variables to explore their relation with outsourcing. Hence, this chapter aims test the explanatory power of these variables by using a probit model. The first part of this chapter presents the exploratory analysis followed by the correlation analysis. Then it presents the results of the probit model for the three waves

of the survey. Finally it presents the main conclusions and findings derived from the results.

6.2. Exploratory Analysis

Table 6.1 reports the means of the explanatory variables for low outsourcing and high outsourcing supplier firms with outsourcing ratios lower and greater than 60 percent in 1992, 1999 and 2001. Significant differences between the two types of firms can be observed over the three waves of the survey.

Firstly, more than 40 percent of the supplier firms engaged in outsourcing in the three waves of the survey are foreign. This might be explained by the fact that MNCs in developed countries tend to relocate activities to countries where production costs are considerably lower, such as Mexico.

Table 6.1 Summary statistics

Variables	1992		1999		2001	
	Low Out.	High Out.	Low Out.	High Out.	Low Out.	High Out.
	Mean	Mean	Mean	Mean	Mean	Mean
Ratio Outsourcing (%)	1.63	97.19	1.05	97.76	0.81	98.55
Foreign (%)	12.53	41.37	9.27	47.87	8.16	45.45
Exports (%)	8.13	3.80	11.59	60.88	10.18	60.79
Labour Productivity	41.61	14.15	30.90	12.77	27.55	8.80
Per-capita annual wages directors[1/]	155.09	121.77	159.12	152.28	136.16	135.77
Per-capita annual wages white collar[1/]	33.90	31.65	35.79	39.12	31.10	33.58
Per-capita annual wages blue collar[1/]	15.38	13.50	16.27	16.89	14.71	14.39
Size (number of employees)	305.92	378.31	258.69	818.85	222.69	861.33
Age	23.25	13.82	20.56	8.7	21.47	15.80
Subsidiary (%)	20.35	41.38	32.24	61.26	29.11	61.25
Quality control (%)	n/a	n/a	22.26	40.02	25.74	47.63
Imported raw materials (%)	19.67	49.28	14.46	47.78	13.58	50.66
Union (%)	n/a	n/a	59.86	54.67	55.26	53.98
Investment in R & D (%)	48	39	33.05	29.79	28.81	31.90
Low skilled labour (% of total labour)	43.20	58.20	26.30	49.23	31.45	40.53
Medium skilled labour (% of total labour)	46.02	34.77	61.66	45.09	57.97	52.88
High skilled labour (% of total labour)	10.78	7.03	12.04	5.67	10.57	6.59
Foreign subsidiary (%)	7.62	30.88	8.80	43.95	8.00	41.88
Manual equipment (%)	20.21	21.19	31.54	31.48	33.58	29.98
Machines and tools (%)	38.95	44.57	32.03	35.59	30.61	32.77
utomatic equipment (%)	20.86	15.59	25.12	23.24	25.90	25.87
Numerical control (%)	6.09	4.55	2.71	2.87	2.74	2.93
Computerized numerical control (%)	4.20	3.64	5.23	4.75	5.39	6.64
Robots (%)	0.68	0.51	0.42	0.69	0.46	1.05
Total number of firms	4,433	638	6,412	1,017	7,674	1,182

[1/] Thousand of pesos 1994=100

Source: Author's calculations from ENESTYC, 1992, 1999 and 2001.

Secondly, firms involved in outsourcing tend to be larger in terms of number of workers. Probably because the activities in which these firms concentrate are more labour intensive, such as 3220, 3831, 3832 and 3212 (see Table 6.1,Table 6.2, Table 6.3) Moreover, these industries also register the larger number of high outsourcing firms. For instance in 1992, 46 percent of the total numbers of high outsourcing firms are concentrated on these four industries and by 1999 and 2001 more than 50 percent. We can also observe that there is a twofold increase of number of firms in 3220, 3831 and 3832.

Regarding the age of the firms, suppliers engaged in outsourcing tend to be younger that non-outsourcing firms. This might indicate that due to the policies offered by the government to attract FDI many new firms in Mexico have started operations over the last two decades, especially under the Maquiladora scheme.

Table 6.2 Industries concentrating the largest number of high outsourcing firms

	Industry	1992	1999	2001
3220	Manufacture of wearing apparel except footwear	119	240	280
3831	Manufacture of electrical industrial machinery and apparatus	81	118	162
3832	Manufacture of radio television and communication equipment and apparatus	47	99	109
3212	Manufacture of made-up textile goods except wearing apparel	47	51	60

Source: Author's calculations from ENESTYC, 1992, 1999 and 2001.

Note also in Table 6.1 that nearly 50 percent of raw materials used by the suppliers involved in outsourcing are imported. This is expected as a great part of supplier's subcontracted are Maquiladora firms and they rely on imported raw materials.

Labour productivity tends to be considerably lower for the suppliers engaged in outsourcing than for the manufacturing firms with lower outsourcing ratios. This result is surprising, as we were expecting that supplier firms contracted by other firms were more productive than non-outsourcing firms. This might indicate that productive firms are not interested in engaging in outsourcing or that probably the segments in which the subcontracted activities are concentrated are more labour intensive activities. For instance, a significant number of high outsourcing suppliers are concentrated on the manufacture of "wearing and apparel". Due to data aggregation, we can not distinguish the specific activities in which these firms specialize or the exact nature of work for example if they are sewing clothes or cutting the fabric. Further disaggregation of data might be of help to explain the differences in productivity, as a sewing firm is more labour intensive than a cutting firm.

We also observe that suppliers who outsource are more likely to use labour with lower skill and pay lower salaries than non-outsourcing suppliers. This is consistent with the labour cost saving motivation of outsourcing from the perspective of the lead firm. It is also supported by the fact that wages are lower for blue-collar workers as compared to wages of blue-collar workers of non-outsourcing firms.

These preliminary findings on productivity and wages are similar to those of Puyana and Romero (2005), shown in.Table 6.3 Selected variables of the performance of the non-Maquiladora and Maquiladora in Mexico. Although, the authors distinguish between Maquiladora and Non-maquiladora activities; we can compare our results on the basis that most of the supplier firms involved in outsourcing are Maquiladora firms.

Table 6.3 shows selected variables of the performance of non-Maquiladora and Maquiladora industry in Mexico. Overall, we note that employment, value added, average wages and productivity have increased in both Maquila and Non-Maquila industries from 1988 to 2001. However, value added, average wages and productivity is lower for Maquiladora firms, particularly in the "wearing an apparel" industry.

Table 6.3 Selected variables of the performance of the non-Maquiladora and Maquiladora in Mexico.

Year	Employment [1/]		Wages [2/]		Value Added [2/]		Average wages [3/]		Productivity [3/]	
	Non-Maquila	Maquila	Non-Maquila	Maquila	Non-Maquila	Maquila	Non-Maquila	Maquila	Non-Maquila	Maquila
Automotive Industry										
1988	0.27	0.07	7,032	1,360	16,416	1,746	26.26	18.5	61.31	23.75
1993	0.35	0.1	9,828	2,059	25,417	2,686	28.24	19.93	73.03	26.01
1995	0.32	0.12	7,983	2,390	23,000	3,199	24.73	19.79	71.25	26.49
1999	0.46	0.19	11,207	3,936	40,408	5,005	24.27	20.27	87.52	25.77
2000	0.5	0.22	13,114	4,688	47,401	5,469	26.18	26.18	94.62	25.33
Electric and Electronic Industry										
1988	0.25	0.13	4,999	2,291	8,763	2,843	19.72	18.1	34.56	22.46
1993	0.29	0.16	6,478	3,015	11,372	3,670	22.16	19.32	38.9	23.51
1995	0.31	0.19	6,443	3,569	12,401	4,574	22.11	18.83	40.63	24.13
1999	0.49	0.33	10,180	6,633	23,550	7,787	20.66	19.97	47.79	23.44
2000	0.57	0.39	12,434	8,366	27,737	9,297	22	21.57	49.08	23.97
Wearing and Apparel										
1988	0.22	0.03	2,393	296	6,091	387	10.98	9.58	27.94	12.51
1993	0.23	0.05	2,902	538	7,393	698	12.59	10.6	32.06	13.75
1995	0.23	0.08	2,450	812	7,103	1,156	10.52	10.07	30.49	14.33
1999	0.39	0.22	3,928	2,243	9,912	2,961	9.96	10.09	25.14	13.33
2000	0.42	0.25	4,638	2,728	10,395	3,386	10.96	10.94	24.57	13.58
Total										
1988	3.03	0.37	61,675	6,072	178,416	7,562	20.29	16.43	58.79	20.47
1993	3.31	0.53	79,694	9,324	219,934	11,529	24.08	17.72	66.45	21.9
1995	3.07	0.62	66,625	10,781	217,582	14,174	21.73	17.33	70.95	22.79
1999	3.91	1.14	80,482	19,736	296,631	24,243	20.58	17.26	75.85	21.2
2000	4.1	1.29	83,853	24,021	317,092	27,481	21.9	18.69	77.3	21.39

Source: Puyana and Romero (2005).
[1/] Millions of workers
[2/] Million of pesos 1993=100
[3/] Thousand of per-capita pesos 1993=100

6.3. Correlation Analysis

The correlation matrixes for the three waves of the survey are included in Appendix 2 tables 2.1, 2.2 and 2.3. This preliminary analysis is conducted to explore the different characteristics of the supplier firms that determine their engagement in outsourcing activities. The sign out the front indicates whether there is a positive or a negative correlation and the value of the coefficient can range from -1.00 to 1.00. To interpret the values of the coefficients, Cohen (1999, pp. 79-81) suggests the following guidelines:

r=0.10 to 0.29 *low correlation*

r=0.30 to 0.49 *medium correlation*

r=0.50 to 1.0 *high correlation*

Since correlations between the independent variables are small (except between outsourcing ratio and export intensity), we interpret that there are no multicollinearity problems in the regressions.

The 1992 results suggest that the degree of outsourcing for high outsourcing supplier firms has a positive correlation with the variables foreign ownership, imported raw materials and foreign subsidiary with the variables that we have focused on (Appendix 1 table 2.1).

In 1999 we have more interesting results suggesting that there is a large and positive correlation between exports and the degree of outsourcing and positive correlation between the ratio of outsourcing and foreign ownership, subsidiary, and imported raw materials (see Appendix 2, table 2.2).

Finally, in 2001 the degree of outsourcing is positively correlated to foreign ownership, export intensity, productivity, per-capita wages of blue collar workers, imported raw materials and foreign subsidiary firms (see Appendix 2, table 2.3).

Over the three waves of the analysis, our preliminary results suggest that the main variables explaining the characteristics of outsourcing are: foreign ownership; imported raw materials; subsidiary status; and exports.

Though the positive sign is as expected in these variables, we must wait for the regressions simultaneously controlling for many factors.

6.4. Econometric Model

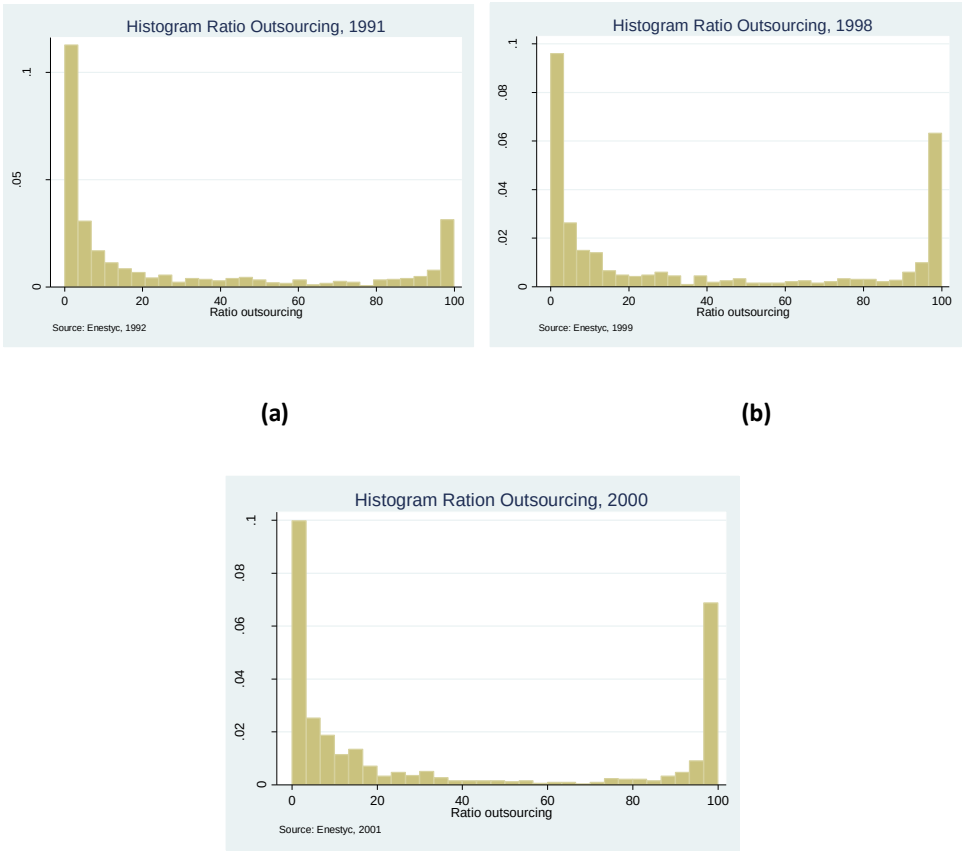
In this section, we describe the econometric methods used to examine the characteristics of outsourcing from the perspective of the supplier.

The econometric analysis consists of two different parts. In the first analysis, we estimate a Probit model to determine the firm-specific characteristics that are important for supplier firms to engage in outsourcing. In the second

analysis, we use a Tobit model to identify the differences within the firms who engage in outsourcing as suppliers and the ones who do not.

Tobit model is used, as a proportion of observations on the dependent variable are zero if a firm is not engaged in any outsourcing and positive if it does (see Figure 6.1). Tobit allows simultaneous examination of both the probability of outsourcing and the extent of outsourcing. This technique makes use of all the observations, both at the limit and those above it (Macdonald and Moffit, 1980).

Figure 6.1 Histograms of Outsourcing ratios



Source: Author's calculations from ENESTYC, 1992, 1999 and 2001.

6.4.1. Probit Estimation

In the first part of the analysis we model outsourcing decisions as a function of a number of variables, which capture suppliers-specific characteristics.

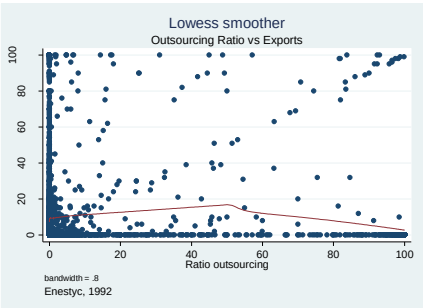
$$\Pr(out_i = 1) = \beta_0 + \beta_1 x_i + \in_{it}$$

Where $\in_{it}$ denotes the firm-specific unobservable effect and we assume that $\in_{it} \sim N(0, \sigma^2)$. Where *i* denotes firm and *x* are the firm's specific characteristics.

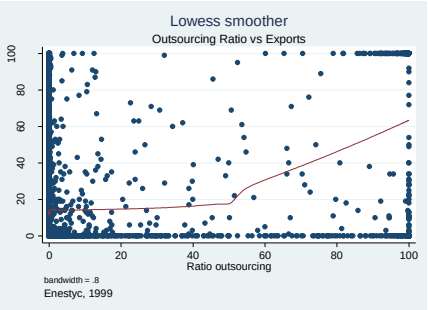
The dependent variable is the probability that a firm involves in outsourcing which is equal 1 if the outsourcing ratio is greater than 60 percent; 0 otherwise.

The cut-off point of 60 percent has been chosen to identify the main characteristics of the suppliers with high outsourcing ratios versus the ones with low outsourcing ratios. This percentage has been selected since the number of supplier firms engaged in outsourcing gradually increases from this cut-off point (see Figure 6.1, charts a,b and c). In addition, when we compare the behaviour of the ratio of outsourcing versus the independent variable propensity to export (see Figure 6.2 charts a, b and c) we can observe that after the 60 percent threshold, the level of exports in 1999 (chart b) and 2001 (chart c) surges, whereas in 1992 it drops down. Therefore, this cut-off point is useful to capture some differences in the behaviour of low and high outsourcing suppliers.

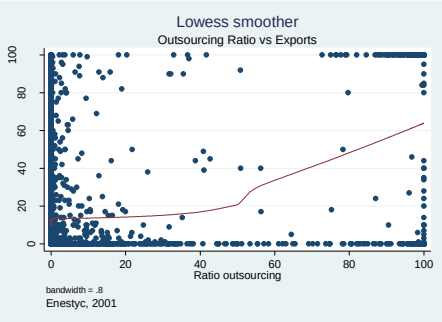
Figure 6.2 Outsourcing Ratios vs. Exports



(a)



(b)



(c)

Source: Author's calculations from ENESTYC, 1992, 1999 and 2001.

6.4.2. Tobit Estimation

The problem with probit is that if we collapse all positive observations on out_{it} and treat them as binomial probit we would discard the information on the different outsourcing intensity ratios (Baum, 2006). The use of tobit estimation allows for the account of limited dependent variables and is designed to deal with estimation bias associated with censoring. The model combines aspects of binomial probit for the distinction of $out_{it} = 0$ versus $out_{it} > 0$.

Therefore, the second part of the analysis uses a tobit model that not only measures the probability that a supplier firm gets involve into outsourcing, but also it measures the intensity of outsourcing.

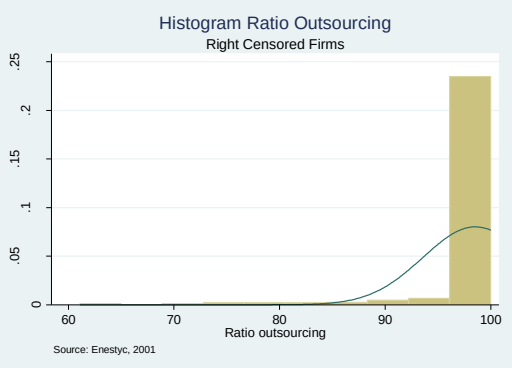
The model can be expressed as follows:

$$Y_{it}^{*} = \beta' x + \in_{it}$$

$$Y_i = 0 \quad if \quad Y_i^{*} \leq 60$$
$$Y_i = Y_i^{*} \; if \; Y_i = Y_i^{*} \geq 60$$

The tobit model captures the firms with outsourcing ratios higher than sixty percent (see Figure 6.3).

Figure 6.3 Outsourcing Ratios



Source: Author's calculations from ENESTYC, 1992, 1999 and 2001.

6.4.3. Probit model and description of variables

We model outsourcing decisions as a function of a number of variables, which capture suppliers-specific characteristics. We propose six different probit specifications to test the explanatory power of a number of the variables. The equations can be written as:

Equation 1*:*

$$\Pr(out_{it}) = \beta_0 + \beta_1 Foreign_{it} + \beta_2 \%Exports_{it} + \beta_3 Lproductivity_{it} + \beta_4 Lsize_{it} + \in_{it}$$

Where *i* denotes firm and *t* is the year. The dependent variable is the probability that the supplier will engage in outsourcing.

The first equation includes four explanatory variables. The first explanatory variable is a dummy for foreign ownership of the firm. The variable takes the value of 1 if the firm has 10 percent or more foreign ownership, 0 otherwise.

