THE DETERMINANTS OF INTERNATIONAL COMPETITIVENESS: THE CASE OF TURKISH MANUFACTURING SECTOR

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ABSTRACT

THE DETERMINANTS OF INTERNATIONAL COMPETITIVENESS: THE CASE OF TURKISH MANUFACTURING SECTOR

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The aim of this thesis is to identify and to study the micro and macro determinants of export performance. The results of micro determinants suggest that there is no significant relationship between export performance and R&D intensity, which could be a result of underreport of R&D expenditures in income statements of firms and the realization of its effects in the long-term. The results for marketing intensity, ratio of foreign exchange profits in total sales, fixed investment intensity and capital intensity are in the same way. On the other hand, bank loans and previous year's export performance is strongly related with export performance. Moreover, it is found that there is no significant difference between low technology industries' and medium and high technology industries' export behavior. On the other hand, from the macro-economic determinants perspective, the implementation of flexible exchange rate policy has favorable effects on the volume of exports. While export intensity is positively affected by the major devaluations experienced in 1994 and 2001.

Keywords: R&D, Manufacturing Sector and International Competitiveness

ÖZ

ULUSLARARASI REKABET GÜCÜNÜ BELİRLEYEN ETKENLER:
TÜRKİYE İMALAT SANAYİ ÖRNEĞİ

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Bu tezde, ihracat performansını belirleyen temel mikro ve makro etkenlerin belirlenmesi amaçlanmıştır. İhracat performansını belirleyen mikro etkenlerden elde edilen sonuçlara göre Ar-Ge harcamaları ile ihracat performansı arasında anlamlı bir ilişki bulunmamaktadır. Bunun temel nedeninin ise ülkemizde Ar-Ge harcamalarının kar-zarar tablolarında olduğundan daha düşük raporlanmasından ve etkilerinin uzun vadede gerçekleşmesinden kaynaklandığı düşünülmektedir. Pazarlama yoğunluğu, sabit yatırım yoğunluğu, sermaye yoğunluğu ve kambiyo karlarının toplam satışlara oranı için de benzer sonuçlar elde edilmiştir. Diğer yandan, banka kredileri ile geçmiş ihracat performansının ihracat performansına olumlu katkıda bulunduğu anlaşılmıştır. Ayrıca, düşük teknoloji ve orta ve yüksek teknoloji yan sektörlerinin ihracat performansları arasında anlamlı bir farklılık da bulunamamıştır. Makro-ekonomik etkenler çerçevesinden bakıldığında ise esnek kur rejiminin ihracat hacminin hızla artmasına katkı sağladığı, diğer yandan 1994 ve 2001 yıllarındaki devalüasyonların ihracat performansını olumlu etkilediği görülmüştür.

Anahtar Sözcükler: Ar-Ge, İmalat Sanayi ve Uluslararası Rekabet Gücü

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I hereby declare that all information in this document has been obtained and presented in accordance with academic rules and ethical conduct. I also declare that, as required by these rules and conduct, I have fully cited and referenced all material and results that are not original to this work.

Date: Signature:

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CHAPTER 1

INTRODUCTION

Some of the newly industrialized countries (NICs), such as South Korea, Taiwan, Hong Kong, Singapore, and Spain etc. are the champions of export growth, which are also dependent to world market demand rather than domestic demand. Exports have been pivotal in the rapid expansion of all these countries. In today's world, their achievements and higher rates of growth tried to be modeled by other developing countries. Exporting perceived by these countries as an important channel to integrate to the world economy, to achieve higher growth rates per capita and better life conditions. However, the interesting point here is, as Kazgan (1988) and Rodrik (2000) indicated, there is not a guarantee for a positive relationship between the exports and growth rates per capita for the countries, which follow export growth model. Export growth and being poor could have a positive relationship. Similarly, there is also not a guarantee for a positive relationship between development and being closed to world economy for the non-industrialized countries such as Bangladesh case.

In accordance with these studies, most of the governments of developing countries have begun to perceive stimulating the exports as a way to increase

social welfare and growth per capita. In order to formulate trade and industrial policies of these developing countries, a growing body of literature has addressed itself to an analysis of export performance of these countries. This growing literature gave importance which factors stimulate or deter firms to enter foreign markets. These studies try to understand whether technology is an important factor in improving the international competitiveness of the countries.

In this vein, some of this empirical literature to formulate the determinants of export performance could be summarized as Gruber et al. (1967), Gustavsson et al. (1996), Hatemi (2000), Plümper and Graff (2001), Roper & Love (2001), Lefebrve and Lefebrve (2001) and etc. focusing on industrialized countries. Some others, such as Kumar and Siddarthan (1993), Lall (2000a) and Lall (2000b), Taymaz and Özçelik (2001), Dijk (2002) and etc. are the major contributors to the understanding of export performance of developing countries using a unique data set, covering virtually all-manufacturing firms. In all of these studies, technological capabilities, such as R&D expenditures, are at the core of the export performance analysis. However, the technological capability is only a part of this story. The thesis will also analyze the effects of other explanatory variables on export performance, such as bank loans, marketing intensity, etc.

However, most of these studies have been focused on the data covering a questionnaire about the characteristics of firms. Differently, this thesis aims to identify and to study the main determinants of export performance by using a

unique data set covering the balance sheets and income statements[1] of the sub-sectors of the Turkish manufacturing sector, which are classified according to NACE (Nomenclature Generale des Activites Economique dans les Communautes Europeennes), Rev.1. Another purpose of this thesis is to identify and to analyze the differences in export behavior between low technology industries[2] and medium and high technology industries[3]. In order to accomplish those objectives, it is necessary to provide the new approaches. It is also important to provide evidence to validate or contradict, whatever possible, some of the conclusions about the role and determinants of international competitiveness. The thesis will apply a simple econometric model to make our estimations on the determinants of international competitiveness of Turkish manufacturing sector.