Foreign is included as over the last decades the increase of outsourcing to developing countries can be partly explained as a movement or shift of firms' value chain functions from developed countries (Hansen, 2008). Therefore, we can expect a positive relation of outsourcing and foreign ownership if the relocation of these activities is through foreign direct investment.

Exports represents the export intensity and is measured by the ratio of $(Exports / Sales)$.This variable tries to identify the outward orientation of the firm. We can expect a positive relationship between outsourcing and exports for two reasons. Firstly, if developed countries use subcontracting as a means of cost reduction in labour intensive segments, we might expect that the outsourced production in Mexico will be exported to a foreign country. Secondly, by engaging in outsourcing collaboration with MNCs, domestic suppliers in developing countries have the opportunity to gain access to foreign markets.

Productivity is measured by the log of the ratio of annual output to total men-hour (Q_{it} / L_{it}). The variable test the hypothesis that firms subcontracted to performs other's production works might have higher productivity than firms which are not involved in any subcontracting at all.

The variable *size* is given by the log of the number of employees per firm; the variable tries to capture many size-related characteristics not captured by other variables. For instance probably larger firms are more likely to be subcontracted because they have better reputation or they have the capacity to produce or assemble large quantities as compared to small firms. Conversely, probably a lot of subcontracting tasks are given to small firms,

because large firms are not able to produce everything or maybe they just want to focus on their core activities.

Equation 2

$$\Pr(out_{it}) = \beta_0 + \beta_1 Foreign_{it} + \beta_2 \%Exports_{it} + \beta_3 Lproductivity_{it} + \beta_4 Lsize_{it} + \beta_5 Lwages_{it}^{dir} + \beta_6 Lwages_{it}^{wc} + \beta_7 Lwages_{it}^{bc} + \in_{it}$$

The second equation includes three wage variables includes the annual per-capita wage for directors, white collar, and blue collar workers: $Lwages^{dir}, Lwages^{wc}, Lwages^{bc}$. These variables test the hypothesis that wages are a determinant that explains outsourcing, for instance if lead firms are subcontracting to other firms as a cost cutting strategy we would expect the salaries of the supplier firm to be lower than firm not engaged in outsourcing.

Equation 3

$$\Pr(out_{it}) = \beta_0 + \beta_1 Foreign_{it} + \beta_2 \%Exports_{it} + \beta_3 Lproductivity_{it} + \beta_4 Lsize_{it} + \beta_5 Lwages_{it}^{dir} + \beta_6 Lwages_{it}^{wc} + \beta_7 Lwages_{it}^{bc} + \beta_8 Lage_{it} + \beta_{9_{it}} Dsubsidiary_{it} + \beta_{10} DQuality + \beta_{11} irm_{it} + \beta_{12} Dunion + \beta_{13} ExpR\ \&\ D_{it} + \in_{it}$$

The third equation includes more control variables such like the *age* of the firm, a dummy for subsidiary, quality control, imported raw materials, a dummy to identify if the firm has a union and a dummy for investment in research and development.

Outsourcing can either attract supplier firms from abroad or it can open up opportunities for domestic firms to become suppliers of specific segments of the production chain. Empirical evidence[41] suggests that firms in many countries are subcontracting abroad a wide number of activities ranging from product design, production of intermediate inputs, assembly, marketing, and after sales service, etc.

Grossman and Helpman (2003), emphasize that it is clear that the production of inputs is an important activity of foreign subsidiaries, and this activity has

[41] see Campa and Goldberg (1997), Feenstra (1998), Hummels et al. (2001), Yeats (2001).

been increasing at a fast pace. Thus, we also include a dummy variable for *foreign subsidiary* to distinguish between foreign and domestic subsidiaries (see Equation 4).

However, one limitation of our data it that we can not distinguish whether the subsidiary firm involved in outsourcing is vertically integrated or it is working under an arm's lengths contract.

Antràs (2003) provides evidence in the US using intra-firm US imports and finds that capital-intensive intermediate goods, such as chemical products, tend to be imported to the US within the boundaries of the multinational firms, while labour intensive goods, such as textiles, are imported from non-affiliated firms. The author also shows that the share of intra-firm imports by multinationals as a share of total U.S. imports is higher, the higher the capital-labour ratio in the exporting country. For instance, U.S. imports from capital-abundant countries, such as Switzerland, tend to involve multinationals, while import from labour abundant countries, such as Egypt are likely to be arm's length contracts.

Taking Antràs arguments as given, we will assume that subcontracted production exported by Mexican suppliers in labour abundant industries is inter-firm rather than intra-firm trade.

The variable age is included, as many of the supplier firms engaged in outsourcing might have established over the last two or three decades due to the advantages offered by the free trade agreements and the Maquiladora Programme. Therefore, we expect a negative relationship between age and outsourcing.

Imported raw materials *"irm"* is included to control the origin of the raw materials used for the production process. For instance, Maquiladoras import materials and equipment on a duty and tariff free basis for assembly or manufacturing and then re-exports the assembled product usually to the country of origin. Since a large proportion of suppliers engaged in outsourcing

are Maquiladora firms, we expect a positive relation on imported raw materials and outsourcing.

We also include a dummy variable for union, which captures the degree of unionization of the supplier firm. Unionized firms may act to increase labour costs as they force firms to abide by the union work rules. Therefore, if lead firms are using outsourcing as a cost-saving strategy, they might contract firms with no unions or unions with low bargaining power. Thus, we expect a negative relationship between outsourcing and unions.

Equation 4

$$\begin{aligned}\Pr(out_{it}) &= \beta_0 + \beta_1 Foreign_{it} + \beta_2 \%Exports_{it} + \beta_3 Lproductivity_{it} + \beta_4 Lsize_{it} \\ &+ \beta_5 Lwages_{it}^{dir} + \beta_6 Lwages_{it}^{wc} + \beta_7 Lwages_{it}^{bc} + \beta_8 Lage_{it} + \\ &\beta_{9it} Dsubsidiary_{it} + \beta_{10} DQuality + \beta_{11} irm_{it} + \beta_{12} Dunion + \beta_{13} ExpR\ \&\ D_{it} \\ &+ \beta_{14} Dforeignsub_{it} + \beta_{15} Skills_{it}^{h} + \beta_{16} Skills_{it}^{m} + \beta_{17} Skills_{it}^{l} + \in_{it}\end{aligned}$$

One of the questions that we are interested in exploring is related to the functions in which suppliers are involved or specialized in. We want to explore if these functions are more intensive in labour or capital. To control for skills intensity of the suppliers, we include the variables $Skills_{it}^{h}, Skills_{it}^{m}, Skills_{it}^{l}$ corresponding to three different levels of education: highly educated, medium educated, and low educated (see

Equation 5).

Equation 5

$$\begin{aligned}\Pr(out_{it}) &= \beta_0 + \beta_1 Foreign_{it} + \beta_2 \%Exports_{it} + \beta_3 Lproductivity_{it} + \beta_4 Lsize_{it} \\ &+ \beta_5 Lwages_{it}^{dir} + \beta_6 Lwages_{it}^{wc} + \beta_7 Lwages_{it}^{bc} + \beta_8 Lage_{it} + \\ &\beta_{9it} Dsubsidiary_{it} + \beta_{10} DQuality + \beta_{11} irm_{it} + \beta_{12} Dunion + \beta_{13} ExpR\ \&\ D_{it} \\ &+ \beta_{14} Dforeignsub_{it} + \beta_{15} Skills_{it}^{h} + \beta_{16} Skills_{it}^{m} + \beta_{17} Skills_{it}^{l} + \beta_{18} Tech_{it}^{me} + \\ &\beta_{19} Tech_{it}^{m\&t} + \beta_{20} Tech_{it}^{ae} + \beta_{21} Tech_{it}^{nc} + \beta_{22} Tech_{it}^{cnc} + \in_{it}\end{aligned}$$

The previous equation controlled for skills, but in order to have a deeper understanding of the kind of activities that are produced by suppliers, we include a dummy variable to control for the technology used by the firms. The

survey distinguished five different types of machines and equipment $Tech_{it}^{me}, Tech_{it}^{m\&t}, Tech_{it}^{ae}, Tech_{it}^{nc}, Tech_{it}^{cnc}$ (see Equation 6).

Equation 6

$$\Pr(out_{it}) = \beta_0 + \beta_1 Foreign_{it} + \beta_2 \%Exports_{it} + \beta_3 Lproductivity_{it} + \beta_4 Lsize_{it} + \beta_5 Lwages_{it}^{dir} + \beta_6 Lwages_{it}^{wc} + \beta_7 Lwages_{it}^{bc} + \beta_8 Lage_{it} + \beta_{9_{it}} Dsubsidiary_{it} + \beta_{10} DQuality + \beta_{11} irm_{it} + \beta_{12} Dunion + \beta_{13} ExpR\ \&\ D_{it} + \beta_{14} Dforeignsub_{it} + \beta_{15} Skills_{it}^{h} + \beta_{16} Skills_{it}^{m} + \beta_{17} Skills_{it}^{l} + \beta_{18} Tech_{it}^{me} + \beta_{19} Tech_{it}^{m\&t} + \beta_{20} Tech_{it}^{ae} + \beta_{21} Tech_{it}^{nc} + \beta_{22} Tech_{it}^{cnc} + \beta_{23} Industry_{it} + \in_{it}$$

Although we have included different firm-specific characteristics in our specifications, it does not take into account a potential unobserved heterogeneity across industries. This is likely to occur, due to the concentration of suppliers in different sectors. For instance, Hansen et al. (2008), state that outsourcing in developing countries is extensively concentrated in low value-added activities related to standardized products and services.

In order to deal with such heterogeneity and identify the industries in which Mexican suppliers are concentrated, we estimate a model including a dummy variable for the 54 manufacturing industries.

Table 6.4 Variable Description

Variable	Description of the variables
Outsourcing ratio	Ratio of income received of subcontracting per unit of total output
Export propensity	Ratio of total exports to output
Foreign Ownership	= 1 if the firm has 10 percent or more foreign ownership, 0 otherwise.
Labour Productivity	Value added per unit of hourly labour
Wages	Log of annual per-capita wages (directors, white collar, blue collar workers) deflated to 1994 pesos by the main price producer index (INPP).
Size of the firm	Log total number of employees in the firm
Age	Log age of the firm
Foreign Subsidiary	= 1 if plant is a subsidiary of a foreign firm, 0 otherwise.
Quality control	= 1 if a firm has a quality certification, 0 otherwise.
Imported raw materials (%)	Percentage of imported raw materials
Union	Dummy variable =1 if the majority of the workers are covered by a collective bargaining agreement, =0 otherwise.
Investment in R & D	Dummy investment in Research & Development=1 ; 0 otherwise
Skills	Level of education (percentage of low, medium and high skilled labour). Low skilled-labour: elementary school (0 to 6 years of education) Medium skilled: secondary school and high-school (more than 6 years less than 12 years) High skilled: bachelor degree and postgraduate studies (more than 12 years of education).
Type of technology used (%)	- Manual equipment - Machines and tools - Automatic equipment - Numerical control - Computerized numerical control - Robots
Industry	Dummy variable =1 if the establishment is in the four-digit CMAP classification (Mexican Classification of Activities and Products), 0 otherwise.

6.5. Econometric results

This section reports the regression results from our firm-level data in 1992, 1999 and 2001. The main question we aim to answer are:

1. What are the firm-specific characteristics determining a firm's involvement in outsourcing as a supplier?

By answering this question, we will be able to understand the characteristics of outsourcing in the Mexican Manufacturing industry. In addition, we will contribute to present empirical evidence of outsourcing from the perspective of the supplier firms in a developing country.

The first part of the analysis shows the results of the different probit specifications mentioned above, and the marginal effects. Since the outsourcing ratio varies between 0 and 100; the second part of the analysis employs a tobit model which allows for left and right censoring of data.

6.5.1. Probit Results

Table 6.5 to Table 6.10 present results of probit estimates for the 1992, 1999 and 2001 ENESTYC Surveys respectively. All the models use robust standard errors to get rid of possible heterosckedasticity problems.

Starting with the firm-specific characteristics in 1992, coefficients in the cross-section estimates of columns 1 to 6 in Table 6.5and Table 6.6 show high level of significance levels in key variables like export propensity, foreign ownership, imported raw materials, etc., and are generally in line with the results we were expecting to obtain.

Supplier firms who are foreign, exporters, subsidiaries, import their raw materials and who are larger are more likely to engage in outsourcing.

In the case of the variable exports, we can see that overall is statistically significant but has a negative relationship with the probability to outsource. This relationship is completely different to the results we were expecting. By exploring the data, we can find that out of 638 firms with outsourcing ratios greater than 60 percent, only 35 firms export their production. Thus, the small sample of exporting firms does not give us robust results to explore the relationship between outsourcing and exports. To get consistent assertions of this relationship we will wait to see the results of the regressions for the following waves of the survey.

We can also observe a negative relationship between productivity and the probability to engage in outsourcing. As mentioned in the descriptive analysis,

this result is surprising as we were expecting a positive relationship between outsourcing and productivity.

There are many reasons to suspect that firms engaged in outsourcing have low productivity. Firstly, activities in which outsourcing firms are involved are more labour intensive such as apparel and electronics industries where more labour is needed to assemble electronic items or stitch clothes. Secondly, the problem with Maquiladoras is that a great part of the value added is made up of wages. For instance, in 1993 approximately 74 percent of the value added in the Maquiladora was made up of wages and in 2000 it reached approximately the 80 percent (Puyana and Romero, 2005). Therefore, productivity of suppliers relies on wages and since suppliers' main comparative advantage is given by low wages, productivity will remain low unless outsourcing suppliers start moving up to more capital intensive activities.

Table 6.5 Characteristics of Outsourcing: Probit Estimation and Marginal Effects 1992

Independent Variables	Model 1		Model 2		Model 3	
	Coefficients	Marginal Effects	Coefficients	Marginal Effects	Coefficients	Marginal Effects
Constant	-0.673***		1.381		1.680*	
	(0.092)		(0.820)		(0.852)	
Foreign	1.275***	0.189	1.293***	0.165	0.632***	0.074
	(0.065)	0.010	(0.075)	0.010	(0.081)	0.010
Exports	-1.417***	-0.210	-1.439***	-0.183	-1.771***	-0.208
	(0.187)	0.026	(0.214)	0.025	(0.224)	0.024
Log Productivity	-0.487***	-0.072	-0.506***	-0.064	-0.456***	-0.054
	(0.028)	0.004	(0.037)	0.005	(0.037)	0.004
Log Size	0.131***	0.019	0.120***	0.015	0.148***	0.017
	(0.022)	0.003	(0.029)	0.004	(0.031)	0.004
Log per-capita			-0.186***	-0.024	-0.163**	-0.019
Wages directors			(0.056)	0.007	(0.060)	0.007
Log per-capita			0.153	0.020	0.079	0.009
Wages white collar			(0.086)	0.011	(0.089)	0.010
Log per-capita			-0.151	-0.019	-0.077	-0.009
Wages blue collar			(0.085)	0.011	(0.087)	0.010
Log Age					-0.321***	-0.038
					(0.038)	0.005
Dummy Subsidiary					0.269***	0.035
					(0.074)	0.011
Share of Imported					1.029***	0.121
raw materials					(0.098)	0.011
Investment in					-0.217***	-0.026
R & D					(0.065)	0.008
Log likelihood	-1.4e+03		-1.0e+03		-941.614	
Prob. chi-squared	586.512		459.653		581.565	
Pseudo r-squared	0.237		0.259		0.331	
N	4,882		4,027		3,995	

Robust standard errors in parenthesis
* Significant at 10%; ** significant at 5%; *** significant at 1%.

Table 6.6 shows three additional specifications controlling for skills, type of technology used in the production process and industry heterogeneity. We can observe that the different types of technology used do not appear to be a good predictor for the general strategy of outsourcing. However, firms with low skill and medium skill labour are highly significant characteristics of outsourcing.

In the last column, we also include 54 industry dummy variables to control for industry specific effects. After removing not significant industries, we can find that firms in industries 3212, 3213, 3220, 3720, 3831 and 3832 have greater probability of engaging in outsourcing as suppliers.

Table 6.6 Characteristics of Outsourcing: Probit Estimation and Marginal Effects 1992

Independent Variables	Model 4		Model 5		Model 6	
	Coefficients	Marginal Effects	Coefficients	Marginal Effects	Coefficients	Marginal Effects
Constant	-2.267		-2.151		-2.062***	
	(1.219)		(1.222)		(0.586)	
Foreign	0.717***	0.079	0.723***	0.0788	0.887***	0.096
	(0.119)	0.013	(0.118)	0.0130	(0.090)	0.010
Exports	-1.810***	-0.200	-1.825***	-0.1987	-1.921***	-0.207
	(0.231)	0.024	(0.230)	0.0238	(0.205)	0.022
Log Productivity	-0.403***	-0.045	-0.406***	-0.0442	-0.417***	-0.045
	(0.041)	0.005	(0.040)	0.0048	(0.036)	0.004
Log Size	0.046	0.005	0.061	0.0067	0.368***	0.046
	(0.037)	0.004	(0.038)	0.0041	(0.077)	0.011
Log per-capita	-0.158*	-0.017	-0.151*	-0.0165	1.043***	0.112
Wages directors	(0.066)	0.007	(0.066)	0.0071	(0.107)	0.012
Log per-capita	0.137	0.015	0.149	0.0162	-0.336***	-0.036
Wages white collar	(0.103)	0.011	(0.104)	0.0112	(0.041)	0.005
Log per-capita	-0.014	-0.001	-0.026	-0.0029	0.027***	0.003
Wages blue collar	(0.100)	0.011	(0.100)	0.0109	(0.006)	0.001
Log Age	-0.317***	-0.035	-0.324***	-0.0353	0.021**	0.002
	(0.042)	0.005	(0.042)	0.0049	(0.006)	0.001
Dummy Subsidiary	0.246*	0.030	0.245*	0.0295	0.897***	0.173
	(0.113)	0.015	(0.114)	0.0149	(0.129)	0.036
Share of Imported	1.052***	0.117	1.073***	0.1169	0.335	0.047
raw materials	(0.106)	0.013	(0.106)	0.0125	(0.284)	0.049
Investment in	-0.182*	-0.020	-0.170*	-0.0186	1.334***	0.318
R & D	(0.072)	0.008	(0.072)	0.0079	(0.122)	0.044
Dummy Foreign	0.114	0.014	0.124	0.0146	0.174	0.021
Subsidiary	(0.155)	0.020	(0.156)	0.0198	(0.165)	0.023
Low skilled labour	0.035***	0.004	0.033***	0.0036	0.791**	0.150
	(0.007)	0.001	(0.007)	0.0007	(0.277)	0.077
Medium Skilled	0.030***	0.003	0.029***	0.0032	0.295	0.039
Labour	(0.007)	0.001	(0.007)	0.0008	(0.166)	0.027
Manual equipment			-0.001	-0.0001	0.320**	0.043
			(0.002)	0.0002	(0.106)	0.017
Machines and tools			-0.000	0.0000	0.780***	0.145
			(0.002)	0.0002	(0.179)	0.049
Automated			-0.003	-0.0003	0.262	0.034
equipment			(0.002)	0.0002	(0.165)	0.025
Numerical control			-0.003	-0.0003	0.335	0.047
			(0.003)	0.0003	(0.287)	0.050
Computerized			-0.008*	-0.0008	0.262	0.035
numerical control			(0.003)	0.0004	(0.283)	0.045
Robots			-0.008	-0.0009	0.887***	0.096
			(0.005)	0.0005	(0.090)	0.010
3212. Fabric Mills					-1.921***	-0.207
					(0.205)	0.022
3213. Textile, Fabric Finishing					-0.417***	-0.045
and Fabric Coating Mills					(0.036)	0.004
3220. Manufacture of wearing					0.368***	0.046
apparel except footwear					(0.077)	0.011
3560. Plastic Products					1.043***	0.112
					(0.107)	0.012
3720. Basic Metals/except iron and steel					-0.336***	-0.036
and include nuclear material					(0.041)	0.005
3814. Other metallic products/except					0.027***	0.003
machinery and equipment					(0.006)	0.001
3831. Machinery and equipment and					0.021**	0.002
electric accessories					(0.006)	0.001
3832. Electronic equipment					0.897***	0.173
(radio, TV and communication)					(0.129)	0.036
3841. Automotive industry					0.335	0.047
					(0.284)	0.049
3842. Transport equipment and					1.334***	0.318
parts/except autos and trucks					(0.122)	0.044
3850. Instruments and precision equipment manufacturing (includes					0.174	0.021
surgical equipment, excludes electronics					(0.165)	0.023
Log likelihood	-791.147		-785.468		-832.360	
Prob. chi-squared	560.578		576.218		729.370	
Pseudo r-squared	0.362		0.367		0.436	
N	3,472		3,472		3,847	

Robust standard errors in parenthesis

* Significant at 10%; ** significant at 5%; *** significant at 1%.