The structure of the thesis is organized as follows. Chapter 2 introduces the theoretical foundations reported in the literature, which are the contributions of new approaches to innovation process and major growth models. In chapter 3, some empirical foundations on R&D expenditures, innovation and international competitiveness will be introduced. In chapter 4, a historical evolution of export performance of Turkish manufacturing sector will be discussed. In Chapter 5, the thesis describes the simple model used in the estimation of the determinants of international competitiveness of the Turkish manufacturing sector in which the micro variables is applied only and macro and organizational variables are

[1] More information about the details of the questionnaires prepared by the Central Bank of the Republic of Turkey is available in Table 9 in Appendix A.
[2] The low technology industries are the sectors with R&D intensity lower than the average of the manufacturing sector.
[3] The high and medium technology industries are the sectors with R&D intensity higher than the average of the manufacturing sector.

ignored. Moreover, in the same chapter, we will handle the data used in the model and analyzed the data to find some clues before the estimation of the model. After that, empirical results will be obtained from the estimation of the determinants of international competitiveness. Policy implications are presented in the last chapter.

CHAPTER 2

MAIN APPROACHES TO TECHNOLOGY AND INTERNATIONAL COMPETITIVENESS

A growing body of literature has addressed itself to an analysis of international competitiveness of manufacturing sector in developed and developing countries. This literature has emphasized the contribution of technology and skills to countries' manufacturing sector relative competitiveness. To understand the background of the literature, we should first of all understand the main approaches to international competitiveness and the effects of technology on international competitiveness. Meanwhile, secondly, understanding the evolution of macroeconomic growth theory and the determinants of growth would also help us to understand the determinants of export performance, since the determinants of growth is also affecting the determinants of export performance and they have generally common determinants. The export performance (or international competitiveness) affects growth and realized growth has repercussion effects on trade due to their common determinants (Corden, 1971; Pomponio, 1996; and Ledesma, 2000). For example, technology is playing an important role in determining both the growth rates and the export performance.

2.1 New Approaches

Understanding the nature of innovation, the processes of innovation at work in a particular economy and the ways in which innovation generates economic benefits has become a central priority for modern economies. As a consequence, international trade and the classical theory of comparative advantage have long been under reconsideration. This reconsideration has stimulated the emergence of new approaches in the economics literature since the early 1980s. The main approaches to these issues can be termed as 'New Neoclassical', ' New Trade Theory', 'Marxist', 'Evolutionary', 'Evolutionary-Structuralist', and 'Neo-technology or Technology gap' respectively.

2.1.1 International Trade Theory and Neoclassical Approach

One of the basic questions that the theory of international trade has to answer is what determines trade. The economics does have an answer. Countries trade with each other because of their differences. This is one of the main assumptions in the *neoclassical general equilibrium* model of international trade. Countries may differ in their preferences, their technologies, or their factor supplies, and these differences jointly determine comparative advantage and hence trade.

The theory of comparative advantage of David Ricardo is a one-factor model. According to Ricardo, differences in labor productivity cause trade. In his

model, there are two countries and two goods. As long as the ratio of the cost of production ratios differ, and one country has a comparative advantage in the production of one of the two goods, while the other country has a comparative advantage in the production of one of the two goods. In this case, both countries gains from trade, regardless of the fact that one of the countries might have an absolute advantage in both lines of production (Appleyard and Field, 1992).

In comparative advantage, productivity of the labor is the cause of trade. However, *in Hecksher-Ohlin (H-O) theories*, technology, as emphasized above, does not appear at all. Production functions are identical across countries; all technology is fully diffused across firms and countries, and trade results from the differences in factor endowments, labor and capital. Firms automatically select the right techniques based on relative capital labor prices. Once they have made the choice (labor intensive techniques for developing countries), they use the technologies efficiently without lags, learning or effort. Since users automatically reach best practice level, there can be technical inefficiency only if governments intervene to distort factor prices or prevent free trade (Harrigan, 1996).

In short, technology differences as a source of comparative advantage were first studied by Ricardo, who identified different relative labor productivities as the cause of trade, while Heckscher and Ohlin (H-O) assumed away technology differences and focused on differences in relative supplies of capital and labor as the causes of trade. Post-war trade theorists have generalized the Ricardian and Heckscher-Ohlin approach; with the general factor proportions statement

encompassing many goods and factors while the generalized Ricardian approach focuses on general technology differences (Harrigan, 1996).

Meanwhile, *in the neo Hecksher-Ohlin theories,* skills are incorporated as a factor of production. However, they continued to assume efficient markets for technology and costless and efficient application of technology. The advantage of developing countries still lies in products with low-skill and labor intensive technologies; in using these, once more, there are no technological lags or costs (Lall, 2000a). Wood and Kersti (1997) assume that capital is fully mobile and reduces the determinants of comparative advantage to two immobile factors, skills of the labor force and the natural resources (environment). Comparative advantage now depends on the ratio of skills to resources: technology remains a permissive, and so irrelevant, factor.

Since the work of Solow (1957), it has been accepted that technological change accounts for a significant portion of GDP growth in industrialized countries. Therefore, the *new neoclassical approach* involves the extension of neoclassical economics into the world of innovation and endogenous technological change. This is one of the main differences of the new neoclassical approach from the neoclassical.

In this world, the standard assumptions do not prevail - information is incomplete and unequally shared; there are sunk costs, increasing returns and oligopoly; new products and processes are created as a result of deliberate

commercial activity by firms (Sheehan, 1999). Lipsey and Carlaw (1998) simplify the defining characteristics of neo-classical models and consider these characteristics as: maximizing behavior, unique equilibrium, the details of technology are not explicitly modeled, competition is seen only as an end product and no explicit economic structure.

As we have argued above, it is widely accepted that the assumptions of the standard neoclassical model are not conducive to the analysis of R&D, innovation, skills and the creation of new goods as endogenous processes within the economic system. As Lipsey (1998) argues standard neoclassical approach assumes firms' resources and technological capability is exogenous and this approach ignores the economic benefits of R&D expenditures, R&D subsidies, R&D tax cuts and other technology factors.

2.1.2 Technology-Based Theories and New Trade Theory

In technology-based trade theories, comparative advantage depends upon 'innovation' discrete improvements to products or processes (shifts of the production function). The use of and changes to existing technologies (reaching or moving along the production function) remain costless. Innovators are primarily in industrial countries; developing countries receive mature technologies from them and use them efficiently. As in H-O models, their comparative advantage depends on relative wages and skills. Since these theories explicitly introduce technology transfer, countries can realize or activate their advantages by facilitating

technology inflows, by opening their economies to trade, licensing and (particularly) foreign direct investment.

Also, several theories regarding the role of technology have been developed, which are generally referred to as "new-trade" theories. They have started from relaxing the fundamental assumptions of the neo-classical theories; but still they are based explicitly on imperfect markets, also concentrate on advanced countries. Abstracting from factor endowments, they use scale and (later) agglomeration economies to explain trade patterns (Krugman, 1990).

The main scope of new trade theories is intra-industry trade between industrial countries; in developing countries, trade remains mainly inter-industry, explained by H-O factor endowments. Krugman (1990) also argues "there is a natural alliance between the new trade theory, with its emphasis on increasing returns and imperfect competition, and the view that technological change is a key factor driving international specialization." The criticisms against neo-classical models made the technology-based theories popular, and academicians like Krugman began to emphasize on the role of technology in explaining the new trade theory.

For instance, learning technology appears in models as an explanatory variable, but it is really a form of scale economies over time: passive, automatic and predictable learning-by-doing, dependent only on the volume of production. It raises no policy issues apart from gaining first mover advantages. Some analysts

also note the existence of cumulative causation, externalities and path dependence as determinants of location and competitiveness (Venables, 1996). However, this applies primarily to agglomeration processes, not to technological learning in developing countries. Nevertheless, this category of trade models has great potential for the realistic analysis of technology and trade patterns in developing countries.

In short, the analyses of long-term growth have focused on patterns of trade and their linkages with the patterns of innovation across countries, across sectors and over time. *Neo-technology models (or new trade models)*, which have attempted to endogenize technical progress within equilibrium open-economy development models studies, have found some robust evidence regarding the impact of innovation on international competitiveness and on growth. (Krugman, 1979; Spencer, 1981) Krugman's modeling of the technology gap between the North and the South of USA and Spencer's analysis of the learning curve have contributed to bringing out some dynamic considerations in the discussions of international trade theory. Such approaches can be reduced to analyses of either learning curves or the generation of new intermediate inputs under monopolistic competition.

Funke and Ruhwedel (2001) also thank to the new trade theory, in their study on export variety and export performance, because of the ability of the new trade theory emphasizing product differentiation to explain the actual pattern of

international trade. Moreover, they add that the new trade theory has not only a theoretical appeal, but it is also empirically useful.

2.1.3 Technology Gap Theory

There has been another group of new contributions which has been called as *the technology gap* theory. For instance, Posner (1961), Soete (1980 and 1981), Rothwell (1981), and Dosi, Pavitt and Soete (1990) are the major contributors to the technology gap theory. **Technology** and **the success of countries in innovation** is their main theme and centered at the heart of the approach in explaining competitive advantage among countries. It has emphasized that innovation creates continuously and unevenly technology gaps across countries and is a fundamental source of competitive advantage among countries (Lee and Suh, 1998).

According to Elmslie and Vieira (1999), this theory attempts to capture the impact of technology on trade flows between the countries and the growth. They link the interaction between comparative and absolute advantage. They view that technological assymmetries determine the industry's net trade flows and each country's overall trade balance. In doing so, it deals with the measures of technology. R&D expenditures and number of patents are used as a proxy for technology in this literature.

2.1.4 Marxist Approach

In the *Karl Marx's* analysis, technological advance was central. In Marx, technological advance is an essential element of the competition among firms. Under the force of competition, firms are inexorably driven to adopt new technologies that substitute capital for labor. The result for Marx was as much rising unemployment as it was rising productivity. One can see here the origins of the modern dispute about the effects of automation. By and large, technological advance seems not to have caused widespread unemployment. However, the issue is repressed in most modern growth theory, which simply assumes full employment (Nelson, 1998).

Meanwhile, for Marxists, the society may be divided into the "social structure" (also called the social superstructure) and the "economic structure" (also called the economic base). The social structure consists of all ideas and all non-economic institutions such as the family, government, political parties, education, and religion. The economic structure consists of the relations and the forces of production. The forces of production consist of land, labor, capital, and **technology**. The relations of production are the relations of classes of people within the economic process such as slave and slave-owner (Sherman, 1979).

Sherman (1979) also argues that all forces of production, including technology, are determined by their own past evolution. This point can be

extended to the patterns of countries, which are technologically competent and which are labor competent.

2.1.5 Schumpeterian View and Evolutionary Theory

Schumpeter's own analysis of innovation as a microeconomic process, especially in its early form, owes much to Marx. In the *Schumpeterian view* on entrepreneurship (individual or organizational), innovation is regarded as an important source for competitive advantage, which is made possible by research and development (R&D) efforts. Both invention and innovation processes are characterized as non-routine decisions with different degrees of uncertainty associated with the different types of product and process innovation (Sheehan, 1999).

The *evolutionary theory* of economic change attempts to provide a formal theory of economic activity, driven by industrial innovation (consistent with the Schumpeterian view). It seeks to understand technical change, its sources and its impacts at micro and macro levels (Nelson and Winter, 1982). Evolutionary theory consists of heterogeneous modeling efforts which emphasize various aspects of economic change, such as the responses to market conditions of firms and industries, economic growth and competition through innovation.

2.1.6 Structuralist-Evolutionary Approach

Lipsey (2000) criticizes the models of growth that use aggregate production functions whether in the neoclassical tradition or the new growth tradition, offer only limited assistance in understanding long term economic growth. This growth is largely driven by technological change, which is an endogenous, path dependent process, heavily influenced by the institutional structure in which it occurs.

Lipsey (2000) defines the *structuralist evolutionary* as evolutionary in that Lipsey deal with the evolution of the economy when technology is changing endogenously and they are structural in the sense that they specifically analyze many of the economic structures that neoclassical theory keeps in black boxes. However, unlike neoclassical economics, there is no agreed canonical model of structuralist-evolutionary theory that captures its essence. In its models, equilibrium may be multiple, unique, or non-existent, depending on the circumstances. The economies that are modeled often display scale and network economies and self-reinforcing positive feedback loops.