Table 6.7 and Table 6.8, show similar results to Table 6.5 and Table 6.6 with respect to the characteristics of outsourcing.

However, in the case of exports we can observe that the coefficient is positive and significant indicating that higher levels of export propensity ratios are related to a higher probability of engaging in outsourcing as supplier. Hence, firms orientated to international markets would have more probabilities to engage in outsourcing. In 1992 export does not seem to be significant because Maquiladoras are not included in the survey.

We can also observe a negative relationship between outsourcing and blue-collar wages. This is consistent with the theory which points that costs do influence the level of outsourcing activity (Gorg, 2000; and Egger and Egger, 2005; Swenson, 2006).

Table 6.7 Characteristics of Outsourcing: Probit Estimation and Marginal Effects 1999

Independent Variables	Model 1		Model 2		Model 3	
	Coefficients	Marginal Effects	Coefficients	Marginal Effects	Coefficients	Marginal Effects
Constant	-3.906***		-3.762***		-2.931***	
	(0.250)		(0.423)		(0.383)	
Foreign	0.988***	0.007	0.932***	0.014	0.554***	0.007
	(0.087)	0.003	(0.094)	0.005	(0.122)	0.003
Exports	2.971***	0.022	3.076***	0.045	2.272***	0.028
	(0.175)	0.008	(0.196)	0.014	(0.171)	0.008
Log Productivity	-0.463***	-0.003	-0.458***	-0.007	-0.402***	-0.005
	(0.041)	0.001	(0.047)	0.002	(0.046)	0.002
Log Size	0.318***	0.002	0.319***	0.005	0.348***	0.004
			(0.042)	0.002	(0.045)	0.001
Log per-capita			-0.078	-0.001	-0.046	-0.001
Wages directors			(0.061)	0.001	(0.065)	0.001
Log per-capita			-0.131	-0.002	-0.115	-0.001
Wages white collar			(0.084)	0.001	(0.094)	0.001
Log per-capita			0.242**	0.004	0.258**	0.003
Wages blue collar			(0.092)	0.002	(0.095)	0.001
Log Age					-0.301***	-0.004
					(0.049)	0.001
Dummy subsidiary					0.201	0.003
					(0.125)	0.002
Dummy Quality					-0.086	-0.001
					(0.110)	0.001
Imported raw					0.591***	0.007
materials					(0.139)	0.003
Dummy Union					-0.480***	-0.009
					(0.103)	0.004
Investment in					-0.249**	-0.003
R & D					(0.095)	0.002
Log likelihood	-528.619		-487.795		-398.662	
Prob. chi-squared	449.582		392.927		460.081	
Pseudo r-squared	0.718		0.714		0.710	
Obs	6,096		4,680		4,531	

Robust standard errors in the parenthesis
* Significant at 10%; ** significant at 5%; *** significant at 1%.

Over the last decades an important element of firms' modernization in Mexico has been the adoption of flexible methods of organizing work in the production lines to reduce costs. The flexible methods of organizing production refer to labour relations, job descriptions, length of the workday, worker mobility between tasks, and forms of hiring and firing. As a result, the changes had important effect on internal labour relations and have modified the structure of worker's qualifications, training and collective bargaining. In this context, unions have been slowly losing control over working conditions such as hiring, legal protection, etc. (Pozas, 2004). Hence, we included in the model the dummy variable "unions" and it seems to be a negative and significant characteristic of engaging in outsourcing before controlling for industry specific effects (see Table 6.8). This result may suggest that we have low unionised industries rather than low unionised firms.

Finally, the last column shows that again firms in labour intensive industries are more prone to be involved in outsourcing.

Table 6.8 Characteristics of Outsourcing: Probit Estimation and Marginal Effects 1999

Independent Variables	Model 4		Model 5		Model 6	
	Coefficients	Marginal Effects	Coefficients	Marginal Effects	Coefficients	Marginal Effects
Constant	-4.344***		-4.567***		-4.496***	
	(0.760)		(0.858)		(0.374)	
Foreign	0.766***	0.013	0.777***	0.0120	0.834***	0.0019
	(0.211)	0.005	(0.218)	0.0048	(0.132)	0.0008
Exports	2.049***	0.034	2.080***	0.0322	2.075***	0.0020
	(0.178)	0.009	(0.179)	0.0086	(0.181)	0.0009
Log Productivity	-0.375***	-0.006	-0.383***	-0.0059	-0.420***	-0.0015
	(0.049)	0.002	(0.049)	0.0017	(0.048)	0.0006
Log Size	0.289***	0.005	0.301***	0.0047	0.302***	0.0006
	(0.051)	0.002	(0.053)	0.0015	(0.044)	0.0008
Log per-capita	-0.039	-0.001	-0.043	-0.0007	0.312***	0.0043
Wages directors	(0.072)	0.001	(0.074)	0.0012	(0.086)	0.0019
Log per-capita	-0.105	-0.002	-0.124	-0.0019	-0.247***	-0.0043
Wages white collar	(0.103)	0.002	(0.105)	0.0017	(0.051)	0.0021
Log per-capita	0.351***	0.006	0.374***	0.0058	0.094	0.0000
Wages blue collar	(0.099)	0.002	(0.100)	0.0022	(0.130)	0.0000
Log Age	-0.278***	-0.005	-0.274***	-0.0042	0.691***	0.0000
	(0.053)	0.001	(0.054)	0.0014	(0.147)	0.0000
Dummy subsidiary	0.210	0.004	0.213	0.0034	-0.482***	0.0133
	(0.162)	0.003	(0.162)	0.0028	(0.114)	0.0109
Dummy Quality	0.035	0.001	0.037	0.0006	0.007***	0.0142
	(0.118)	0.002	(0.121)	0.0020	(0.002)	0.0139
Imported raw	0.744***	0.012	0.793***	0.0123	0.003*	0.0317
materials	(0.149)	0.005	(0.149)	0.0045	(0.001)	0.0123
Dummy Union	-0.503***	-0.012	-0.479***	-0.0108	0.745*	0.0252
	(0.108)	0.005	(0.109)	0.0045	(0.299)	0.0249
Investment in	-0.279**	-0.004	-0.267*	-0.0040	0.752*	0.0307
R & D	(0.105)	0.002	(0.106)	0.0020	(0.351)	0.0303
Dummy Foreign	-0.167	-0.002	-0.162	-0.0022	1.099***	0.0188
Subsidiary	(0.244)	0.003	(0.250)	0.0030	(0.167)	0.0197
Low skilled labour	0.018*	0.0003	0.018*	0.0003	0.988*	0.0071
	(0.007)	0.0001	(0.007)	0.0001	(0.412)	0.0056
Medium Skilled	0.013	0.0002	0.013	0.0002	1.070*	0.0221
Labour	(0.007)	0.0001	(0.008)	0.0001	(0.434)	0.0133
Manual equipment	0.766***	0.013	-0.001	0.0000	0.861*	0.0053
	(0.211)	0.005	(0.004)	0.0001	(0.397)	0.0032
Machines and tools			0.004	0.0001	0.527*	0.0132
			(0.004)	0.0001	(0.245)	0.0094
Automated			0.001	0.0000	0.938***	0.0052
equipment			(0.004)	0.0001	(0.251)	0.0051
Computerized			-0.002	0.0000	0.449**	0.0123
numerical control			(0.005)	0.0001	(0.149)	0.0085
Robots			-0.009	-0.0001	0.728**	0.0019
			(0.006)	0.0001	(0.222)	0.0008
3212 Fabric Mills					0.447	0.0020
					(0.252)	0.0009
3214 Textile Furnishing					0.702**	-0.0015
Mills					(0.246)	0.0006
3220 Manufacture of wearing					0.834***	0.0019
apparel except footwear					(0.132)	0.0008
3410 Manufacture of pulp					2.075***	0.0020
paper and paperboard					(0.181)	0.0009
3420 Publishing and printing					-0.420***	-0.0015
and related industries					(0.048)	0.0006
3512 Basic chemicals, excludes					0.302***	0.0006
basic petro chemicals					(0.044)	0.0008
3812 Metallic frames, tanks					0.312***	0.0043
and industrial boilers					(0.086)	0.0019
3814 Other metallic products/except					-0.247***	-0.0043
machinery and equipment					(0.051)	0.0021
3831Machinery and equipment					0.094	0.0000
and electric accessories					(0.130)	0.0000
3832 Electronic equipment					0.691***	0.0000
(radio, tv and communication)					(0.147)	0.0000
3841 Automotive industry					-0.482***	0.0133
					(0.114)	0.0109
3900 Other manufacturing industries					0.007***	0.0142
					(0.002)	0.0139
Log likelihood	-335.697		-331.073		-344.647	
Prob. chi-squared	487.019		507.631		553.421	
Pseudo r-squared	0.722		0.726		0.741	
Obs	3706		3706		4849	

Robust standard errors in the parenthesis

* Significant at 10%; ** significant at 5%; *** significant at 1%.

Table 6.9 presents outcomes for 2001, which are similar to the results of previous years. Foreign ownership, export propensity, productivity, size, wages of blue collar workers, imported raw materials and unions are among the main characteristics of outsourcing in the Mexican manufacturing industry.

Table 6.9 Characteristics of Outsourcing: Probit Estimation and Marginal Effects 2001

Independent Variables	Model 1		Model 2		Model 3	
	Coefficients	Marginal Effects	Coefficients	Marginal Effects	Coefficients	Marginal Effects
Constant	-4.198***		-4.872***		-3.772***	
	(0.374)		(0.864)		(0.860)	
Foreign	0.857***	0.0004	0.846***	0.0002	0.466***	0.0001
	(0.105)	0.0003	(0.120)	0.0003	(0.138)	0.0001
Exports	3.255***	0.0014	3.897***	0.0009	3.484***	0.0007
	(0.263)	0.0012	(0.415)	0.0011	(0.405)	0.0008
Log Productivity	-0.876***	-0.0004	-0.943***	-0.0002	-0.955***	-0.0002
	(0.058)	0.0003	(0.086)	0.0003	(0.091)	0.0002
Log Size	0.468***	0.0002	0.586***	0.0001	0.543***	0.0001
	(0.052)	0.0002	(0.061)	0.0002	(0.064)	0.0001
Log per-capita			-0.238*	-0.0001	-0.140	0.0000
Wages directors			(0.101)	0.0001	(0.105)	0.0001
Log per-capita			-0.293*	-0.0001	-0.452**	-0.0001
Wages white collar			(0.143)	0.0001	(0.152)	0.0001
Log per-capita			0.665***	0.0002	0.655***	0.0001
Wages blue collar			(0.168)	0.0002	(0.172)	0.0002
Log Age					-0.224**	0.0000
					(0.084)	0.0001
Dummy subsidiary					0.198	0.0000
					(0.159)	0.0001
Dummy Quality					-0.046	0.0000
					(0.139)	0.0000
Imported raw					1.069***	0.0002
materials					(0.163)	0.0003
Dummy Union					-0.441**	-0.0002
					(0.141)	0.0002
Investment in					0.041	0.0000
R & D					(0.115)	0.0000
Log likelihood	-384.527		-302.573		-269.518	
Prob. chi-squared	341.043		311.462		348.769	
Pseudo r-squared	0.784		0.811		0.832	
Obs	6,888		4,988		4,988	

Robust standard errors in the parenthesis
* Significant at 10%; ** significant at 5%; *** significant at 1%.

In this wave of the survey technology such as machine tools and automated equipment have a positive and significant effect on outsourcing. However, the type of technology used by outsourcing suppliers seem not to be very high-tech.

The last regression of our model again shows that the activities in which subcontractors are involved are again labour intensive activities like 3212, 3213, 3220, 3410 (see Table 6.10).

Table 6.10 Characteristics of Outsourcing: Probit Estimation and Marginal Effects 2001

Independent Variables	Model 4		Model 5		Model 6	
	Coefficients	Marginal Effects	Coefficients	Marginal Effects	Coefficients	Marginal Effects
Constant	-6.342***		-7.804***		-7.850***	
	(1.215)		(1.664)		(1.042)	
Foreign	0.017	0.0000	0.387*	0.0000	0.853***	0.0001
	(0.249)	0.0001	(0.154)	0.0001	(0.146)	0.0001
Exports	3.724***	0.0001	3.710***	0.0004	3.532***	0.0004
	(0.532)	0.0001	(0.549)	0.0006	(0.360)	0.0005
Log Productivity	-0.966***	0.0000	-0.966***	-0.0001	-0.912***	-0.0001
	(0.109)	0.0000	(0.116)	0.0002	(0.083)	0.0001
Log Size	0.584***	0.0000	0.596***	0.0001	0.379***	0.0000
	(0.069)	0.0000	(0.069)	0.0001	(0.062)	0.0001
Log per-capita	-0.073	0.0000	-0.073	0.0000	0.369*	0.0000
Wages directors	(0.102)	0.0000	(0.101)	0.0000	(0.161)	0.0001
Log per-capita	-0.316*	0.0001	-0.313*	0.0000	0.286	0.0000
Wages white collar	(0.157)	0.0002	(0.156)	0.0001	(0.158)	0.0001
Log per-capita	0.560**	-0.0001	0.600**	0.0001	-0.443**	-0.0001
Wages blue collar	(0.200)	0.0001	(0.199)	0.0001	(0.138)	0.0001
Log Age	-0.226*	0.0000	-0.209*	0.0000	0.027**	0.0000
	(0.099)	0.0000	(0.097)	0.0000	(0.008)	0.0000
Dummy subsidiary	-0.010	0.0001	0.165	0.0000	0.025**	0.0000
	(0.220)	0.0002	(0.180)	0.0000	(0.009)	0.0000
Dummy Quality	0.031	0.0000	0.062	0.0000	0.548	0.0002
	(0.153)	0.0000	(0.155)	0.0000	(0.321)	0.0003
Imported raw	1.149***	0.0000	1.129***	0.0001	1.491***	0.0054
materials	(0.182)	0.0000	(0.182)	0.0002	(0.411)	0.0071
Dummy Union	-0.335*	0.0000	-0.347*	-0.0001	1.543***	0.0054
	(0.148)	0.0001	(0.149)	0.0001	(0.217)	0.0050
Investment in	0.105	0.0001	0.129	0.0000	0.694*	0.0004
R & D	(0.129)	0.0001	(0.128)	0.0000	(0.294)	0.0005
Dummy Foreign	0.525	0.0000	0.016	0.0000	3.335***	0.2312
Subsidiary	(0.293)	0.0000	(0.009)	0.0000	(0.634)	0.1584
Low skilled labour	0.017	0.0000	0.014	0.0000	0.841**	0.0006
	(0.009)	0.0000	(0.010)	0.0000	(0.312)	0.0008
Medium Skilled	0.015	0.0000	0.015	0.0000	1.780***	0.0121
Labour	(0.010)	0.0000	(0.011)	0.0000	(0.370)	0.0106
Manual equipment			0.012	0.0000	0.793**	0.0005
			(0.011)	0.0000	(0.247)	0.0006
Machines and tools			0.015	0.0000	0.927***	0.0009
			(0.011)	0.0000	(0.175)	0.0009
Automated			0.007	0.0000	0.981***	0.0011
equipment			(0.012)	0.0000	(0.243)	0.0014
Numerical control			0.015	0.0000	0.621**	0.0003
			(0.012)	0.0000	(0.224)	0.0003
Computerized numerical control			0.387*	0.0000	0.311	0.0001
			(0.154)	0.0001	(0.441)	0.0002
3212. Fabric Mills					0.813**	0.0006
					(0.290)	0.0009
3213. Textile, Fabric Finishing and					0.853***	0.0001
Fabric Coating Mills					(0.146)	0.0001
3220. Manufacture of wearing					3.532***	0.0004
apparel except footwear					(0.360)	0.0005
3410. Manufacture of pulp paper					-0.912***	-0.0001
and paperboard					(0.083)	0.0001
3521. Pharmaceuticals					0.379***	0.0000
					(0.062)	0.0001
3560. Plastic Products					0.369*	0.0000
					(0.161)	0.0001
3720. Basic Metals/except iron and					0.286	0.0000
steel and include nuclear material					(0.158)	0.0001
3814. Other metallic products/					-0.443**	-0.0001
except machinery and equipment					(0.138)	0.0001
3831. Machinery and equipment and					0.027**	0.0000
electric accessories					(0.008)	0.0000
3832. Electronic equipment (radio,					0.025**	0.0000
TV and communication)					(0.009)	0.0000
3841. Automotive industry					0.548	0.0002
					(0.321)	0.0003
3842. Transport equipment and					1.491***	0.0054
parts/except autos and trucks					(0.411)	0.0071
3850. Instruments and precision					1.543***	
equipment manufacturing						0.0054
(includes surgical equipment, excludes					(0.217)	
electronics						0.0050
Log likelihood	-212.007		-211.437		-217.531	
Prob. chi-squared	307.909		325.472		374.207	
Pseudo r-squared	0.845		0.845		0.849	
Obs	3975		3975		4661	

Robust standard errors in the parenthesis

* Significant at 10%; ** significant at 5%; *** significant at 1%.

The results show an interesting insight into the characteristics of being an outsourcing supplier versus the probability of not being an outsourcing supplier in the Mexican manufacturing industry. Overall, results are consistent for the three years analysed and show that the firms are more likely to involve in outsourcing if they are foreign owned, exporters, if they use more low skilled labour, if they import their raw materials, if they are subsidiaries and pay lower wages.

As we can observe from our results, Mexico is specializing in labour intensive activities, which are concentrated by Maquiladoras.

We can also observe that wages are an important characteristic. This is consistent with Puyana et. Al (2005) findings who assert that wages are among the main incentives to attract foreign firms to subcontract activities in Mexico. The authors also point that the Maquila activities did not have the expected impact on industrialization. In this case, this argument is also consistent with present findings. In the case of Mexico evidence suggest that productivity levels, employment, and wages have not increased. Besides, due to the regulations of the Maquiladoras it has not created linkages with non-maquiladora firms. Maquiladoras were supposed to import all the raw materials to get advantage of the duty free and until 2001 they were forced to export all their production. Therefore, this has not opened incentives or promoted opportunities for domestic linkages through subcontracting.