In short, *structuralist-evolutionary perspective* assumes that innovation is determined by organizational characteristics such as centralization, complexity, formalization, size, strategy and goals. Central to this perspective is the notion of determinism, where organizational behavior is shaped by external constraints on

actors. The structuralist perspective is criticized for the way; it assumes that organizational features are objective realities (Slappendel, 1996: 114).

2.2 Major Growth Models

In the literature, generally economists emphasize upon the beneficial contributions of export performance to growth (Plümper, 2001; Vohra 2001; Hatemi, 2000; Corden, 1971). Meanwhile, understanding the evolution of macroeconomic growth theory (and understanding the determinants of growth) is also important in understanding the determinants of international competitiveness, since the determinants of growth is also affecting the determinants of export performance. The growth and export performance feed back each other due to their common determinants. As emphasized by Corden (1965), Pomponio (1996) and Ledesma (2000) etc., trade affects growth and this growth then has repercussions on trade due to the complex interrelationship between them.

For instance, technology is playing an important role in determining the growth and export performance. To understand the effects of technology and skills on export performance, it is important to understand the factors of production by looking at the major growth models. The secret and the evolution of export performance have been hidden in the major growth models.

There have been three waves in the evolution of macroeconomic growth theory in the past half-century. The first was stimulated by the work of Harrod

(1939) and Domar (1946). The second wave began in the 1950s with the development by Solow (1956, 1957) of a neoclassical model of economic growth. The third wave was initiated firstly by the criticisms of Arrow's learning by doing models and these criticisms followed by Romer, Lucas and other academicians in the mid-1980s.

2.2.1 The Keynesian (Harrod-Domar) Growth Model

In the Harrod-Domar model instability in economic growth is the result of failure to save. According to this model, a developing country can achieve higher growth rates than a developed country since marginal productivity of capital and profitability is much higher. Ruttan (2001) summarized this model as: "s/v=m+n" where s is the saving rate, v is the capital requirement per labor, m is the rate of labor saving technical change and n is growth rate of labor force.

Thus, Harrod-Domar model is "under what circumstances an economy could achieve steady state growth". In Harrod Domar model, the transition from slow to rapid growth can only be achieved by increasing the rate of saving and investment. This also implies that the lower the capital per labor, the higher the marginal productivity ($MPP_K > MPP_L$). However, Harrod-Domar model ignores the effects of technology on productivity and its main assumption is that technology is an exogenous factor.

2.2.2 The Neoclassical Growth Model

John Stuart Mill proposed that wealth was created by the exploitation of capital, labor and land; and it was Cobb and Douglas who based their mathematics on a formula of Euler's, generated an equation that confirmed that an economy's performance could indeed be modeled by the appropriate handling of those three factors of production modulated by profits (the return on capital), wages (the income of labor) and agricultural rents (the return on land) (Romer, 1994).

Afterwards, the neoclassical model was employed in a study by Solow (1957) in which labor and capital production function was used in accounting for growth in the U.S. economy. The interesting result for Solow (1957) was 51 percent of the growth in U.S. output per worker over the 1909-1949 periods was accounted for by the changes in the technology coefficient. Because the something else (or error term) could not be directly measured, Solow called it the residual. The same results also found by Meade (1961) (Romer, 1994).

The Swan-Solow growth model substitutes a variable capital-output ratio for the fixed coefficient capital output ratio in the Harrod Domar model. The model has a constant returns to scale aggregate production function that permits substitution between capital and labor. It is assumed that a constant fraction of output is invested. In this model, K=s.F(K,L), where K is the aggregated capital stock, s is the savings rate, L is the labour force and F (.) is the constant returns to scale production function (Helpman, 1991).

The main assumptions of neoclassical model are that the labor force does not grow; capital does not depreciate; and the state of technology does not change over time. Under these assumptions, capital accumulation equals to saving.

2.2.3 The Endogenous Growth Model

The inconsistencies of the neoclassical model are the lack of evidence of convergence toward steady state growth and the differences in income growth rates and income levels between developed and developing countries. These inconsistencies are motivated by the new literature on endogenous growth, which is driven primarily by the accumulation of knowledge. The initial models abandoned the neoclassical assumptions of perfect competition and increasing returns to capital. Following Arrow's analysis of learning-by-doing (1962), some growth theorists have linked the state of technology to cumulative investment experience (Helpman; 1991: 7-8). Also, in Lucas' analysis (1988) human capital serves as the engine of growth. In his learning by doing model, the growth of human capital is a positive function of the effort devoted to the production of new goods (Ruttan; 2001: 27).

These initial models are frequently referred to as AK models after the assumed production function AK where K can be thought as a proxy for a composite capital good that includes physical and human components. In this model, $Y=K^{1-\alpha}(AL_Y)^{\alpha}$, where, Y is output, A is productivity ($A=\delta L_A$), knowledge (includes learning by doing), ideas, or designs, etc. and K is capital (Ruttan, 2001).

δ parameterizes the efficiency of research and development (R&D) expenditures. Labor is used in two activities, the production of output (L_Y) and the search for innovations (L_A) so that $L_{Y+} L_{A=}L$. According to this model doubling the stock of knowledge as well would lead to more than doubling of output.

For instance, in Romer (1994), according to the analysis of cross country data, Greg Mankiw, David Romer, and David Weil (1992) found that the differences in income and growth level between countries could be solved by only extending the usual two-factor model by allowing for human capital H which is also associated with learning by doing as well as physical capital K.

Such studies show that using and producing ideas, human capital, accumulation of knowledge and learning by doing are ignored in these neoclassical models. In response to the various failures of the neoclassical model, Romer, Lucas, Arrow, Jones, and other academicians have developed models in which steady state growth generated endogenously.

According to the "new" endogenous models on growth, economics are basically associated with the accumulation of knowledge and, hence, of 'human capital'. This process is associated with learning by doing, but it also involves a conscious effort to educate and to gain knowledge. The development of endogenous economic growth models in which the accumulation of knowledge (human capital) plays the leading role is gaining importance in the expansion of economic activity in the aggregate.

The problem with Solow's residual was that it apparently came out of nowhere. Technology is exogenous. Arrow (1962) tried to solve this problem and endogenize the new technology. He tried to show that the acquisition of knowledge is possible in a dynamic context, which is produced by investments. These investments consist in using new capital goods capable of generating fresh experiences.

In Arrow's spillover model (1962), learning is central to knowledge-based development. Learning is the product of experience. It is through learning that innovation capabilities of firm and social capabilities to adapt to change get improved. Simply, in Arrow's model "learning by doing" is the effect of improving productivity (or reducing cost) by repetition of the production process (Leiby, et. al. 1997).

Theoretically, output for firm j can be written as $Y_j=A(K)F(K_j,L_j)$, where K denotes the aggregate stock of capital. Simply, his model emphasizes that if the size of the population is held constant, growth eventually comes to a halt. He emphasizes that the engine of growth is learning-by-doing in the capital goods industry (Jovanovic, 1995).

Arrow (1962) assumed that A, the technical augmentation factor, might thus written look specific to the firm, but it is in fact related to total "knowledge" in the economy. This knowledge and experience, Arrow (1962) argued, is common to all firms: a free and public good (i.e. non-competitive consumption).

Arrow (1962) argued that accumulation of knowledge arises from past cumulative investment of all firms (G). Thus, Arrow assumed that the technical augmentation factor is related to economy-wide aggregate capital in a process of "*learning-by-doing*"**.** In other words, the experience of the particular firm is related to the stock of total capital in the economy, G, by the function: $A=G^{z}$

Thus, as the physical capital stock G accumulates, knowledge used by a particular firm also accumulates by a proportion z such that $Y = G^{z}K^{a}L^{1-a}$

In sum, in Arrow's learning by doing model, learning by doing led to knowledge creation, which creates productivity and decreasing costs. This productivity growth is correspondent to the rate of growth. In other words, learning by doing allowed Arrow to endogenize technological development and economic growth: knowledge was produced as capital accumulated, production being a positive function of the capital stock. The larger the capital stock, the more could be produced, and thus the more that would be discovered in a learning by doing matter. After the learning by doing model, the knowledge creation became an important concern in the 1970s.

Spencer (1981) primarily concerned with learning as an entry barrier. Spencer (1981) argues that the firm should produce to the point where current marginal cost exceeds revenue, because a unit of current production reduces future production costs by moving the firm down the learning curve. Also, (Leiby, et. al.,

1997) finds that speed of learning primarily effects latecomers' effectiveness with an early entrant.

In Lucas' model[4], there is a very similar underlying structure. His contribution (1988) is in terms of human capital rather than knowledge (Steedman, 2001). According to Lucas (1988), workers have different skills. Their productivity depends on their skills. Lucas (1988) has used the term human capital to indicate the general skill level of a worker, or worker's qualification. A worker whose skill is twice as much as of another worker, then that worker has a twice as high as the productivity of the other.

This model simply implies that investments in human capital rather than spillover effects of physical capital output that increase the level of technology and the qualification of the labor (Lombardini, 1996). In Lucas model (1988), output for firm j can be written as $Y_j=A(H)F(K_j,H)$, where K denotes capital stock of firm j, A denotes the level of technology, H denotes human capital and F denotes the factors of production. In Romer (1986), stock of results from expenditure on research and development by firm is replaced to human capital in the formulization of the level of technology. Simply, Romer (1986) and Lucas (1988), the level of growth rate is dependent to the rate of accumulation of knowledge. The learning technology gains importance at this point of time.

[4] $ds(t)/dt=\delta a(t)s(t)$, where s is a worker's knowledge, and a is the fraction of the worker's time spent learning. This formulation can be termed "learning or doing", because only a fraction 1-a of time can be devoted to the production.

In fact, research is generally associated with the accumulation in human capital and leads to innovation (Lombardini, 1996). Schools (particularly universities) produce both research and manpower qualifications for the uses of a firm to implement successful R&D programs: Research will be more effective, if the technicians of the firm are better qualified.

Simply, the more people research, the more chance to get valuable discoveries. However, due to scarcity of human capital, and the gap between education and industry in less developed countries, learning by doing process could not increase the productivity growth. The reasons behind the misachievement of increasing technological capacity are the lack of understanding the learning by doing process. Thus, without a human capital accumulation, the technological capacity would not increase.

World Development Report (1988) illustrates that primary education and, literacy rates could be higher for developed and developing countries. However, tertiary education is far from widespread. These results could help us to understand the differences in productivity growth between countries. Human capital stock changes from country to country due to tertiary education as well as learning by doing process.

In this report, the national economies, which are lacking accumulation of knowledge and, hence, of 'human capital', have lower productivity growth. The

lower productivity growth of developing countries is associated with learning by doing, but it also involves a conscious effort to educate and to gain knowledge.

The report also points out that the national economies, which have higher university education level, have a luxury to research. The engine of growth could work only by the capability of research and development. The main requirement here is an educated army who could use learning technology.

Romer (1986) took the Arrow's idea of disembodied knowledge in his model and concluded that there indeed could be constant returns. Romer (1986) claims that the growth rate of capital is equal to the growth rate of per capita consumption. For example, there is a constant positive growth in per capita consumption and capital. The reason is the externality[5], from learning-by-doing, that gives a positive growth rate for consumption and output.

In Jones (1995)[6], and Romer (1990), the engine is research. The output of research is designs, which is associated with learning by doing. In equilibrium, per capita income grows at the same rate as the aggregate number of designs, S" (Jovanovic, 1995). Jones (1995) further points out that the U.S. growth rate has not risen over the last century despite increases in some variables (e.g. investment share, R&D share).

[5] "Romer says it may cost people nothing to access an idea, they may yet be excluded from it. Ideas possess this second characteristic of excludability. This allows ideas to command a price and a discoverer can choose to sell exclusive legal rights to an idea to a firm" (Al Ubaydli and Kealey; 2000).