6.5.2. Tobit results

This chapter is not only interested in the characteristics determining whether a supplier firm gets involves in outsourcing or not, but also in the determinants of the outsourcing ratio, i.e. how much a firm outsources. Figure 6.1 previously shown that outsourcing ratios vary between 0 and 100. Therefore OLS estimation is not appropriate, instead we employ a tobit model which allows for left and right censoring of data. To estimate the tobit model, we stick to the definition of outsourcing used in the probit analysis and we look at the firms with outsourcing ratios higher than 60 percent[42].

As in the probit estimations, results show that foreign firms and exporters tend to outsource more. For example in 2001, the tobit results suggest that an increase in the export propensity ratio by one percentage point, leads to and increase in the firm's outsourcing ratio by 0.257 while holding the other variables in the model constant (see Table 6.11).

Other variables like wages of blue collar workers and the share of imported raw materials are significant at the 1 and 5 percent respectively. However, results are positive and significant only in one wave of the survey. Therefore we cannot draw strong conclusions from these two variables.

Finally, when we control for industry specific effects we do not find strong and significant results suggesting that outsourcing is more practiced in one industry.

[42] To estimate the tobit model firms with less than 60 percent of outsourcing ratio or without outsourcing have outsourcing ratios of zero. For the firms with ratios greater than 60 percent, we transformed the ratio by subtracting 60 to the outsourcing ratio. Thus the new ratios range from 1 to 40 percent.

Table 6.11 Tobit Results

Independent Variables	1992	1999	2001
Constant	76.674***	16.633***	9.694***
	(15.97)	(2.425)	(2.449)
Foreign	0.096***		0.027***
	(0.017)		(0.007)
Exports	-0.279***	0.265***	0.257***
	(0.034)	(0.018)	(0.019)
Log Productivity	-1.826*	0.461	-1.196*
	(0.787)	(0.464)	(0.537)
Log per-capita wages	-3.124	-0.601	2.901***
blue collar workers	(1.715)	(0.79)	(0.853)
Imported raw materials		0.032**	
		(0.01)	
3111 Meat Products			-12.057*
			(6.014)
3114 Grain Mill products, starch products and cereals			18.389**
			(6.14)
3212 Fabric Mills	3.192		
	(2.689)		
3213 Textile, Fabric Finishing and Fabric Coating Mills	22.962*		
	(10.449)		
3214 Textile Furnishing Mills	7.388		
	(3.947)		
3220 Wearing Apparel Manufacturing	3.924*	-3.134**	
	(1.997)	(0.969)	
3230 Leather and fur products/except footwear		-8.655***	
		(2.602)	
3311 Products of Wood and Carpentry/except furniture		25.848***	
		(7.782)	
3420 Publishing and printing and related industries		-9.663**	
		(3.473)	
3522 Chemical Products	-13.275		
	(7.233)		
3691 Cement, lime and plaster/ includes other products		-8.653*	
based and non metallic products		(4.304)	
3811 Metallic pieces melting and moulding			-7.663
			(4.355)
3821 Machinery and Equipment for specific purposes		-8.908*	
		(3.87)	
3841 Automotive industry	-6.955		
	(3.946)		
Standard error of estimate	13.827***	7.376***	5.781***
	(0.763)	(0.373)	(0.307)
Log likelihood	-977.524	-898.912	-775.214
Prob. Chi-squared	118.150	279.838	217.289
Pseudo r-squared	0.057	0.135	0.123
Obs.	609	561	495

Standard errors in the parenthesis
* Significant at 10%; ** significant at 5%; *** significant at 1%.

6.6. Conclusions

Results show an interesting insight into the characteristics related to the suppliers involved in outsourcing. Overall, results are consistent for the three years analysed and show that the firm specific characteristics that increase the suppliers' probability to involve in outsourcing are, the share of foreign ownership, the propensity to export, wages of blue collar labour, low skilled labour, the share of raw materials that are imported, and if a firm is a subsidiary. In the case of the dummy variable unions, results suggest that we have low unionised industries rather than low unionised firms.

We can also observe that Mexico is specializing in labour intensive activities, where lot of Maquiladora firms are concentrated Maquiladoras.

Results also show that wages are one of the main characteristics the main drivers of being subcontracted.

Chapter 7 Spill-overs and Upgrading effects of Outsourcing on suppliers in the Mexican Manufacturing Industry

7.1. Introduction

Over the years developing country firms have relied on imported technology, licensed know-how and FDI for firm technological upgrading and spill-overs. However, with the integration of international production systems into global networks, access to advanced technology for developing country firms (DCF) depends on their ability to integrate and move up global value chains. Entry into global production chains offers firms in developing countries not only upgrading capabilities from "learning" through technology transfer but also exposure to international practice systems of corporate governance (Palit, 2006).

Mexico is an interesting case study, as the country embraced trade and financial liberalization reforms from the mid 1980s. Reforms in rules and regulations on foreign investment opened the door to an increase of capital flows and trade in goods and services. It also offered the opportunity to the country to participate in global production networks. Since then, the country has been used as a production base for supplying the North American market.

The liberalization strategy aimed to attract global firms, which in turn will generate spill-overs to local firms through backward supply linkages. Spill-overs from MNC's were supposed to flow through different channels. For instance, increased demand may help local suppliers to achieve economies of scale; consequently the increased efficiency or revenue could be used to invest in new technology.

Similarly, spill-overs can also flow to local contractors and suppliers as MNCs encourage them to upgrade technology and to adopt higher and more consistent quality standards. Also MNCs can provide training to local supplier firms involved in outsourcing. (Gallaguer and Zarsky, 2007).

The growth rate of exports since the early 1980s has been very fast (around 8 percent per year) and has risen at a faster pace since NAFTA took effect, increasing from a rate of 5.8 per annum from 1982 - 1993 to 11.1 percent in 1993-2006 (Table 7.1). Although exports have increased fast, real per-capita income has not increased since 1982.

Table 7.1 Export Growth for Mexico and selected developing countries (average annual rate in percent)

	1982-1993	1993-2006
China	6.9	18.7
South Korea	10.9	14.2
Turkey	7*	11.5
Mexico	**5.8**	**11.1**
Malaysia	12.3	8.9
Argentina	3.7	8.3
Thailand	14.5	7.8
Chile	8.4	7.5
Brazil	8	7.1

Source: World Bank, World Development Indicators
*1987-1993

Mexico's paradox of successful export growth with poor economic performance needs to be analyzed. Some authors argue that the lacklustre economic performance may be attributed to the lack of linkages between foreign firms and the domestic economy, low levels of technological capacity building; low value added exports of the Maquiladora sector; and overdependence of the US (Puyana and Romero; 2005; De la Garza Toledo, 2007; Gallagher and Shafaeddin, 2010).

Therefore, taking the GVC and FDI approach, the present chapter aims to analyse how subcontracting linkages have or have not been responsible for the upgrading of supplier firms involved in outsourcing in the Mexican manufacturing industry using firm level data. Particularly, this chapter aims to answer the following research questions:

- Does outsourcing linkages encourage research and development of the supplier firms?
- Does outsourcing increase human capital training?
- Does outsourcing improve organizational techniques of supplier firms?

The existing empirical evidence generally tends to be dominated by case studies of manufacturing companies or, they study few selected industries within the manufacturing sector (e.g. Gereffi, 1999; and Gallagher and Zarzky, 2007).

The present study contributes to the literature as it presents empirical evidence of the spill-overs and upgrading effects of outsourcing on the supplier firms involved in outsourcing in all manufacturing industries in Mexico.

To answer the research questions, we use the concepts of upgrading and spill-overs embedded in the theoretical approaches of the global value chains GVC and FDI previously discussed in Chapter 2. For the empirical analysis we use econometric techniques based on micro-level data to test the validity of our hypothesis.

This chapter consist of three hypotheses, for each of these the data and econometric model is presented followed by a discussion of the estimated results. The chapter concludes by drawing together the analysis of the three hypotheses.

7.2. Hypothesis 1. Outsourcing fosters R & D activities of supplier firms involved in outsourcing

MNCs are widely recognised as crucial actors in the technology transfer of local firms in developing countries. Moreover, relationships with lead firms can be key channel of technology transfer and R & D activities to supplier firms. However, it is up to MNCs to make strategic decisions regarding whether to develop an R & D capacity with the supplier firms or not.

Although R & D is regarded as being one of the least internationalised segments, a survey conducted to the largest R & D investors by UNCTAD from November 2004 to March 2005, suggests that the internationalisation of R & D may be accelerating with a clear trend towards increasing relocation to developing economies. In fact, expenditures on R & D by affiliates of United States TNCs in developing countries are concentrated in five countries: China, Singapore, Brazil, Mexico and Republic of Korea. The survey also finds that the chemical and pharmaceutical industries were the most internationalized in terms of R & D (UNCTAD, 2005).

Secondly, as economies become more open, lead firms look for suppliers who can be more competitive in terms of price or quality. In this sense, supplier firms have to innovate their products or processes opening up a possibility to invest more in R & D.

MNCs can also undertake R & D in host countries to adapt products to local and regional needs (product upgrading), they very rarely transfer advanced engineering and innovation capabilities (Kim, 2003).

Conversely, there are cases where the relationships between lead-firm and suppliers involved in outsourcing might not generate spill-overs.

Negative spill-overs can occur through backward linkages, if the entry of foreign firms decreases the efficiency or competitiveness of domestic supplier firms or drives them out of the business. Likewise, if a MNC has a strong bias

toward global suppliers it is not possible to generate spill-overs through backward linkages with domestic suppliers (Gallagher and Zarsky, 2007).

Negative spill-overs also occur if the outsourcing relationship is based merely on cheap labour. For instance, if MNCs outsource their simplest and least skill-intensive technology activities within the value chain.

To explore this hypothesis, the survey includes two questions regarding R & D. In one of the questions, firms have to answer whether or not they invest in R & D. In the other question, firms have to specify the amount invested in R & D over the last two years. Since many of the Maquiladora firms did not answer the amount invested in R & D, we rather use the first question regarding R & D practices.

For instance in 2001, 377 suppliers involved in outsourcing invested in R & D and only 69 reported the amount invested in R & D.

7.2.1. Descriptive Statistics

R & D is a key factor that enables developing countries to achieve economic development and growth. Unfortunately Mexico's R & D intensity is one of the lowest of the OECD countries.

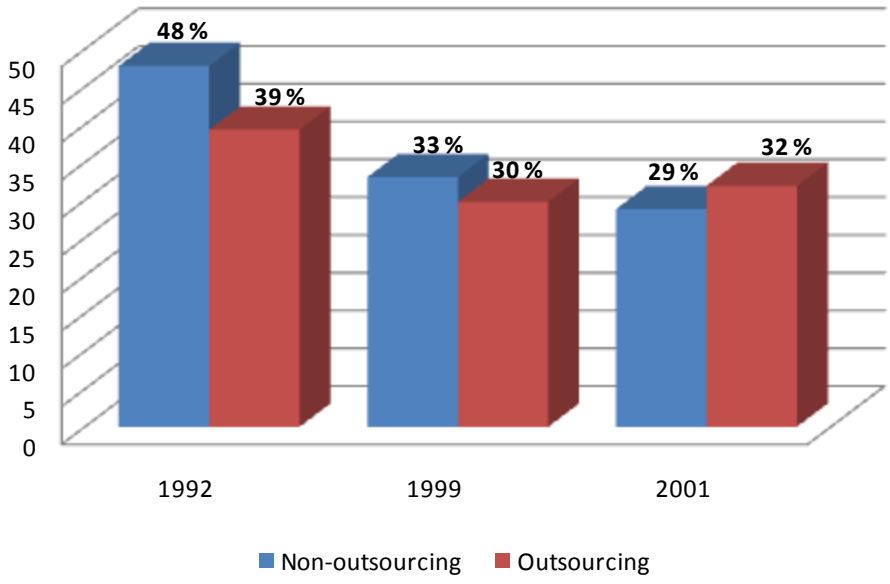
According to the OECD (2008b), in 2008 Mexico's gross domestic expenditure in R & D was 0.5 percent of total GDP. This figure has not increased significantly over time, as in 1993 it accounted for just 0.3 percent of total GDP (OECD, 2006 and 2008b).

Even though Mexico has very low levels of investment among the OECD countries, we want to explore whether outsourcing agreements have been a factor that increased the probability that suppliers involved in outsourcing will invest in R & D.

This section presents descriptive statistics of R & D and some variables that can drive its growth in Mexico. We use data from the ENESTYC in 1992, 1999 and 2001.

Figure 7.1 shows that the proportion of firms investing in R & D after 1992 decreased drastically. In 1992, 48 percent of the non-outsourcing firms and 39 percent of suppliers engaged in outsourcing invested in R & D. By 2001 only 29 percent of the non-outsourcing firms and 32 percent of the suppliers involved invested in R & D. The figure also shows that after NAFTA the investment in R & D decreased, probably because of the lack of policies from the government to promote R & D; the lack of access to credit for firms to finance R & D activities; or because the subcontracted activities involved do not need to invest in R & D.

Figure 7.1 Percentage of firms investing in R & D



Source: Author's calculations from ENESTYC, 1992, 1999 and 2001.

During 1999 and 2001 large outsourcing supplier firms are more likely to invest in research and development than large non-outsourcing firms[43]. A reason for this is that R & D activities are related to high costs, which small firms may not be able to afford and thereby excluding them from innovation activities. Or more likely, small firms perform basic activities that do not require R & D. We can also observe that, medium non-outsourcing firms invest more in R & D than suppliers engaged in outsourcing by examining the three waves of the survey (see Table 7.2)

Table 7.2 Percentage of firm investing in R & D by size

Size of the Firm	1992		1999		2001	
	Non-Out	Out.	Non-Out	Out.	Non-Out	Out.
Large	20.32	20.38	13.88	22.91	11.21	25.38
Medium	16.47	11.60	11.98	5.11	9.20	4.40
Small	8.75	5.96	5.04	1.67	6.23	1.86
Micro	2.21	1.41	2.15	0.10	2.18	0.25

Source: Author's calculations from ENESTYC, 1992, 1999 and 2001.

Evidence suggests that foreign firms invest more in R & D than national firms. However, our data shows that this pattern does not completely hold. We find that foreign supplier firms involved in outsourcing and national and non-outsourcing are more likely to invest in R & D[44] (see Table 7.3).

Table 7.3 Percentage of firms investing in R & D by ownership

Ownership	1992		1999		2001	
	Non-Out	Out.	Non-Out	Out.	Non-Out	Out.
National	37.94	17.87	27.34	9.64	23.66	13.62
Foreign	9.81	21.47	5.71	20.16	5.15	18.27

Source: Author's calculations from ENESTYC, 1992, 1999 and 2001.

[43] The one-tailed t-tests for the three years show statistically significantly differences in investment in R & D between large, medium, small and micro firms. This may suggest that larger firms have higher investment in R & D than the other firms. For example in 1992, t(4968)=-8.98, p<0.00; 1999, t(6880)=-10.94, p<0.00; and 2001, t(7816)=-12.41, p<0.00.

[44] The t-test results show that there are statistically significantly differences in the investment in R & D between domestic and foreign firms. In 1992, *t*(5069)=-5.84, p=0.00 (two-tailed); 1999, *t*(7427)=-7.83, p<0.00 (two-tailed); and in 2001, *t*(8554)=-13.27, p<0.00 (two-tailed).

In the case of exports, a similar pattern is found. We find again two different groups of firms investing in R & D[45]. Table 7.4 shows that firms who are more likely to invest in R & D are non-outsourcing and non-exporting firms and suppliers who are involved in outsourcing are exporters.

Table 7.4 Percentage of exporting and non-exporting firms investing in R & D

	1992		1999		2001	
	Non-Out	Out.	Non-Out	Out.	Non-Out	Out.
Exporter	3.32	2.51	3.68	23.21	3.00	23.35
Non-exporter	44.44	36.83	29.37	6.59	25.81	8.54

Source: Author's calculations from ENESTYC, 1992, 1999 and 2001.

Turning to the industries, we can observe that firms investing in R & D tend to be concentrated in few sectors. For instance, suppliers involved in outsourcing and investing in R & D are concentrated in two sectors: textile, clothing and leather; and in the machinery and equipment industries. Whereas non outsourcing firms investing in R & D tend to concentrate in more traditional industries such as food, beverage and tobacco; chemicals, oil and derivatives; and coal; and in the machinery and equipment industries (see Table 7.5).

Table 7.5 Percentage of firms investing in R & D by industry

Industry	1992		1999		2001	
	Non-out	Out	Non-out	Out	Non-out	Out
I. Food, beverages and tobacco	**9.36**	1.88	**7.17**	2.06	**6.87**	2.28
II. Textiles, clothing and leather	5.5	**12.07**	3.68	**7.67**	3.11	**8.21**
III. Wood and wood products	1.65	0.47	0.98	0.79	0.72	0.25
IV. Paper and printing	2.89	1.1	2.09	0.29	1.64	0.85
V. Chemicals, oil and derivatives and coal	**9.65**	2.82	**7.14**	2.56	**5.98**	2.2
VI. Non-metallic mineral products	2.64	0.63	2.04	0.59	1.77	0.76
VII. Basic metals	1.78	0.63	0.84	0.1	0.64	0.42
VIII. Machinery and Equipment	**13.65**	**19.28**	**8.36**	**15.24**	**7.7**	**16.24**
IX. Other manufacturing Industries	0.63	0.47	0.73	0.49	0.38	0.68

Source: Author's calculations from ENESTYC, 1992, 1999 and 2001.

[45] One-tailed t-test results indicate that the mean differences are always statistically significantly different from 0. In 1992, $t(5069)=-5.86$, $p<0.00$ (one-tailed); 1999, $t(7427)=-10.90$, $p<0.00$ (one-tailed); and in 2001, $t(8554)=-12.35$, $p<0.00$ (one-tailed).

7.2.2. Econometric Model

A firm's decision to invest in R & D can be influenced by a number of factors. We use a simple probit model to test firms' specific characteristics which can be associated with the decision to invest in R & D. The equation to be estimated will thus be of the following type:

$$\Pr(R\,\&\,D=1)_{it} = \beta_0 + \beta_1 Outratio + \beta_2 Ownership + \beta_3 Exportpropensity + \beta_4 Size + \beta_5 Industry + \in_{it}$$

We want to test whether being involved in outsourcing increases the probability of investment in R & D by suppliers. Therefore, outsourcing ratio is included as one of our explanatory variables along with other factors that can influence the firms' decision to invest in R & D such as: the share of foreign ownership; export propensity; and size. Table 7.6 presents a description of the selected variables used in our econometric analysis.

The presence of foreign firms can play a significant role on a host country's own innovation because it can bring directly or indirectly technology transfer or R & D activities. However, theoretical and empirical evidence produce mixed results suggesting that FDI can increase or decrease R & D depending on the specific context. Using firm-level data in Morocco, Haddad and Harrison (1993), found that FDI with higher technology will not necessary increase domestic R & D capacity. Similarly, Aitken and Harrison (1999) found that the impact of FDI on R & D in Venezuela is negative. In China, Fang and Mohen (2009) found that foreign firms are less R & D intensive, but when they innovate new products, they are more product innovative than domestic firms.