[6] Jones sets out the equations $Y=K^{1-\alpha}(Al_y)^{\alpha}$ and $\mathring{A}/A=\delta L_A$ where A is productivity of growth (Steedman; 2001).

Romer (1990) and Jones (1995) assume that the research process is such that the creation of new designs by an individual is proportional to (1-nt)At, where At is the total number of designs and (1-nt) is the fraction of labor time devoted the production of designs not the person-value. Thus, Romer (1990) assumes that designs are non-rival in the research process, and the entire stock of design knowledge accumulated to date enhances each researcher. Thus never ending growth is generated via endogenously rationalized, never ending accumulation of knowledge.

2.3 Conclusion

In the *neoclassical general equilibrium* model of international trade, it is assume that countries trade with each other because of their differences. Countries may differ in their preferences, their technologies, or their factor supplies, and these differences jointly determine comparative advantage and hence trade. On the other hand, it is widely accepted that the assumptions of the standard neoclassical model are not conducive to the analysis of R&D, innovation, skills and the creation of new goods as endogenous processes within the economic system. As a result, the new approaches are developed, such as ‘ new trade theory’, ‘marxist’, ‘evolutionary’, ‘evolutionary-structuralist’, and ‘neo-technology or technology gap’. In their mainstream, technological asymmetries are important in determining the trade flows in the long run.

Meanwhile, understanding the evolution of macroeconomic growth theory and the determinants of growth would also help us to understand the determinants of export performance, since the determinants of growth is also affecting the determinants of export performance and they have generally common determinants. The export performance (or international competitiveness) affects growth and realized growth has repercussion effects on trade due to their common determinants. In the first (Harrod, 1939 and Domar, 1946) and second wave (Solow, 1956 and 1957), the technology is accepted as an exogenous factor. However, in the third wave, which was initiated firstly by the criticisms of Arrow's learning by doing models and followed by Romer, Lucas and other academicians began to give importance to technology, and try to endogenize it.

CHAPTER 3

R&D, INNOVATION AND INTERNATIONAL COMPETITIVENESS: SOME EMPIRICAL FOUNDATIONS

In this chapter, firstly, the thesis points out the effects of R&D expenditures on growth and export performance to make a connection with R&D expenditures, export performance and major growth theories. Secondly, the thesis emphasizes on the role of R&D on innovation, since the R&D expenditures will be used as a proxy to understand the effects of technology on export performance. Thirdly, the thesis describes the major determinants, which are used in the literature to measure the international competitiveness.

3.1 Is R&D Expenditures Stimulating Growth and International Competitiveness?

Nadiri (1979) estimates the contribution R&D to growth of output in US manufacturing industries. The important issues addressed are: whether the slower growth of R&D expenditures in 1970s has been the cause of slowdown in the growth of productivity, and what the factors are in explaining the slower growth of R&D expenditures. He formulated a production function and estimated by using

time series and cross-section data for the manufacturing industries. Moreover, formulating a dynamic model of demand for R&D activity identifies the factors determining the rate of growth of R&D expenditures in the 1958-1975 periods.

As a result, Nadiri (1979) finds that the stock of R&D, as a measure of stock of knowledge, positively and strongly affect growth of output in total manufacturing, total durable, and total non-durable industries. Potential growth of output is affected because of the slowdown of growth of stock of R&D since 1966, but the gross rates of return on stock of R&D have not changed much in the 1966-1975 periods. Growth of output, changes in relative prices, cyclical fluctuations of the economy, as well as changes in level of employment and capital stocks are the factors affecting R&D expenditures.

The affect of government financing of R&D expenditures on private decisions regarding R&D expenditures differs among different industries. Nadiri (1979) adds that the results on government financing of R&D expenditures on private decisions regarding R&D expenditures are basically inconclusive and require further information.

Evangelista et al (1998) recognize the different elements of innovation and innovation processes and use evidence from a large-scale survey of European enterprises to show that 50 per cent of the total innovation expenditure is embodied in plant, machinery and equipment purchased by firms. The internal technological expenditures devoted to R&D, design and trial production are 20 per

cent, 10 per cent and 11 per cent respectively of the total innovation expenditure with the rest devoted to acquiring technology through patents and licenses.

Segerström (1998) presents a model of R&D-driven growth without scale effects where firms can engage in horizontal and vertical R&D activities[7]. His study covers five advanced countries: United States, France, Japan, Sweden, and United Kingdom. He found that, a permanent increase in the R&D subsidy rate decreases the long-run rate of economic growth.

Elmslie and Vieira (1999) use either the number of patents and R&D expenditures as a proxy for technology to capture the impact of technology on trade flows between countries. However, they also accept that there are some problems in the use of these data in their study.

Ledesma (2000) tested that whether trading partners' R&D expenditures has a positive effect on domestic exports through trade-related international R&D spillovers for advanced OECD countries. Ledesma (2000) finds support for the hypothesis that R&D spillovers increase competitiveness of the trading partners and continues that this has important implications for recent theories of growth that emphasize the role of international trade as the main factor promoting technology diffusion and growth. Moreover, this paper points out that, since R&D spillovers are shown to be an important determinant of exports this has interesting

[7] Firms engage in vertical R&D to improve the quality of existing products and firms engage in horizontal R&D to increase the number of industries in the economy (create entirely new products)

implications for growth modeling. This is because the link between trade and growth may well not stop at the first generation effect from trade to growth.

Morales (2001) studies the effects of different types of research policy (government financing) on economic growth. Morales (2001) finds that while tax incentives provided by Spanish governments to private research, public funding of private projects, and basic research performed at public institutions have unambiguously positive effects on economic growth, performing applied research at public institutions could have negative growth effects. This is due to the large crowding out of private research caused by public R&D when it competes with private firms in the "patent race". Concerning the effects of these policies on welfare, it is found that research policy can either improve or reduce consumer welfare depending on the characteristics of the policy and that an excessively high research subsidy will reduce it.

Zachariadis (2001) uses aggregate and industry-level data for a group of OECD countries (Japan, Canada, US, Germany, France) for the period 1973 to 1991 to estimate a system implied by a model of R&D-induced growth that relates R&D intensity, productivity, and output growth. He finds evidence of positive long-run impact of R&D intensity on productivity and, ultimately, on the growth rate of output. The null hypothesis that R&D does not induce growth is therefore rejected for this group of OECD countries.