The variable "propensity to export" is included because if exporters want to compete successfully in foreign markets, they have to acquire the appropriate knowledge and technological capability. For instance, through spill-overs arising from lead firms.

Firm size measured by the total number of employees is regarded as an important factor in explaining R & D activities. Size is included as one of the classic Shumpeterian hypothesis states that innovation activity increases more than proportionally with firm size (Schumpeter, 1954). Large firms have easier access to finance and can spread the costs of R & D over a larger number of sales (Fang and Mohnen, 2009). Numerous studies have found a positive relationship between R & D expenditures and size (Martinez-Ros and Labeaga, 2002; Shefer and Frenkel, 2005).

Given size, firms which are subsidiaries may have easier access to financial capital necessary for investment. Therefore, the dummy for subsidiary is a potential explanatory variable.

Investment in R & D can vary between industries, therefore to control for industry heterogeneity we include 53 industry dummy variables.

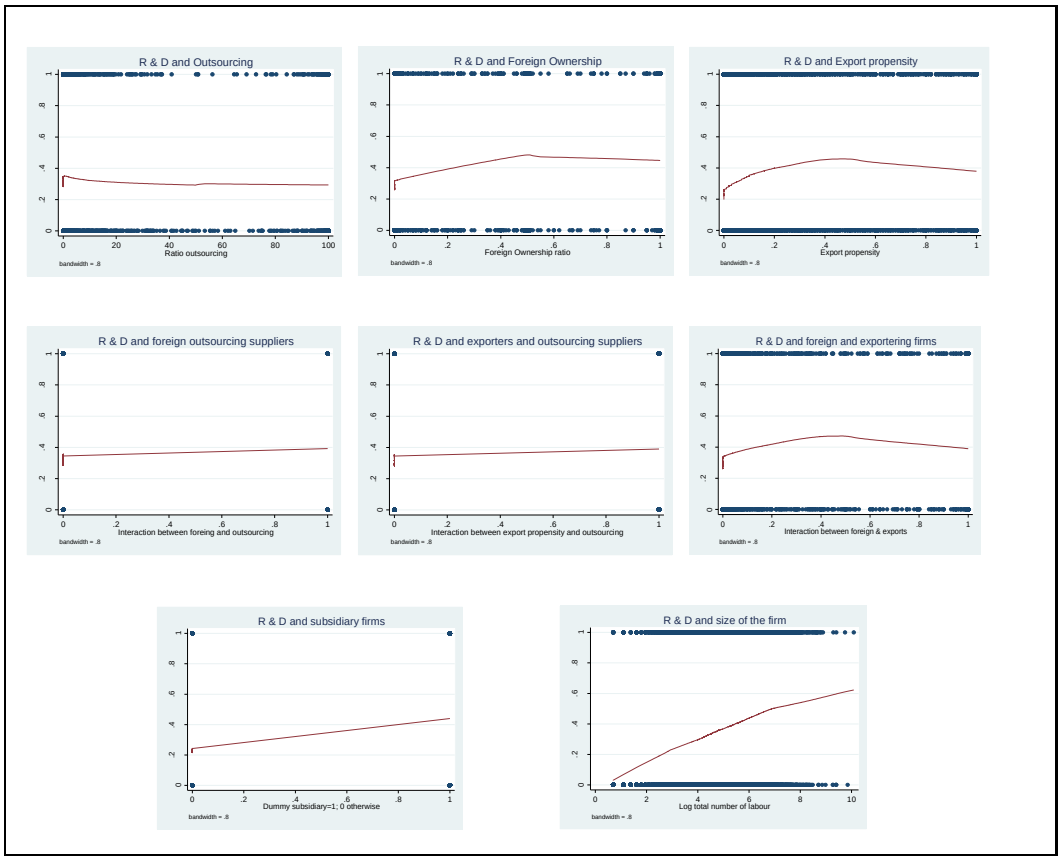
Table 7.6 List of Variables hypothesis 1

Variable	Description
Investment in R & D	Dummy investment in Research & Development=1 ; 0 otherwise
Outsourcing	Outsourcing ratio.
Share of foreign Ownership	Ratio of foreign ownership
Export propensity	Ratio of total exports to output
Size of the firm	Log total number of employees in the firm
Subsidiary	= 1 if plant is a subsidiary of a foreign firm, 0 otherwise.
Industry	Dummy variable =1 if the establishment is in the four-digit CMAP classification (Mexican Classification of Activities and Products), 0 otherwise.

Source: Author.

We also present exploratory plots to examine the relationship between R & D and the explanatory variables described above in 2001 (See Figure 7.2). The most evident and positive relationship is between R & D and size of the firms, followed by the dummy variable subsidiary. The other variables seem to have a positive, but not strong relationship with R & D. It is particularly interesting to note that firms are more likely to invest in R & D the lower their export propensity and foreign ownership ratio. The turning point in the ratio for investment appears to be around 0.5.

Figure 7.2 Relationship between R & D and selected independent variables 2001



Source: Author's calculations from ENESTYC, 1992, 1999 and 2001.

7.2.3. Results

Table 7.7 reports the main regression results predicting the probability of a firm to invest in R & D.

The general picture of the probit models over the three waves of the survey is that they do not perform very well. The probit formulations of the model is not explaining a lot as the estimate of ρ equal 0.05, 0.074 and 0.075 respectively for the three waves of the survey. But with significant parameters at a 1 percent level of significance (the parameters will be interpreted below). Possibly, there are other factors that explain the probability to invest in R & D

that our model is not able to capture. In spite of these shortcomings, our results can provide a broad idea of the drivers of R & D in Mexico.

Many of the coefficient estimates have the expected sign and are highly significant, while others have fluctuating significance and a different sign (see Table 7.7). The results reveal that suppliers who are involved in outsourcing have lower probability of investing in R & D. This result is very robust and contrary to our expectations, but the variable is significant at the 1 percent over the three waves of the survey. This suggests that outsourcing does not encourage suppliers involved in outsourcing to invest in R & D. Probably because firms are merely concentrated in low-value added activities which do not require any R & D such as the production of apparel and the assembly of electronics.

There share of foreign ownership increases the firm's probability to invest in R & D. The variable export propensity does not show consistent results in the three regressions. In 1992 export propensity is positive and significant at the 1 percent level, yet in 1999 it is not significant. In 2001 it is positive and significant at the 10 percent. Therefore, we decided to include an interaction variable if the firm is foreign and exporter. The coefficient of the variable is very significant in 1992 and 2001. Firms who are exporters and foreign have a lower probability of investing in R & D. We also observe that the propensity to engage in R & D increases with size. These effects are very significant over the three periods and are consistent with previous empirical evidence (Martinez-Ros and Labeaga, 2002; Shefer and Frenkel, 2005; Fang and Mohnen, 2009).We excluded the dummy variable subsidiary as it was not significant.

Table 7.7 Probit results hypothesis 1

probr_d	1992		1999		2001	
	Probit	Marginal Effects	Probit	Marginal Effects	Probit	Marginal Effects
Constant	-1.075***		-1.488***		-1.553***	
	(0.068)		(0.056)		(0.051)	
Outsourcing	-0.323***	-0.127	-0.498***	-0.169	-0.380***	-0.124
	(0.059)	0.022	(0.063)	0.019	(0.062)	0.018
Foreign and exporter firm	-0.703***	-0.28	-0.290*	-0.108	-0.475***	-0.169
	(0.184)	0.073	(0.128)	0.048	(0.125)	0.044
Share of Foreign ownership	0.148*	0.059	0.263***	0.098	0.320***	0.114
	(0.0649)	0.025	(0.077)	0.029	(0.078)	0.028
Export propensity	0.468***	0.186	0.138	0.051	0.152*	0.054
	(0.122)	0.049	(0.075)	0.028	(0.07)	0.025
Log size	0.210***	0.084	0.239***	0.089	0.240***	0.085
	(0.014)	0.005	(0.012)	0.004	(0.011)	0.004
Log. likelyhood	-3.20E+03		-4.00E+03		-4.30E+03	
Prob. chi-squared	337.936		635.154		700.181	
Pseudo r-squared	0.05		0.074		0.075	
N	4,901		6,941		7,321	

Source: Author's calculations from ENESTYC, 1992, 1999 and 2001.
Standard errors in the parenthesis
* Significant at 10%; ** significant at 5%; *** significant at 1%.

Table 7.8 shows the results of our probit estimation, where we test for systematic differences in the investment in R & D across industries. We also included other interaction variables such as if the firm is a foreign supplier involved in outsourcing, exporter supplier involved in outsourcing, and a foreign and exporter firm. Results are similar and robust as in the previous table for the variables outsourcing and size over the three years. In contrast, we can observe that when we control for industry specific effects foreign ownership is not significant anymore and the interaction variables that we include are also not significant. Firms that are subsidiaries have a higher probability of engaging in R & D. These effects are significant for the three time periods at the 5 and 10 percent level.

What is interesting to note is that the propensity to invest in R & D is negative and significant in labour-intensive industries such as 3118, 3212, 3220 and 3311. In contrast to other industries such as: high-tech such 3512, 3521, 3522, 3841 and 3850 these have a higher likelihood of investing in R & D.

Table 7.8 Probit model controlling for industry specific effects

probr_d	1992 Coeff.	1992 Mfx	1999 Coeff.	1999 Mfx	2001 Coeff.	2001 Mfx
Constant	-1.219***		-1.479***		-1.632***	0.249
	(0.071)		(0.058)		(0.054)	0.054
Outsourcing	-0.243***	-0.096	-0.474***	-0.161	-0.298**	0.098
	(0.06)	0.023	(0.079)	0.024	(0.093)	-0.028
Share of Foreign assets	-0.043	-0.017	0.03	0.011	0.109	0.038
	(0.069)	0.027	(0.083)	0.031	(0.083)	0.029
Export propensity	0.452***	0.180	0.168*	0.062	0.118	0.042
	(0.123)	0.049	(0.078)	0.029	(0.083)	0.029
Log size	0.220***	0.087	0.235***	0.087	0.235***	0.083
	(0.014)	0.006	(0.013)	0.005	(0.012)	0.004
Foreign Out. supplier		-0.242	0.362*	0.140	-0.195	-0.066
		0.074	(0.148)	0.058	(0.174)	0.056
Exporter out. supplier					0.260	0.096
					(0.153)	0.059
Foreign exporter	-0.608**	0.038	-0.532**	-0.197	-0.397*	-0.140
	(0.186)	0.019	(0.172)	0.064	(0.172)	0.061
Subsidiary	0.096*	-0.244	0.171***	0.064	0.107**	0.038
	(0.048)	0.053	(0.04)	0.015	(0.038)	0.014
3112 Manufacture					0.283*	0.106
of dairy products					(0.114)	0.044
3113 Canning and preserving foods					0.287**	0.107
exclude meat and milk					(0.105)	0.041
3114 Grain mill products, starch					0.308*	0.116
products and cereals					(0.135)	0.053
3118 Sugar factories	-0.665***	0.178	-0.558***	-0.178		
And refineries	(0.17)	0.061	(0.169)	0.044		
3119 Manufacture of cocoa chocolate and	0.455**	0.246				
Sugar confectionery	(0.166)	0.041				
3121 Other human feed products					0.540***	0.207
					(0.109)	0.044
3130 Beverages		0.379	-0.406***	-0.137		
		0.081	(0.091)	0.027		
3212 Fabric mills		0.176	-0.303***	-0.105	-0.273**	
		0.046	(0.084)	0.027	(0.085)	
3213 Textile, fabric finishing and fabric		0.201	-0.269*	-0.094		
of coating mills		0.041	(0.137)	0.044		
3214 Textile		0.188	-0.309*	-0.106		
furnishing mills		0.095	(0.138)	0.043		
3220 Manufacture of wearing apparel		0.182	-0.347***	-0.119	-0.350***	-0.090
except footwear		0.071	(0.079)	0.025	(0.077)	0.026
3311 Products of wood and carpentry/		0.187	-0.566***	-0.180	-0.600***	-0.113
except furniture		0.053	(0.16)	0.041	(0.169)	0.022
3410 Manufacture of pulp paper and		0.122	-0.297**	-0.103		
paperboard		0.044	(0.099)	0.031		
3512 Basic chemicals, excludes basic	0.649***	0.210	0.600***	0.235	0.696***	-0.175
Petro chemicals	(0.12)	0.061	(0.116)	0.045	(0.108)	0.038
3513 Synthetic or	1.123**	0.152				
artificial fibres	(0.36)	0.037				
3521 Pharmaceuticals	0.451***	0.163	0.600***	0.235	0.687***	0.269
	(0.123)	0.066	(0.124)	0.048	(0.113)	0.042
3522 Chemical	0.519***		0.444***	0.173	0.495***	0.265
products	(0.113)		(0.103)	0.041	(0.095)	0.044
3540 Coke, includes other coal and					0.657***	0.189
oil derivatives					(0.191)	0.038
3550 Rubber industry			0.367**	0.142		
			(0.125)	0.050		
3611 Ceramics and Pottery	0.485					
	(0.261)					
3612 Clay for the	0.469*					
construction industry	(0.194)					
3691 Cement, lime and plaster/ includes					0.435***	0.254
other products based on non-metallic prod.					(0.103)	0.075
3811 Ceramics and			-0.314*	-0.108		
pottery			(0.15)	0.047		
3814 Other metallic products/ except			-0.248**	-0.087		
machinery and equip.			(0.088)	0.029		
3821 Machinery and equipment for	0.480**					
Specific purposes	(0.146)					
3822 Machinery and equipment for	0.308**					
generic purposes	(0.112)					
3831 Machinery and equipment and					0.310***	0.165
Electric accessories					(0.081)	0.041
3833 Devices and accessories for domestic use/	0.545**			0.094		
except electronics	(0.173)			0.033		
3841 Automotive	0.387***		0.245**	0.207		
industry	(0.097)		(0.084)	0.063		
3850 Instruments and precision equipment manufacturing	0.416*		0.528***		0.644***	0.116
(includes surgical equipment,						
electronics)	(0.177)		(0.16)		(0.138)	0.032
Log. likelihood	-3.20E+03		-3.80E+03		-4.20E+03	
Prob. chi-squared	476.561		868.961		962.805	
Pseudo r-squared	0.07		0.102		0.103	
N	4901		6491		7321	

Source: 1992, 1999 and 2001 ENESTYC surveys.
Standard errors in the parenthesis
* Significant at 10%; ** significant at 5%; *** significant at 1%.

Although outsourcing has not encouraged supplier firms engaged in outsourcing to invest in R & D, one questions might be related to the type of R & D that has been taken place by the limited number of firms that have invested in it. The survey identifies four categories of investment in R & D: a) design of new products; b) product quality improvement; c) process improvement; and d) design, improvement, production of machinery and equipment. Using the GVC approach we can classify the first two categories into product upgrading and the last two into process upgrading. Table 7.9 shows that both non-outsourcing firms (non-out) and supplier firms involved in outsourcing (out) that invested in R & D in Mexico are more likely to invest in product upgrading. This result is consistent with Gerber and Carrillo (2002), who found in a case study of Baja California electronics and automotive manufacturing cluster than more than one-fifth of plants surveyed were engaged in product upgrading.

Table 7.9 Type of investment in R & D (% of firms)

Type of Investment	1992		1999		2001	
	Non-out	Out	Non-out	Out	Non-out	Out
Product Upgrading	**65**	**63**	**67**	**55**	**67**	**60**
Design of new products	38	35	37	21	38	36
Product quality improvement	27	28	30	34	29	24
Process upgrading	**35**	**37**	**33**	**45**	**33**	**40**
Process improvement	25	25	26	37	25	29
Design, improvement, production of machinery and equipment	10	12	7	8	8	11

Source: Author's calculations from ENESTYC, 1992, 1999 and 2001.

Our results do not seem to be very positive for Mexico's industrial development, since outsourcing has not encouraged suppliers to invest more in R & D.

7.3. Hypothesis 2. Outsourcing encourages in-firm training of supplier firms involved in outsourcing

The integration of local suppliers into global production networks has created greater pressure, as they face more competition not only with other local firms but also with suppliers abroad. To improve their performance and retain their supplier status, it is possible that supplier firms benefit from direct knowledge transfer from their multinational customers or they increase the training programmes.

FDI literature points out that vertical spill-overs occur through contact between multinationals and their local suppliers of intermediate inputs by means of technological know-how transfer and staff training (Javorcik and Spatareanu, 2005). Hence, domestic suppliers of intermediate inputs to MNCs may capture spill-overs through technical training to meet the specifications and requirements established by the lead firms (Gallagher and Zarsky, 2007).

The training of local labour is seen as an expected benefit from the relationship between the lead-firms and the supplier firms. In this context, our second hypothesis tests the probability that supplier firms involved in outsourcing provide more in-firm training than non-outsourcing firms.

Empirical studies comparing the performance of MNCs and locally-owned firms suggest that MNCs offer more training to managers and other types of employees than domestic firms do.

This section begins with an overview of the principal trends in in-firm training over the 1992-2001 periods, in terms of the number of firms doing in-plant training, varying by size, ownership status, export propensity and industry. A formal probit analysis of the key determinants of training, including, export propensity, share of foreign ownership, and dummy variables for outsourcing,

R & D and subsidiary is provided in section 7.3.2 and section 7.3.3 concludes with the main findings.

7.3.1. Descriptive Statistics

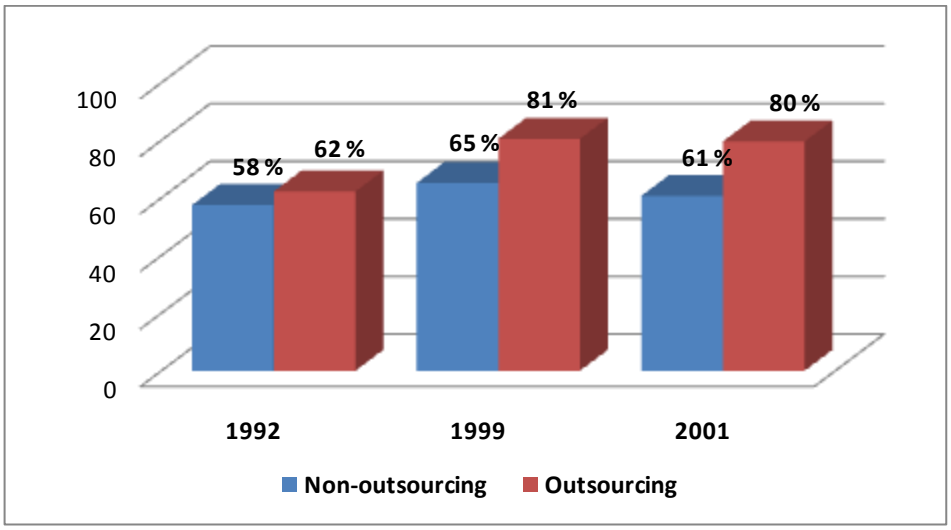
For the analysis we use the 1992, 1999 and 2001 ENESTYC surveys to show a broad picture of the trends in enterprise training in the Mexican manufacturing sector. The ENESTYC surveys provide information on a variety of training practices such as if the training is provided by the company or by external sources; benefits gained from the training, reasons for not doing any in-plant training, etc.

In this section we will focus on the characteristics that are associated with the firms' probability to do in-plant training, particularly we aim to analyse whether supplier firms involved in outsourcing do more in-plant training than non-outsourcing firms.