Griffith et al. (2001) has produced econometric evidence on the importance of the "two faces of R&D" by examining the determinants of productivity growth in a panel of industries across twelve OECD countries. R&D stimulates growth directly through innovation and also indirectly through technology transfer. Thus, R&D has played a role in the convergence of "total factor productivity" (TFP) levels within industries across OECD countries. Griffith et al (2001) also identified a role for human capital in stimulating innovation and absorptive capacity. By contrast, trade had a statistically weak effect on productivity. The R&D and human capital effects were shown to be quantitatively important as well as statistically significant.

An implication of the results of Griffith et al. (2001) is that the social returns to investing in R&D and human capital are underestimated in studies, which focus solely on the U.S. economy, since the U.S. is the technological frontier for a large number of industries. There is also an important spillover at the world level from frontier to non-frontier countries. As a result of technology transfer, an increase in frontier R&D not only raises the steady-state rate of TFP growth in the frontier, but also raises steady-state TFP growth in non-frontier countries. One important question is why non-frontier countries do not invest more in R&D since the social return is higher than in the frontier? As the incentive to invest in R&D is determined by the private return and not the social return, it may be the case that R&D is held back in many non-frontier countries by under-development of financial markets or inappropriate government policies. A future research agenda should be to investigate these issues, through using firm-level data

across a number of countries to estimate private and social rates of return in a framework, which allows for the two faces of R&D expenditures.

Dietzenbacher and Los (2002) recognized innovation and R&D effort as a major source of economic growth. R&D investments explicitly aim at generating innovations and creating knowledge. Since knowledge has certain public good properties, positive externalities are likely to exist. In their paper, they indicate that commodities stimuli should be targeted to enhance R&D and its positive externalities in the economy as a whole. Furthermore, they argue that there may also be negative externalities of R&D, due to increased prices. Both externalities are applied to the United States, 1977-90.

3.2 Role of R&D in Innovation

It is widely accepted that growth, technological change and innovation have long been associated. R&D expenditures of significantly contributes to innovations, at the same time R&D results have decisive influence on the performance of the certain fields of the economy as well. Therefore, it was very important to study the role of R&D activities in innovation.

For instance, according to Lindegaard's propeller model (1997), sub-layer of energy and materials flows between the suppliers, business organizations and customers is in focus together with the external nuisances and diseconomies for a range of actors. These range of actors are external to the market interaction of the

product chain and typically finds their primary articulation among the group of public sphere movements. Furthermore, they diffuse into regulatory authorities as well as market customers in much the same way as preferences regarding health and safety do. Then, the preferences turn into formal regulations in interaction with the public and private science and technology communities. The various regulatory approaches and selection pressures can in the environmental field give an important lead to the performance of firms as in the general case of innovation and technical change. Development processes can be understood as complex processes of matches and mismatches in the symmetrical co-evolution of knowledge, values, organizations, resources and technologies (Lindegaard, 1997).

Simply, much effort has been devoted, within the literature on innovation, to developing models of the innovation process. In early and latest discussions of innovation and science and technology policy, R&D expenditures are the basis for such analysis. Rothwell (1992) summarizes the innovation process in five models:

Linear (technology push) model: The market is merely a receptacle for the output of R&D (Kline and Rosenberg (1986).

Research ⟶ Development ⟶ Production ⟶ Marketing

Market-pull: It is also a simple linear sequential process but with emphasis on marketing. The market is the source of ideas for directing R&D. R&D has a reactive role.

Chain-link model: It is sequential but with feed back loops. There are push or pull or push/pull combinations. Also, R&D and marketing are both more in balance. This model emphasizes on integration at the R&D/marketing interface.

Integrated model: Parallel development with integrated development teams. It emphasizes on strong input supplier and customer linkages. Also, it gives emphasis on integration between R&D and manufacturing and marketing. In this model, there is horizontal collaboration (joint ventures etc).

Systems integration and networking model: Fully integrated parallel development. Expert systems and simulation modeling in R&D are used. There are strong linkages with leading edge customers ('customer focus' at the forefront of strategy). Strategic integration with primary suppliers including co-development of new products and linked information and design systems (Horizontal linkages, joint ventures, collaborative research groupings, collaborative marketing arrangements, etc.) This model emphasizes corporate flexibility and speed of development (time-based strategy-kaizen). Quality and other non-price factors are focused.

Tödtling and Kaufman (1999) acknowledge the studies of Kline and Rosenberg (1986) and Rothwell (1992), and observe that the understanding of innovation has changed considerably in the past years. The models shifted from linear and firm-based conceptions towards interdependent and systemic approaches. Their study investigates on the basis of data for several European

regions, collected in a European project (REGIS), to which extent companies engage in networks in their innovation process. In their study, they find that innovation is still rather an internal process for many firms. Furthermore, they add that a high share of technologically advanced quality producers is relying strongly on R&D and the knowledge of their work force. However, networks are not still relevant for many of these firms.

Fischer (2000) tries to provide greater understanding of the systems of innovation approach in parallel with Rothwall (1992). Fischer (2000) argues that three types of innovation analysis can be performed. The first type of analysis is at the micro-level of the system covering internal capabilities of the firm. The second type of analysis refers to the meso-level of the system focusing on specific sub-systems, attempting to map knowledge and interactions between and within subsystems. The main concern at the meso-level is the flow of knowledge. The third type of analysis refers to the macro-level of the system and involves macro-indicators, such as R&D personnel ratios, R&D expenditure intensity rates, innovation rates, patent intensity rates, networking indicators.

Radnor and Robinson (2000) visit eight organizations (supermarket retailer, pharmaceutical company, healthcare company, IT company hardware, flavorists, research commercialization of a major UK university, Biotechnology research and consumer goods company) and collect data through a mini-case study approach. The results of their survey conclude that innovation is complex and multi-dimensional in its approach. Besides, R&D still has an important role in

innovation process of these eight organizations, when they look at their innovation features.