As a proxy for in-plant training we use one of the questions where firms have to answer whether or not they have some formal in-plant training program. According to Verhoogen (2008) from the patterns of responses, it seems that respondents misinterpreted many of the specific questions, or used different rules of thumb to guide their answers. Thus, this measure seems to be most reliable variable measuring the extent of training.

Figure 7.3 shows that over the three waves of the survey suppliers involved in outsourcing provided more in-firm training than non-outsourcing firms over the three waves of the survey. In 1999 and 2001, approximately 80 percent of the outsourcing firms surveyed provided in-firm training to their employees.

Figure 7.3 Percentage of firms providing in-firm training



Source: Author's calculations from ENESTYC, 1992, 1999 and 2001.

Table 7.10 present figures by firm sizes: large firms with more than 250 workers; medium firms with 101-250 workers; small firms with 16-100 workers; and micro firms with less than 15 workers. These results show that firms that do in-firm training tend to be larger or medium for suppliers involved in outsourcing and for non-outsourcing firms. For instance, in 2001 57.78 percent of large suppliers involved in outsourcing provided in-plant training. We can also observe that small and medium enterprises offered limited in-firm training. Small firms might not provide in-firm training probably because of the lack of knowledge about training techniques and organisation, training is not affordable (Miyamoto, 2003).

Table 7.10 Percentage of firms providing in-firm training by size

Size	1992		1999		2001	
	Non-Out	Out.	Non-Out	Out.	Non-Out	Out.
Large	26.30	34.95	25.70	55.46	20.55	57.78
Medium	20.10	17.24	24.33	18.19	21.37	15.14
Small	9.41	7.52	11.85	6.29	14.75	6.09
Micro	1.69	2.51	3.32	0.59	4.03	0.59

Source: Author's calculations from ENESTYC, 1992, 1999 and 2001.

Table 7.11 presents the corresponding training trends with ownership as the unit of observation. The table shows the percentage of firms providing in-plant training by ownership status. In general we observe that national non-outsourcing firms train more workers than any of the other group of firms.

Table 7.11 Percentage of firms providing in-plant training by ownership status

Ownership	1992		1999		2001	
	Non-Out	Out	Non-Out	Out	Non-Out	Out
National	44.46	26.96	54.49	33.73	50.95	35.19
Foreign	13.04	35.27	10.71	46.80	9.75	44.42

Source: Author's calculations from ENESTYC, 1992, 1999 and 2001.

Table 7.12 provides some initial insight trends into the relationship between training and export status. With exception of 1992, firms that do not export and do not outsource; and firms that do export and are engaged in outsourcing are invariably more likely to provide more training than those that do not belong any of these groups.

Table 7.12 Percentage of firms training by export status

Export Status	1992		1999		2001	
	Non-Out	Out	Non-Out	Out	Non-Out	Out
Exporter	4.26	3.13	7.08	**55.85**	6.37	**55.58**
Non-exporter	53.24	59.09	**58.13**	24.68	**54.33**	24.03

Source: Source: Author's calculations from ENESTYC, 1992, 1999 and 2001.

Table 7.13 summarizes data on the percentage of in-firm training at the two-digit industry level. We see that the training incidence is higher for supplier firms involved in outsourcing concentrated in the textile; clothing and leather; and in the Machinery and equipment industries. Whereas non outsourcing firms training their workers are likely to concentrate in more traditional industries such as food, beverage and tobacco and chemicals, oil and derivatives of coal.

Table 7.13 Percentage firms providing in-firm training by industry

Industry	1992		1999		2001	
	Non-out	Out	Non-out	Out	Non-out	Out
I. Food, beverages and tobacco	12.70	2.51	14.41	4.33	13.73	4.23
II. Textiles, clothing and leather	7.49	**20.38**	9.61	**29.11**	8.43	**29.44**
III. Wood and wood products	1.94	1.57	2.37	2.36	2.58	1.52
IV. Paper and printing	4.20	1.25	4.94	1.87	4.39	2.20
V. Chemicals, oil and derivatives and coal	10.29	3.13	11.70	4.72	10.67	4.91
VI. Non-metallic mineral products	2.84	0.47	3.23	1.08	3.00	1.02
VII. Basic metals	1.96	1.41	1.75	0.79	1.36	0.76
VIII. Machinery and Equipment	15.32	**31.35**	16.25	**34.91**	15.66	**34.09**
IX. Other manufacturing Industries	0.77	0.16	0.95	1.38	0.87	1.44

Source: Author's calculations from ENESTYC, 1992, 1999 and 2001.

From previous indicators we may conclude that the majority of the suppliers involved in outsourcing providing training tend to be large, exporters, and foreign. Conversely, non-outsourcing firms show a completely opposite trend. In the following section, we analyze these trends more formally using a regression framework.

7.3.2. Econometric Model

As mentioned earlier, the second hypothesis aims to test whether supplier firms involved in outsourcing do more in-firm training than non-outsourcing firms. But if we estimate a model including only one independent variable, we will incur in omitted variable bias. Therefore, we explore the factors that have contributed to the training trends observed above by estimating a probabilistic regression model. The explanatory variables are the share of foreign ownership, outsourcing ratio, export propensity, size of the firm, a dummy if the firm is a subsidiary, a dummy variable if the firm invests in R & D and controls for industry heterogeneity. In general, the probability of training fuction can be represented by:

$$\Pr(Training = 1)_{it} = \beta_0 + \beta_1 Outratio_{it} + \beta_2 Ownership_{it} + \beta_3 Exportpropensity_{it} + \beta_4 Size_{it} + \beta_5 Industry_{it} + \beta_6 Subsidiary_{it} + \beta_7 R\&D_{it} + \in$$

Where subscripts *i* and *t* denote firm and time period respectively. For training incidence, a 0, 1 indicator variable for whether or not the firm provided any training to its employees is used.

The outsourcing ratio is also included as our hypothesis is that supplier firms involved in outsourcing do more in-plant training than non-outsourcing firms.

Foreign ownership is included as previous empirical evidence in Mexico, Indonesia and Malaysia shows that firms with higher foreign equity train more than domestic firms (Tan and Batra, 1996; Tan and Lopez-Acevedo, 2003). These studies suggest that MNCs are more likely to train their workers for two reasons. Firstly, they are less likely to face credit constraints since they have more access to foreign capital. Secondly, MNCs are more likely to gain information on techniques and organisation of training since they have a global range of information.

Export propensity is included as it may indirectly exert an indirect influence on training through improved access to foreign ownership or through higher quality standards established by the lead firms.

A dummy variable to identify whether a firm is a subsidiary or not is included as subsidiary firms might receive training from the parent firms in order to maintain the same quality and production standards within the entire group.

We also include the dummy variable "R & D" as sophisticated production processes and R & D requires intensive training for workers to adapt to new technologies. Previous empirical evidence suggests that there is a positive correlation between training and R & D (Tan and Batra, 1996; and Tan and Lopez-Acevedo, 2003).

7.3.3. Results

Table 7.14 reports the probit results for training for 1992, 1999 and 2001. Since probit coefficients can not be interpreted, we report the marginal effects that explain the change in the explanatory variables. First consistent with cross tabulations, share of foreign ownership, is a statistically significant predictor of training over the three waves of the survey. Second, size is associated with an increased likelihood of training. This means that larger firms are more likely to do in-firm training than smaller firms. Third, the probability of training is positively and significantly related to R & D. This may indicate the positive relationship between the use of advanced technology used in the production process and the level of skills needed by workers to implement the use of technologies. Subsidiary is positively associated with training in the three years, but the relationship is significant only at the 10 percent level for 1999 and 2001.

Finally, previous tabulations indicated that supplier firms involved in outsourcing were more likely to do in-plant training, but when we control for other factors, the effect disappears. We can observe that the relationship between outsourcing and training is negative and not robust. Therefore, we reject our hypothesis that outsourcing encourages in-plant training of the supplier firms involved in outsourcing.

Table 7.14 Results hypothesis 2

Prob_train	1992 Coefficients	1992 Marginal Effects	1999 Coefficients	1999 Marginal Effects	2001 Coefficients	2001 Marginal Effects
Constant	-1.612***		-1.754***		-1.482***	
	(0.075)		(0.062)		-0.051	
Outsourcing	-0.035	-0.013	-0.138	-0.033	-0.098	-0.028
	(0.063)	0.024	(0.078)	0.019	(0.073)	(0.022)
Foreign exporter firm	-0.181	-0.069	-0.439	-0.100	-0.368	-0.102
	(0.212)	0.081	(0.24)	0.054	(0.196)	(0.055)
Share of foreign	0.345***	0.132	0.684***	0.155	0.420**	0.117
ownership	(0.075)	0.028	(0.172)	0.039	(0.133)	(0.037)
Export	0.17	0.065	-0.079	-0.018	0.039	0.011
propensity	(0.129)	0.049	(0.095)	0.022	(0.087)	(0.024)
Log size	0.322***	0.123	0.528***	0.120	0.467***	0.130
	(0.015)	0.006	(0.015)	0.004	(0.013)	(0.004)
Subsidiary	0.236***	0.088	0.119*	0.027	0.114*	0.031
	(0.053)	0.019	(0.054)	0.012	(0.047)	(0.013)
R & D	0.446***	0.169	0.611***	0.127	0.444***	0.116
	(0.04)	0.015	(0.051)	0.010	(0.044)	(0.011)
Log. likelihood	-2.80E+03		-2.10E+03		-2.90E+03	
Prob. chi-squared	1052.076		2763.804		2701.832	
Pseudo r-squared	0.16		0.391		0.319	
N	4901		6941		7321	

Source: Author's calculations from ENESTYC, 1992, 1999 and 2001.
Standard errors in the parenthesis
* Significant at 10%; ** significant at 5%; *** significant at 1%.

Does the probability of training over the three waves vary across industries? This question can be addressed using dummy variables to control for industry specific effects (see Table 7.15). Consistent with the trends reported in the previous model, the probability of training rises with firm size, foreign owned firms, firms that are subsidiaries and firms that invest in R & D. Again outsourcing has a negative and not significant relationship with the probability of training. The industry results vary across years, and we only report the industries that are significant in at least in one of the years. Results show that the probability of training is greater and significant over the three years of the survey in three industries: basic chemicals (3512); pharmaceutical (3521); and electronic equipment (3832). It is also interesting to note that from 1992 to 2001 the probability of training is widespread across more industries such as 3112, 3117, 3841, 3850, etc.

Finally, again as mentioned above the probability of training is more likely to occur in high-tech industries and traditional industries such as textile and apparel.

Table 7.15 Probit model controlling for industry specific effects

	1992 Coefficients	Marginal Effects	1999 Coefficients	Marginal Effects	2001 Coefficients	Marginal Effects
Constant	-1.665***		-1.820***		-1.636***	
	(0.076)		(0.064)		(0.055)	
Outsourcing	-0.014	-0.006	-0.128	-0.030	-0.037	-0.010
	(0.064)	(0.024)	(0.078)	(0.019)	(0.074)	(0.021)
Foreign exporter firm	-0.172	-0.066	-0.514*	-0.115	-0.394	-0.107
	(0.212)	(0.081)	(0.244)	(0.054)	(0.201)	(0.055)
Share of foreign ownership	0.288***	0.110	0.649***	0.145	0.308*	0.084
	(0.077)	(0.029)	(0.174)	(0.038)	(0.137)	(0.037)
Export propensity	0.169	0.065	-0.075	-0.017	0.088	0.024
	(0.129)	(0.049)	(0.096)	(0.021)	(0.088)	(0.024)
Log size	0.327***	0.125	0.533***	0.119	0.469***	0.128
	(0.016)	(0.006)	(0.016)	(0.004)	(0.014)	(0.004)
Subsidiary	0.224***	0.084	0.112*	0.025	0.093	0.025
	(0.053)	(0.019)	(0.054)	(0.012)	(0.048)	(0.013)
R & D	0.438***	0.165	0.587***	0.121	0.394***	0.101
	(0.04)	(0.015)	(-0.052)	(0.010)	(0.045)	(0.011)
3112 Manufacture of dairy products					0.470**	0.103
					(0.143)	(0.024)
3117 Edible oils and fats					0.808***	0.146
					(0.243)	(0.024)
3118 Sugar factories and refineries	-0.570***	-0.224				
	(0.167)	(0.064)				
3120 Other human feed products					0.267	0.064
					(0.139)	(0.029)
3130 Beverages	0.462***	0.161			0.546***	0.116
	(0.108)	(0.033)			(0.13)	(0.020)
3213 Textile, Fabric Finishing and Fabric Coating Mills			0.374*	0.068	0.343*	0.080
			(0.184)	(0.026)	(0.158)	(0.030)
3230 Leather and fur products/except footwear			0.496*	0.083		
			(0.205)	(0.024)		
3410 Manufacture of pulp paper and paperboard					0.280*	0.067
					(0.114)	0.024
3512 Basic chemicals, excludes basic petrochemicals	0.349**	0.125	0.420*	0.074	0.627***	0.126
	(0.129)	(0.042)	(0.188)	(0.025)	(0.157)	(0.021)
3521 Pharmaceuticals	0.357*	0.127	0.731**	0.107	0.779***	0.144
	(0.139)	(0.045)	(0.239)	(0.020)	(0.193)	(0.021)
3522 Chemical Products					0.424**	0.095
					(0.133)	(0.024)
3540 Coke, includes other coal and oil derivatives					0.703**	0.134
					(0.247)	(0.029)
3550 Rubber Industry			0.462*	0.080	0.414*	0.093
			(0.191)	(0.024)	(0.168)	(0.030)
3710 Iron and steel basic industries					0.665**	0.130
					(0.213)	(0.027)
3811 Metallic pieces melting and moulding					0.391*	0.089
					(0.154)	(0.028)
3814 Other metallic products /except machinery and equipment					0.629***	0.128
					(0.114)	(0.016)
3822 Machinery and equipment for generic purposes					0.424**	0.095
					(0.136)	(0.024)
3823 Machinery and equipment for offices and informatics	0.481	0.165				
	(0.253)	(0.075)				
3831 Machinery and equipment and electric accessories			0.301*	0.057	0.275*	0.067
			(0.146)	(0.023)	(0.13)	(0.027)
3832 Electronic equipment (radio, tv and communication)	0.359*	0.128	0.439*	0.077	0.700***	0.136
	(0.151)	(0.049)	(0.204)	(0.027)	(0.188)	(0.023)
3841 Automotive industry			0.19	0.038	0.393**	0.090
			(0.143)	(0.026)	(0.128)	(0.024)
3850 Instruments and precision equip. Manuf. include surgical equip., excludes electronics	0.377	0.133	0.409	0.072	0.605***	0.122
	(0.198)	(0.063)	(0.228)	(0.031)	(0.181)	(0.025)
Log. likelihood	-2.70E+03		-2.10E+03		-2.80E+03	
Prob. chi-squared	1108.962		2805.855		2859.349	
Pseudo r-squared	1.68E-01		0.397		0.337	
N	4901		6941		7321	

Source: Author's calculations from ENESTYC, 1992, 1999 and 2001.

Standard errors in the parenthesis

* Significant at 10%; ** significant at 5%; *** significant at 1%

7.4. Hypothesis 3. Outsourcing promotes better organizational techniques of supplier firms involved in outsourcing

This hypothesis is explained by both spill-overs literature and upgrading effects of GVC. The GVC literature stresses that firms can upgrade their processes by transforming inputs into outputs in a more efficient way, through superior technology or reorganising production systems. For instance, just-in-time can be a form of process upgrading. In this sense, suppliers participating in GVC have to comply with international standards and it is through lead firms that supplier firms can acquire organizational techniques.

This section aims to test if outsourcing promotes better organizational techniques of the supplier firms. We start by showing trends of the organizational techniques implemented by firms; we follow by presenting the econometric model. Main empirical findings are presented in section 7.5.3.

7.4.1. Descriptive Statistics

The ENESTYC contains a question regarding the organizational techniques implemented by the firm. The survey identifies ten organizational techniques which are listed in Table 7.16. It is important to mention that during 1992 only limited number of firms answered to the question. For this reason, we omit 1992 in the econometric analysis.

The statistics indicate that the most widely used technique by both non-outsourcing firms and outsourcing suppliers is the Total Quality Management (TQM); followed by the establishments of rules and procedures. In addition, suppliers involved in outsourcing seem to have adopted more organizational techniques compared to non-outsourcing firms.

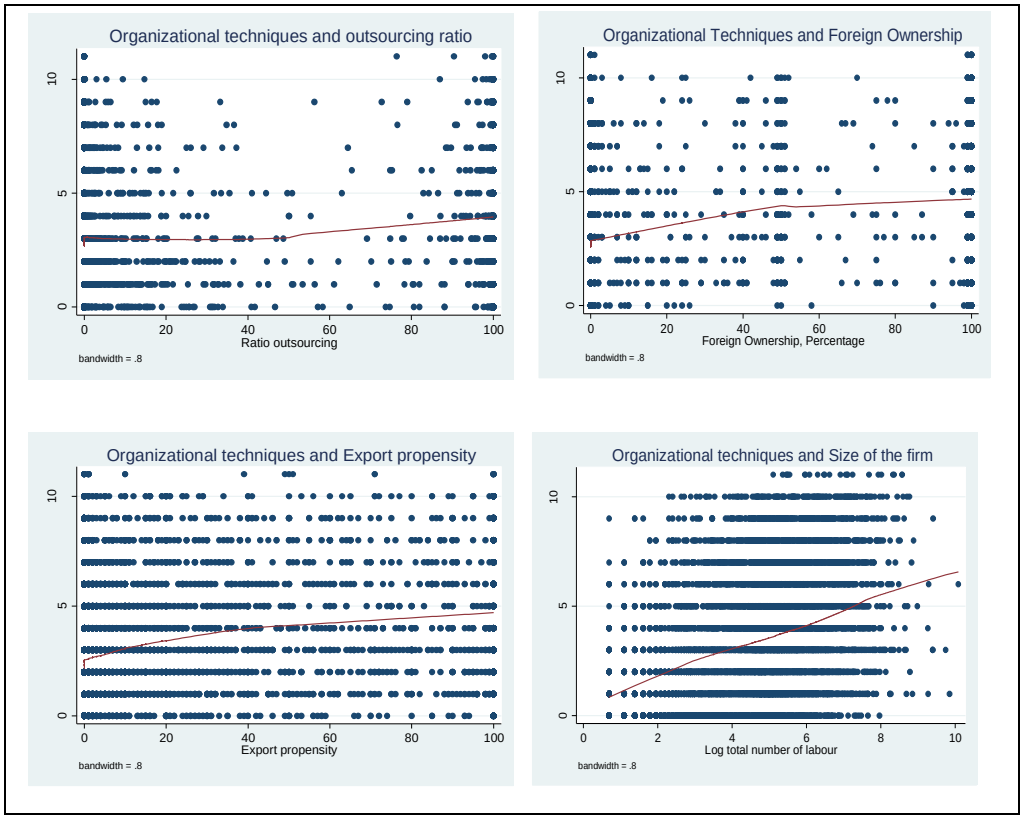
Table 7.16 Organizational techniques implemented in the firm (% of firms)

Organizational techniques	1992		1999		2001	
	Non-out	Out	Non-out	Out	Non-out	Out
1. Just in Time	4.83	9.72	12.68	27.73	13.46	28.51
2. Statistical control in the production process	8.73	9.25	30.26	41.99	29.32	44.50
3. Job Rotation	5.77	7.21	19.59	25.96	21.01	31.30
4. Quality circles	7.38	6.11	22.61	34.71	23.47	39.85
5. Total quality management	0.00	0.00	37.48	47.20	41.41	53.81
6. Rearrangement of the equipment, machines and improvement of facilities	10.51	10.66	28.63	39.72	26.97	39.59
7. Establishment of rules and procedures	0.00	0.00	32.70	41.40	32.45	46.79
8. Participation of workers in the decision making process	0.00	0.00	23.42	29.40	25.24	35.28
9. Strict supervision of labour	5.41	4.08	25.58	29.40	28.90	34.18
10. Performance standards	0.00	0.00	25.48	36.09	24.65	40.27
11.Other	12.81	12.85	4.57	6.88	4.81	9.05
12. None	44.55	40.13	25.37	16.13	25.48	14.30

Source: Author's calculations from ENESTYC, 1992, 1999 and 2001.

Similarly, Figure 7.4 presents a scatter of the relationship between the number of organizational techniques implemented by the firm and selected explanatory variables such as outsourcing ratio, share of foreign ownership, export propensity and size of the firm. From the exploratory analysis we observe a steady positive and increasing relationship between outsourcing and the number of organizational techniques implemented. For foreign ownership and size of the firm the trend is clearly positive. However, the econometric analysis is going to help us to establish more solid evidence on these relationships.

Figure 7.4 Relationship between organizational techniques and selected independent variables, 2001



Source: Author's calculations from ENESTYC, 1992, 1999 and 2001.

7.4.2. Econometric Model

The econometric model includes different independent variables which might explain firms' adoption of organizational techniques. The organizational techniques function is estimated using OLS (ordinary least squares) as follows:

$$Orgtech_{it} = \beta_0 + \beta_1 Outsourcing_{it} + \beta_2 Exportpropensity_{it} + \beta_3 Ownership_{it} + \beta_4 largefirms_{it} + \beta_5 mediumfirms_{it} + \beta_4 smallfirms_{it} + \in_{it}$$

This equation is estimated using ordinary least squares (OLS) and the independent variable is the number of organizational techniques that a firm has implemented. To explain the factors that determine whether a firm has implemented an organizational technique we include firm attributes such as export propensity, ownership of the firm, size, and outsourcing ratio. The following section describes our main findings.

7.4.3. Results

After testing and correcting for hetersokedasticity using the White Test,

Table 7.17 contains the OLS results. The coefficient of outsourcing ratio is negative and highly significant at the 5 percent level. This outcome leads us to reject our hypothesis that firms involved in outsourcing implement more organizational techniques than non-outsourcing firms. There are other factors that are more important in determining the adoption of organizational techniques like export propensity, foreign ownership, large and medium firms. The coefficients of these variables are positive and statistically significant at the 1 percent level. We can also notice that there is a negative and significant relationship between small firms and organizational techniques.

An interaction variable between large supplier firms involved in outsourcing is included. For 2001 we can notice that there is a positive and significant relationship at the 10 percent. In other words, only large suppliers involved in outsourcing increase the number of organizational techniques. But, probably this effect is more related to the variable size than with outsourcing.

A regression that included industry dummies was conducted, but we did not include the results as none of the coefficients of the industry dummies were significant.

Table 7.17 Results Hypothesis 3

Variables	1999 Coeff.	2001 Coeff.
Constant	2.560***	2.921***
	(0.066)	(0.059)
Outsourcing ratio	-0.348**	-0.319**
	(0.107)	(0.116)
Export propensity	0.381**	0.814***
	(0.123)	(0.125)
Foreign ownership	0.863***	0.476***
	(0.114)	(0.116)
Large firms	1.255***	0.897***
	(0.092)	(0.089)
Medium firms	0.519***	0.431***
	(0.085)	(0.08)
Small firms	-1.910***	-2.032***
	(0.072)	(0.067)
Large outsourcing firms	0.229	0.418*
	(0.178)	(0.194)
No. Obs.	7425	8675
R-squared	0.2816	0.2578

Source: Author's calculations from ENESTYC, 1992, 1999 and 2001.
Robust Standard errors in the parenthesis
* Significant at 10%; ** significant at 5%; *** significant at 1%.

7.5. Conclusions

The expected upgrading and spill-overs effects that Mexican economy anticipated as a result of integrating into global production networks have not materialised. Our results show that supplier firms involved in outsourcing do not invest more in R & D, do not invest more in and do not have better organizational techniques. This is in stark contrast to the Korean experience, one of the most successful countries that encouraged domestic firms to build extensive global networks with foreign firms, providing technology via licensing; capital goods and original equipment manufacture (OEM) contracts. The Networks developed by Korean firms are a major source of technological learning (Kim, 2003). In the case of Mexico, we can find that the global production networks have not brought benefits for the country and its firms.

Chapter 8 Conclusions

8.1. Introduction

This thesis contributes to the current literature on off-shoring and outsourcing by providing evidence of the phenomenon in the context of suppliers in a developing country. This research focuses on firm level data from the National Survey of Employment, Wages, Technology and Training (ENESTyC) covering 52 manufacturing activities at a four-digit level in 1992, 1999 and 2001. The main research question focused on answering: *""To what extent does the integration in global production networks through outsourcing and off-shoring benefit producers in developing countries along with opening channels for upgrading?".*

Due to the gap in the existing literature addressing the phenomenon from the perspective of the supplier firms, we looked at different literature from the perspective of the lead firms to identify potential variables that may be related to the characteristics of supplier firms in developing countries. We have also reviewed the theories of Global Value Chains, Foreign Direct Investment and Learning by exporting to identify the possible opportunities that outsourcing and off-shoring collaborations can open for developing countries in terms of upgrading and spill-over effects. Mixing these theoretical and empirical bodies of literature we developed our framework to analyse the phenomenon in Mexico.

By this research we have contributed in the existing literature in two ways. For the first time an effort has been made to present evidence of off-shoring and outsourcing in Mexico using firm level data in 1992, 1999 and 2001. This research also enriches the current debate of the effects of outsourcing and off-shoring in terms of upgrading and spill-over effects on supplier firms in developing countries.

8.2. Principal Research Findings

This section presents the major findings of the research questions raised in Chapter 5.

1. ***How significant is outsourcing in the Mexican Manufacturing Industry?***

To answer this question, we first needed a variable able to capture the extent of outsourcing. In the literature review chapter we stressed that outsourcing can be measured using macro-data measures such as in Campa and Goldberg, (1997); Feenstra and Hanson, (1997); Geishecker and Görg, (2003); Hummels, et al, (1997); Athukorala, (2003); Yeats, (2001); Lall, et al, (2004); and Kimura et al, (2005), and micro-data at the firm level, like in Jones (1998); (Diaz-Mora, 2005); and Tomiura, (2005). Evidence suggests that micro-data at the firm level better captures the extent of outsourcing. For this reason we gathered data at the firm level.

The results suggest that outsourcing practices are significant in the Mexican Manufacturing industry. In 2000, 31.3 percent of Mexico's gross value of production was produced under outsourcing agreements by approximately 13 percent of Mexican supplier firms.

Thus, outsourcing practices are significant, but they are concentrated in a small number of firms.

2. ***What are the characteristics of the supplier firms involved in outsourcing in the Mexican Manufacturing Industry?***

To answer this question we used a probit model on a large sample of detailed firm-level data to test the characteristics of firms involved in outsourcing. We present the findings of the descriptive analysis as well as summarizing the main findings of our econometric results in a table.

Results of the Descriptive Analysis

***Ownership status*:** the proportion of domestic firms involved in outsourcing is greater than the proportion of national firms for the three years of the analysis. More than 40 percent of the supplier firms engaged in outsourcing in the three waves of the survey were foreign.

***Export propensity*:** the GVC approach emphasizes that value chains promote inter-firm networks, by which developing-country producers through foreign buyers are able to access foreign markets (Bair and Dussel-Petters, 2006).

Results suggest that with exception of 1992, firms involved in outsourcing as suppliers tend to export more than non-outsourcing firms. In 1999 and 2001; approximately 60 percent of the firms involved in outsourcing exported more than 50 percent of their production.

Thus at first glance our results are consistent with the GVC approach.

Size: the dualistic approach expresses that lead firms in developed countries outsource to reduce production costs and to smooth production cycles at the expense of small suppliers. In this sense, the dualistic approach suggests that primarily small firms assume the role of suppliers in the outsourcing relationship.

In the case of the Mexican Manufacturing industry, this argument does not hold and results suggest that more than 70 percent of the suppliers involved in outsourcing are large and medium sized firms for the three waves of the survey.

Subsidiary status: our findings suggest that a significant proportion of suppliers involved in outsourcing are subsidiaries. For instance, in 1992; 41.38 percent of the suppliers involved in outsourcing were subsidiaries; in 1999 and 2001, approximately 61 percent of the total number supplier firms were subsidiaries.

Disaggregated figures of subsidiary firms by ownership and exporting status show that during 1992 and 2001 more than 40 percent of the supplier firms engaged in outsourcing are foreign subsidiaries and between 39.73 and 42.97 are foreign subsidiaries producing for the export markets.

Share of imported raw materials: firms with higher outsourcing ratios are more likely to have higher shares of imported raw materials used in their production. Over the three waves of the survey, more than the 48 percent of the supplier firms engaged in outsourcing imported more than 50 percent of their raw materials This is expected as a great part of supplier‘s subcontracted firms are Maquiladora firms that rely on imported raw materials**.**

Skills: during 1992 and 1999 58.2 percent and 49.2 percent of the employees of suppliers firms involved in outsourcing were unskilled having less than 6 years of schooling. By 2001, we observe a significant increase in the years of schooling of the employees working with outsourcing firms as 52 percent of them had from 7 to 12 years of schooling. However, compared to non-outsourcing firms, it seems that suppliers engaged in outsourcing contract labour with lower years of education. Probably because the activities in which they are concentrated are low-value added activities which require minimal skills.

We also observe that suppliers who outsource are more likely to use lower skilled labour and pay lower salaries than non-outsourcing suppliers.

This is consistent with the labour cost saving motivation of outsourcing from the perspective of the contractor. It is also supported by the fact that wages are lower for blue-collar workers as compared to wages of blue-collar workers of non-outsourcing firms.

Concentration of outsourcing activities by industry: To control of potential unobserved heterogeneity across industries we included industry dummy variables. Results show that supplier firms involved in outsourcing are concentrated in labour intensive industries such as textile and wearing apparel manufacturing, plastic products and basic metals.

This result is consistent with Hansen et al. (2008), who state that outsourcing in developing countries is extensively concentrated in low value-added activities related to standardized products and services.

Productivity: Labour productivity tends to be considerably lower for the suppliers engaged in outsourcing than for the manufacturing firms with lower outsourcing ratios. This result is surprising, as we were expecting that supplier firms contracted by other firms were more productive than non-outsourcing firms. This might indicate that productive firms are not interested in engaging in outsourcing or that probably the segments in which the subcontracted activities are concentrated are more labour intensive.

Econometric Results: Probit model

To test the joint significance of the variables mentioned above, we use a probit model. Results show an interesting insight into the characteristics of being an outsourcing supplier versus the probability of not being an outsourcing supplier in the Mexican manufacturing industry.

The results are summarized in table Table 8.1:

Table 8.1 Summary of the Results: Characteristics of outsourcing firms

Variables	1992	1999	2001
Foreign	Positive and Significant	Positive Significant	Positive Significant
Exports	Positive and Significant	Positive Significant	Positive Significant
Productivity	Negative and Significant	Negative and significant	Negative and significant
Size	Positive Significant	Positive Significant	Positive Significant
Age	Negative and significant; Positive (when we include industry dummy variables)	Negative and significant Positive (when we include industry dummy variables)	Negative and significant + (when we include industry dummy variables)
Subsidiary	Positive and significant	Positive and not Significant Negative when we include industry dummy variables	Positive and Significant when we include industry dummy variables)
Low Skill Labour	Positive and Significant	Positive and Significant	Positive and significant
Wages (Blue collar worker)	Negative and not significant Positive and significant when we include industry dummy variables	Positive and significant when we do not include industry dummy variables	Negative and significant when we include industry dummy variables
Imported raw materials	Not significant	Positive and significant	Positive and significant
Unions		Positive and significant at 1% when we include industry dummy variables	Positive and significant at when we include industry dummy variables

Results suggest that Mexico is specializing in labour intensive activities, which are concentrated by Maquiladoras. We can also observe that wages are among the main drivers of being subcontracted. This is consistent with Puyana et. al (2005) findings who assert that wages are among the main incentives to attract foreign firms to subcontract activities in Mexico. The authors also pointed out that the Maquila activities did not have the expected impact on industrialization. This argument is also consistent with the present findings. In the case of Mexico as it has not increased productivity levels, employment, or wages. Besides, due to the regulations of the Maquiladoras it has not created linkages with non-maquiladora firms. Maquiladoras were supposed to import all the raw materials to get advantage of the duty free and until 2001 they were forced to export all their production. Therefore, this has not opened channels or promoted opportunities for domestic linkages through outsourcing.

An interesting result regarding the "dummy variable to control for unions" is that it is positive and significant before we control for industry specific effects. This may suggest that we have low unionised industries rather than low unionised firms

Tobit model

The results of the tobit model show that foreign owned firms and exporters outsource more. For instance, in 2001 estimations show that an increase in the export propensity ratio by one percentage point, leads to an increase in the firms' outsourcing ratio by 0.257 while holding the other variables in the model constant.

Does the engagement in outsourcing increases the technology transfer, training and improves the organizational techniques of the supplier firms involved in outsourcing?

To answer this question a series of propositions were derived and the results are listed below:

a. Does outsourcing foster R & D activities of supplier firms involved in outsourcing?

The results reveal that suppliers who are involved in outsourcing have lower probability of investing in R & D. This result is very robust and contrary to our expectations, although the variable is significant at the 1 percent level over the three waves of the survey. This suggests that outsourcing does not encourage suppliers involved in outsourcing to invest in R & D. Probably because firms are merely concentrated in low-value added activities which do not require any R & D such as the production of apparel and the assembly of electronics.

The share of foreign ownership increases the firm's probability to invest in R & D. The variable export propensity does not show consistent results in the three regressions. An interaction variable if the firm is foreign and exporter is included and results show that firms who are exporters and foreign have a lower probability of investing in R & D. We also observe that the propensity to engage in R & D increases with size. These effects are very significant over the three periods and consistent with previous empirical evidence (Martinez-Ros and Labeaga, 2002; Shefer and Frenkel, 2005; Fang and Mohnen, 2009).The dummy variable subsidiary was not significant.

Although outsourcing has not encouraged supplier firms engaged in outsourcing to invest in R & D, one questions might be related to the type of R & D that has been undertaken by the limited number of firms that

have invested in it. The survey identifies four categories of investment in R & D: a) design of new products; b) product quality improvement; c) process improvement; and d) design, improvement, production of machinery and equipment. Using the GVC approach we can classify the first two categories into product upgrading and the last two into process upgrading shows that both non-outsourcing firms (non-out) and supplier firms involved in outsourcing (out) that invested in R & D in Mexico are more likely to invest in product upgrading.

Our results do not seem to be very positive for Mexico's industrial development, since outsourcing has not encouraged suppliers to invest more in R & D.

b. Does outsourcing encourage in-firm training of supplier firms involved in outsourcing?

To answer this question includes several variables to avoid possible omitted variable bias problems. The explanatory variables are the share of foreign ownership, dummy of outsourcing, export propensity, size of the firm, dummy if the firm is a subsidiary, a dummy variable if the firm invests in R & D and controls for industry heterogeneity.

Results show that the share of foreign ownership is positive and statistically significant predictor of training over the three waves of the survey. In addition, size is associated with an increased likelihood of training. This means that larger firms are more likely to do in-firm training than smaller firms. Thirdly, the probability of training is positively and significantly related to R & D. This may indicate the positive relationship between the use of advanced technology used in the production process and the level of skills needed by workers to implement the use of technologies. Subsidiary is positively associated with training in the three years.

We can observe that the relationship between outsourcing and training is negative and not robust. Therefore, we conclude that outsourcing does not encourage in-plant training of the supplier firms.

We also used dummy variables to test whether the probability of training over the three waves varies across industries? Results show that the probability of training rises with firm size, foreign owned firms, firms that are subsidiaries and firms that invest in R & D. The industry results vary across years, and we find that the probability of training is greater and significant over the three years of the survey in three industries: basic chemicals (3512); pharmaceutical (3521); and electronic equipment (3832). It is also interesting to note that from 1992 to 2001 the probability of training is widespread across more industries such as 3112, 3117, 3841, 3850, etc.

Thus, the probability of training is more likely to occur in high-tech industries and traditional industries such as textile and apparel.

c. Does outsourcing promote better organizational techniques of supplier firms involved in outsourcing?

The spill-over effects and upgrading literature stresses that a firm can upgrade their processes by transforming inputs into outputs in a more efficient way, through superior technology or reorganising production systems. For instance, just-in-time can be a form of process upgrading. In this sense, suppliers participating in GVC have to comply with international standards and it is through lead firms that supplier firms can acquire organizational techniques.

Considering this argument we want to test if firms involved in outsourcing implement more organizational techniques than non-outsourcing firms. Using an OLS model results show that the coefficient of outsourcing ratio is negative and highly significant at the 5 percent level. This outcome leads us to reject our hypothesis that firms involved in outsourcing implement more organizational techniques than non-outsourcing firms. There are however, other factors that are more important in determining the adoption of organizational techniques such as export propensity, foreign ownership, large and medium sized firms. The coefficients of these variables are positive and statistically significant at the 1 percent level. We find that there is a negative and significant relationship between small firms and organizational techniques.

An interaction variable between large supplier firms involved in outsourcing is included and for 2001 survey where we find that only large suppliers involved in outsourcing increase the number of organizational techniques. Probably the implementation of organizational techniques is more related to the variable size than with outsourcing.

A regression that included industry dummies was conducted, but the coefficients of the industry dummies were not significant.

8.3. Lessons from Mexico

Mexico's trade and FDI liberalisation policies implemented since the mid-1980s have so far had mixed results. These policies lead to a good export performance, but poor economic growth. For instance, from 1980 to 2000 exports grew at an average rate of 7.9 percent per year. By 2000 exports represented 28.7 percent of GDP and manufacturing exports and accounted for 87.3 percent of total exports. In this export boom, Maquiladora exports played a key role, as they accounted for 47.9 percent of manufacturing exports in 2000 (De la Garza Toledo, 2007). However, the expansion of exports does not mean that the country increased productivity or export content. Puyana, et al. (2005) estimates that an increase by one percentage point of Maquila exports is related to a 0.01 percent increase of productivity. In fact, Palma (2010) asserts that although Maquila has absorbed a significant amount of labour, it is associated with little or no productivity growth, and that it can only expand on the basis of low wages (Moreno Brid and Ros, 2004; Palma, 2009). The problem is that exports of the Maquiladora industry have concentrated in basic assembly activities rather than in products higher-up in the value chain. This situation raises doubts about the ability of the current industrial model to generate self-sustained growth.

Results presented in this thesis show that outsourcing as a strategy for development and promotion of economic growth has failed. In fact outsourcing is not associated with higher investment in R & D, with higher in-plant training and with improved organisational techniques of the supplier firms involved in this type of production.

While outsourcing practices have been dynamic, they have been characterized by a lack of domestic linkages in export oriented activities. Maquiladora programme failed to provide incentives for domestic companies to become suppliers to exporters, because the programs' benefits are exclusively to firms that are themselves exporters (Ten Kate, et. al. 2000).

The results presented in this thesis suggest the need to reshape Mexico's industrial policy. Mexico's industrial development can no longer be based on low wages, and Maquiladora production. If Mexico is to succeed the industrial policy needs to allow linkages between exporters and domestic suppliers to increase the local value added and technology transfer. To promote linkages with local suppliers, incentives to allow tax-free entry of imported inputs and raw materials for export purposes must be reconsidered, and policies to promote technological innovation in manufacturing should be designed.

8.4. Limitations of the research

There are two limitations of this study:

- The data of the ENESTYC makes it impossible to distinguish whether the supplier firms that are subsidiaries are operating under vertical integrated or arm's length market transactions. If their production corresponds to vertical integration and trade happens through intra-firm transactions this type of production can not be considered as outsourcing, and we might be over estimating the magnitude of the phenomenon.
- A second limitation is related to potential issues of self selection that arise when using cross-section data.

8.5. Suggestions for future research

- Use panel data techniques to test selection bias and causality problems
- To do the same analysis using the most recent ENESTYC to see more recent trends. Especially to see the impacts of the world financial crisis in the Maquiladora firms.
- To include qualitative research techniques because from our results, we can have a general overview of off-shoring and outsourcing, but it will be good to expand the research to understand more deeply the relationships entailed in the outsourcing agreement.

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Appendices

APPENDIX 1. Summary of Methodologies on the measurements of outsourcing

AUTHOR	DATA	METHODOLOGY
Campa and Goldberg (1997)	• Data for 20 manufacturing industries at the two-digit SIC level in each country with annual data from the early 1970's to the mid 1990s for four countries (United States, Canada, Japan and United Kingdom). • The series are constructed from the industry production input-output tables and industry-by-industry import shares.	• It is important to highlight that the aim of the paper is to study the external orientation of the manufacturing industries and not outsourcing. However, one of the measures proposed to measure the external orientation (share of imported inputs into production) can be used as a proxy for outsourcing (Feenstra, 1998). • In the methodology the series are created with input-output tables for each sector of each country which provide information on the weight of each industry as an input into the final output of another industry. The component input shares are combined with the fraction of that component input industry that is imported. • The imported input share of an industry indexed by *i* and is given by: $\alpha_t^i = \frac{\sum_{j=1}^{n-1} m_t^j p_t^j q_t^j}{VP_t^i}$ Where: i = index representing the output industry j = index representing the production input industry m_t^i = share of imports consumed by industry j in period t ; $p_t^i q_{j,t}^i$ = the value of inputs form industry j used in the production of industry i in period t.
Feenstra and Hanson (1997)	• The authors combine data on imports of final goods with data on total input purchases. • The data includes US imports and exports by four-digit (broad measure) and two-digit (narrow measure) SIC manufacturing industry for the period 1971-1994. The trade data is combined with data on material purchases from the Census of manufacturers. The Census data shows the value of intermediate inputs that each four-digit manufacturing industry purchased from every other manufacturing industry.	• In the methodology outsourcing is measured combining data on imports of final goods with data on total input purchases. • Two different measures of outsourcing are proposed: *Broad Measure of Outsourcing* $Outsourcing = \sum_j \left[IP_{ji}\right] x \left[\frac{M_j}{C_j}\right]$ Where: IP_{ji} =Input purchases of good j by industry i . M_j = Imports of good j . C_j = Consumption of good j *Narrow Measure of Outsourcing* The narrow measure of outsourcing is obtained by restricting the four-digit subscript i and j in (1) to be within the same two-digit SIC industry.

AUTHOR	DATA	METHODOLOGY
Hummels, Ishii and Yi (2001)	• OECD Input-output database which includes sector-level data on inputs (distinguishes foreign and domestic sources), value added, gross output, and exports. The data set covers 10 OECD countries, the main G7 nations plus Australia, Denmark, and the Netherlands for several years between 1968 and 1990. • In addition the study includes four emerging market countries (Ireland, Korea, Taiwan and Mexico). Input-output tables are used for Ireland, Korea and Taiwan. For Mexico, the data is taken from "*Maquiladoras*" and includes imported inputs, gross output and exports.	• The authors use a narrow measure of vertical specialization or outsourcing that measures the value of imported input content (or foreign value-added) embodied in good s that are exported. For country k and good or sector i, outsourcing is defined as follows: $VS_{ki} = \left(\frac{\mathbf{Im}\ portedIntermediates}{grossoutput} \right) xExports$
Geishecker and Görg (2003)	• The industry level data on foreign outsourcing was obtained from input-output tables by the German Federal Statistics Office. • For the narrow definition of outsourcing intermediate inputs are represented by the main diagonal of the input-output matrix for imports. • Intermediate inputs corresponding to the wide definition are obtained from the column sum of imported intermediate inputs from manufacturing industries.	• The authors propose two measures of outsourcing similar to the narrow and wide definitions proposed by Feenstra and Hanson (1997): $Out_{jt}^{narrow} = \frac{IMP_{jt}}{Y_{jt}}$ $Out_{jt}^{wide} = \frac{\sum_{j=1}^{J} IMP_{jt}}{Y_{jt}}$ Where: j denotes the respective two-digit manufacturing industry $(j \in J)$ IMP = value of imported intermediate inputs from a foreign industry Y = industry's output value Narrowly defined outsourcing only captures an industry's imported intermediate inputs from the same industry abroad whereas widely defined outsourcing integrates all imported intermediate, manufacturing goods of an industry.
Athukorala, P (2003)	• United Nations trade in parts and components data based on the SITC (Rev, 3) at the 5-digit level for two sectors SITC 7 (Machinery and Transport Equipment), and SITC 8 (Miscellaneous Manufactured Articles) for East Asian economies. The data contains 225 five-digit products (168 within the SITC 7 and 57 for the SITC 8)	• The methodology basically consists on a systematic separation and description trade in parts and components from total trade flows using UN trade data.

AUTHOR	DATA	METHODOLOGY
Yeats, A. (2001); Ng. F and Yeats, (2003)	• The first source of the data is the UN trade data of the Standard International Trade Classification (SITC 7 Revision 2) at the three, four and five-digit level for OECD countries from 1978 to 1995. • A second source of information is data compiled in connection with the use of special OECD tariff provisions, which provide for preferential access for the re-entry of domestically produced components assembled abroad.	• Outsourcing is measured by comparing trade in parts and components (P & C) with that in final products.
Lall, et al (2004)	• Trade in parts and components at the four-digit SITC (Rev 2) level from 1990 to 2001 for the electronics and automotive industry in East Asia and Latin America.	• Three alternative measures to capture the extent of outsourcing are proposed: • The first methodology is slightly similar to the one proposed by Yeats (2001) and Ng. and Yeats, (2003), since it compares trade in parts and components with trade in final products. However, the difference stems from the level of aggregation used. For instance, Ng. and Yeats include finished telecom products in their category of parts and components (SITC 764), while Lall uses SITC 7648 since the author considers this category as the correct for parts and components. In addition, the authors take only 7599 to capture parts and components of office and machines, but Lall argues that they should had also included 7591 (Parts and accessories for machines of headings 7511 or 7518). • The author recognizes that separating finished products from P & C does give only a partial indication of the phenomenon. For this reason, two more measures are proposed as a proxy for outsourcing: export performance and exports of finished products vs. parts and • The export performance measure cannot distinguish outsourcing from other exports but provides an envelope indicator of electronics and auto global production networks. The author argues that it is well known that multinational corporations (MNCs) production networks account for a great part of production and exports in both industries (electronics and auto), therefore there is a great probability that a significant share of trade is related to outsourcing. • Finally, the author points that the proposed measure of outsourcing using exports of finished products vs parts and components is questionable, since it excludes processing of given products and misses the full dimension of outsourcing.
Kimura et al. (2005)	• Harmonized System (HS) data for general machinery (HS84); electric machinery (HS 85), transport equip.(HS 86-89) and precision machinery (HS 90-92) at the 6-digit-level.	• The author provides a general overview of the global trends of outsourcing. The analysis consists in the comparison of machinery parts and components trade as a share of total exports and imports.

APPENDIX 2. Correlation Tables

Table 2.1 Correlations of suppliers with outsourcing ratios greater than 60 percent, 1992.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
1. Ratio Outsourcing	1																							
2. Foreign	0.19	1																						
3. Exports	-0.30	0.08	1																					
4. Log. Productivity	-0.17	-0.08	-0.02	1																				
5. Per-capita wages directors	-0.05	-0.02	0.03	0.24	1																			
6. Per-capita wages white collar	0.04	0.23	0.02	0.22	0.28	1																		
7. Per-capita wages blue collar	-0.08	0.08	-0.05	0.24	0.22	0.37	1																	
8. Size	-0.02	0.30	0.13	-0.05	0.04	0.07	-0.07	1																
9. Age	-0.08	-0.23	-0.05	0.08	0.19	-0.04	0.13	0.01	1															
10. Subsidiary	0.18	0.58	-0.04	-0.07	-0.02	0.18	0.01	0.20	-0.13	1														
11. Quality control	.	.	.	.	.	.	.	.	.	.	.													
12. Imported raw materials (%)	0.17	0.79	0.09	-0.08	0.01	0.20	0.03	0.25	-0.26	0.41	.	1												
13. Union	.	.	.	.	.	.	.	.	.	.	.	.	.											
14. Investment in R & D	-0.10	0.16	0.08	0.04	-0.02	0.07	0.06	0.09	-0.12	0.07	.	0.13	.	1										
15. Low skilled labour	0.03	-0.03	0.08	-0.26	-0.08	-0.20	-0.18	-0.01	0.03	-0.03	.	-0.01	.	-0.10	1									
16. Medium skilled labour	-0.02	0.03	-0.08	0.21	0.10	0.16	0.12	0.01	-0.04	0.02	.	0.01	.	0.10	-0.96	1								
17. High skilled labour	-0.06	0.02	-0.03	0.23	-0.03	0.17	0.23	0.00	0.02	0.02	.	0.00	.	0.02	-0.42	0.14	1							
18. Foreign subsidiary	0.19	0.79	0.00	-0.08	-0.01	0.16	0.01	0.26	-0.21	0.83	.	0.61	.	0.14	-0.04	0.03	0.02	1						
19. Manual equipment	0.02	0.09	0.03	-0.04	-0.07	0.08	0.02	-0.08	-0.11	-0.01	.	0.04	.	-0.04	-0.01	0.00	0.04	0.03	1					
20. Machines and tools	-0.01	-0.21	0.01	-0.04	0.01	-0.16	-0.06	-0.03	0.07	-0.08	.	-0.09	.	-0.15	0.19	-0.15	-0.18	-0.17	-0.51	1				
21. Automated equipment	-0.01	0.14	0.01	0.10	0.03	0.09	0.04	0.04	0.01	0.11	.	0.07	.	0.12	-0.21	0.18	0.16	0.11	-0.13	-0.48	1			
22. Numerical control	0.06	0.05	-0.03	-0.06	0.05	0.09	0.05	0.03	-0.01	0.03	.	0.01	.	0.11	-0.02	0.01	0.06	0.08	-0.16	-0.20	-0.07	1		
23. Computerized numerical control	0.01	0.21	0.00	0.00	0.06	0.12	-0.03	0.10	-0.08	0.19	.	0.17	.	0.13	-0.13	0.10	0.12	0.22	-0.11	-0.20	0.01	0.07	1	
24. Robots	0.04	0.10	0.00	-0.03	0.01	-0.02	-0.06	0.09	-0.01	0.04	.	0.13	.	0.04	-0.09	0.08	0.06	0.06	-0.02	-0.09	0.05	-0.01	0.05	1

APPENDIX 2. Correlation Tables

Table 2.2 Correlations of suppliers with outsourcing ratios greater than 60 percent, 1999.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
1. Ratio Outsourcing	1																							
2. Foreign	0.39	1																						
3. Exports	0.71	0.37	1																					
4. Log. Productivity	0.23	0.27	0.32	1																				
5. Per-capita wages directors	0.08	0.06	0.04	0.24	1																			
6. Per-capita wages white collar	0.07	0.13	0.00	0.25	0.28	1																		
7. Per-capita wages blue collar	0.05	0.09	0.04	0.31	0.21	0.68	1																	
8. Size	0.10	0.14	0.10	0.12	0.04	0.00	0.01	1																
9. Age	-0.54	-0.36	-0.84	-0.30	-0.04	0.00	-0.03	-0.12	1															
10. Subsidiary	0.37	0.45	0.31	0.15	0.07	0.10	0.07	0.22	-0.26	1														
11. Quality control	0.18	0.31	0.09	0.12	0.12	0.17	0.09	0.27	-0.08	0.39	1													
12. Imported raw materials (%)	0.40	0.42	0.37	0.12	-0.06	0.04	0.02	0.11	-0.32	0.32	0.23	1												
13. Union	-0.15	-0.23	-0.13	-0.17	-0.03	-0.10	-0.10	-0.11	0.15	-0.13	-0.13	-0.17	1											
14. Investment in R & D	0.09	0.11	0.03	-0.06	0.04	0.01	0.00	0.05	-0.04	0.18	0.18	0.01	-0.04	1										
15. Low skilled labour	0.07	0.03	0.12	-0.04	-0.04	0.03	-0.05	0.04	-0.15	0.00	-0.07	0.08	-0.15	-0.02	1									
16. Medium skilled labour	-0.06	-0.06	-0.10	0.00	0.03	-0.03	0.02	-0.03	0.14	-0.02	0.04	-0.08	0.15	-0.01	-0.97	1								
17. High skilled labour	-0.03	0.09	-0.10	0.15	0.05	0.03	0.10	-0.07	0.09	0.04	0.11	0.01	0.01	0.09	-0.29	0.04	1							
18. Foreign subsidiary	0.35	0.82	0.32	0.24	0.09	0.13	0.09	0.18	-0.31	0.75	0.37	0.38	-0.25	0.16	0.02	-0.04	0.07	1						
19. Manual equipment	0.03	-0.08	0.05	-0.16	-0.06	-0.05	-0.07	-0.10	-0.05	-0.08	-0.19	0.01	-0.02	-0.04	0.10	-0.08	-0.12	-0.07	1					
20. Machines and tools	-0.08	0.01	-0.06	0.08	-0.05	0.01	0.05	-0.08	0.05	-0.09	-0.10	-0.08	-0.02	-0.05	0.04	-0.04	-0.01	-0.05	-0.41	1				
21. Automated equipment	0.02	0.00	-0.01	0.04	0.07	0.00	0.00	0.15	0.03	0.08	0.15	0.04	0.05	0.06	-0.12	0.09	0.11	0.03	-0.34	-0.52	1			
22. Numerical control	0.04	0.10	0.01	0.02	0.00	0.04	0.02	0.04	-0.04	0.09	0.14	-0.02	-0.04	0.04	-0.05	0.03	0.09	0.11	-0.12	-0.19	-0.07	1		
23. Computerized numerical control	0.04	0.03	0.02	0.04	0.10	0.05	0.01	0.03	-0.03	0.09	0.13	0.08	0.02	0.02	-0.01	0.02	-0.03	0.06	-0.20	-0.23	-0.09	0.04	1	
24. Robots	0.01	0.06	0.02	0.02	-0.02	-0.03	-0.02	0.07	-0.02	0.06	0.08	0.06	-0.02	0.06	-0.01	0.01	0.00	0.07	-0.07	-0.09	-0.05	-0.02	0.00	1

APPENDIX 2. Correlation Tables

Table 2.3 Correlations of suppliers with outsourcing ratios greater than 60 percent, 2001.

Variables	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
1. Ratio Outsourcing	1																							
2. Foreign	0.25	1																						
3. Exports	0.59	0.22	1																					
4. Log. Productivity	0.22	0.24	0.41	1																				
5. Per-capita wages directors	0.09	0.09	0.03	0.14	1																			
6. Per-capita wages white collar	0.08	0.19	0.08	0.25	0.22	1																		
7. Per-capita wages blue collar	0.10	0.07	0.05	0.44	0.18	0.24	1																	
8. Size	0.09	0.21	0.09	0.29	0.22	0.10	0.09	1																
9. Age	-0.03	-0.07	-0.17	-0.12	0.11	0.05	0.01	0.00	1															
10. Subsidiary	0.25	0.49	0.12	0.16	0.17	0.21	0.07	0.23	0.00	1														
11. Quality control	0.08	0.26	0.06	0.20	0.14	0.20	0.12	0.24	0.10	0.31	1													
12. Imported raw materials (%)	0.25	0.35	0.25	0.26	0.08	0.25	0.11	0.13	-0.09	0.25	0.22	1												
13. Union	-0.13	-0.30	-0.08	-0.07	0.01	-0.13	-0.08	-0.03	0.07	-0.14	-0.07	-0.23	1											
14. Investment in R & D	-0.04	-0.02	0.00	0.07	-0.06	0.02	0.01	0.04	0.11	0.07	0.10	0.01	-0.06	1										
15. Low skilled labour	-0.03	0.01	0.03	-0.10	-0.12	-0.05	-0.12	-0.12	0.00	0.00	-0.19	-0.03	-0.09	-0.10	1									
16. Medium skilled labour	0.01	-0.02	-0.04	0.10	0.11	0.00	0.08	0.11	-0.02	0.00	0.13	0.02	0.10	0.08	-0.97	1								
17. High skilled labour	0.07	0.06	0.03	0.01	0.06	0.20	0.17	0.04	0.08	0.02	0.25	0.03	-0.03	0.09	-0.32	0.07	1							
18. Foreign subsidiary	0.22	0.86	0.19	0.23	0.12	0.19	0.07	0.25	-0.01	0.73	0.32	0.32	-0.23	0.02	-0.01	-0.01	0.07	1						
19. Manual equipment	0.04	-0.02	0.05	-0.06	-0.01	-0.09	-0.12	-0.12	-0.06	-0.10	-0.18	-0.04	0.00	-0.01	0.07	-0.04	-0.13	-0.01	1					
20. Machines and tools	-0.02	-0.04	-0.03	-0.07	-0.08	0.00	-0.04	0.00	-0.03	-0.02	-0.09	0.02	0.02	-0.05	0.00	0.02	-0.09	-0.05	-0.43	1				
21. Automated equipment	-0.05	-0.02	-0.04	0.04	0.06	0.03	0.09	0.08	0.06	0.03	0.14	-0.01	-0.03	0.03	-0.01	-0.03	0.14	-0.02	-0.37	-0.47	1			
22. Numerical control	0.06	0.01	0.01	0.04	0.01	0.06	0.08	0.01	0.00	0.02	0.08	-0.01	-0.04	0.07	-0.11	0.09	0.08	-0.01	-0.17	-0.13	-0.10	1		
23. Computerized numerical control	0.01	0.12	0.02	0.12	0.08	0.08	0.08	0.07	0.08	0.14	0.18	0.04	0.00	-0.01	-0.06	0.04	0.08	0.13	-0.16	-0.24	-0.12	0.09	1	
24. Robots	0.02	0.07	0.02	0.07	-0.01	0.00	0.05	0.04	-0.03	0.05	0.11	0.03	0.08	0.05	0.01	-0.04	0.12	0.08	-0.09	-0.11	-0.01	-0.03	0.03	1