3.3 The Determinants of International Competitiveness

There is little doubt that exports are an important factor in explaining the long-run growth performance of countries and regions. Frankel and Romer (1999), World Bank Report named as Globalization, Growth and Poverty (2002) and Marin (1992) has found support for this hypothesis. That's why there have been numerous studies published in the past 30 years on the determinants of export performance (see Zou and Stan, 1998; Lohrmann, 2000; Dijk, 2002; Roper and Love, 2001; Funke and Ruhwedel, 2001; etc.). However, in these studies the knowledge of the determinants of export performance is still characterized by a fragmented collection of confusing findings. A major reason for the lack of clear conclusions regarding the determinants of export performance, inspite of the large volume of published studies, is the lack of synthesis and assimilation of the fragmented knowledge.

One of the important studies in this literature was of the Gruber et.al. in 1967. According to them, all roads lead to a link between export performance and R&D expenditures. They provide an evidence which relates research effort by US industry to US trade performance in 1962. There is a positive correlation between the "research effort" measures (total R&D expenditures as percentage of sales (R_1) and scientists and engineers in R&D as a percentage of total employment (R_2)) and

export performance (Exports as a percentage of sales (E_1) and excess of exports over imports as percentage of sales (E_2)). The interesting result was the five industries with greatest "research effort" are also the five industries with the most favorable trade position.

Gruber et. al (1967) also examine that the five industries with the strongest research effort accounted for 72 percent of the US exports of manufactured goods, though they were responsible for only 39.1 percent of the US total sales of such goods. These five industries were also responsible for 89,4 percent of the R&D expenditures of US and 74,6 percent of the company financed R&D expenditures. In short, these five industries represent the heart of US export strength in manufactured products and the heart of industrial research effort.

Parry (1974) followed the studies of Gruber et al. (1967). He investigated the relationship between book value of direct investment and total R&D expenditures and value of exports. He found that, in the U.K. manufacturing industries, there is a clear link between both export performance and international investment activity of industries and the "R&D intensity" of those industries, as in the four most research intensive US industries.

The financial constraints that the developing countries face in the research and development expenditures and funding exports with lower costs should also be investigated to understand the export performance. Myers (1977) defines the value of a firm as the sum of the value of its assets-in-place and the value of its growth

opportunities. The export growth opportunities reflect the value of future investments that owner-managers can undertake or not. Since R&D expenditures induce significant growth opportunities because they are expected to generate investment options, firms characterized by significant R&D expenditures should exhibit low leverage levels and high proportions of short term-debt.

Nelson and Winter (1982) also argue that technological effort can be a vital determinant of competitive advantage. They consider three basic mechanisms, namely *mechanisms of transmission* (in terms of routine behavior); *search* (in terms of search for new routines or technologies); and *selection* (in terms of market selection or 'Schumpetarian competition'). Thus, an evolutionary interpretation is that firms of countries competes (the selection mechanism) in a struggle for market shares, where they learn (the mechanism of search) and gain or loose depending on their relative (technological) competitiveness (or 'fitness'). In addition, what firms (and countries) can do in period *t* is dependent on what have been done in period *t-1* (the mechanism of transmission).

Kazgan (1988) argues that increases in capacity utilization rate of manufacturing sector has a positive effect on international competitiveness of a country, which opens its economy and decrease trade barriers. Such an economy can increase its capacity utilization rate by growing with increasing exports. This growth helps the economy to use the scale economy and decrease the unit costs. However, an economy that reaches 80 percent of its capacity utilization rate could

not receive any increase in its international competitiveness (Kazgan 1988: pp. 393-394).

Magas (1992) uses a Vector Auto-Regressive (VAR) model to understand the dynamics of export competition in high-technology trade between USA, Germany and Japan with three-digit SITC high-technology commodity groups. From the forecast error decomposition of the VAR model, three important results have emerged. First, in many commodity groups examined, the forecast error of the market share variable can be improved if the innovation variables (relative prices, market share, R&D efforts, and effective exchange rates) are accounted for. Second, price or output setting behavior is not a priori identifiable and, if so, it is very industry-specific. For some industries (e.g. telecommunication equipment), relative prices appeared exogenous; for others market shares (aircraft) did. Third, competitiveness in high-technology exports does not necessarily have to mean price competitiveness unless economies of scale and factor prices become dominant elements of pricing.

Kumar and Siddarthan (1993) in their study on the Indian enterprises about technology, firm size and export behavior find that in developing countries like India, a firm's technological activity favorably influences its export behavior only in medium and low technology industries. In high technology industries, they find that Indian firms are unable to enter the export markets. Also, the firm-size-export behavior has a positive relationship, but it is found to be inverted U-shape. Multi-national enterprises tend to focus on the domestic market. Furthermore,

government policy measures for encouraging Indian enterprises to export have had varying levels of success. Another implication of their study is the measure of capital intensity suggests that while a higher degree of capital intensity of operations does not give a competitive advantage to exporting firms in low and medium technology industries, it is desirable for high technology industries. However, advertising intensity have favor on exports only in some of the industries.

Pomponio (1996) shows weak evidence supporting the hypothesis that manufactured exports lead to output growth by the bivariate causality tests. Pomponio (1996) performed these tests for 65 countries. According to the tests, when the investment factor is included in the trivariate causality tests, there is mixed evidence in supporting the hypothesis that manufactured exports and investment together cause the growth of industrial output. It is also found that rather mixed evidence supporting the other two hypotheses: one is that manufactured exports and output together cause the growth of investment, while the other states that investment and manufactured output together cause the growth of manufactured exports.

Clark and Guy (1997) investigate the competitiveness at micro-level for the manufacturing plants of European Community, USA and Japan. In their study, competitiveness refers to the ability of a firm to increase in size, market share and profitability. In traditional economic theory, comparative costs of production determine relative competitiveness at firm level - the way to become more

competitive is to produce more cheaply, for example by finding ways to reduce labor costs.

Moreover, according to Clark and Guy (1997), the range of non-price factors is diverse. They include **human resource endowments** (such as skills and worker motivation), **technical factors** (such as R&D capabilities, and the ability to adapt and use technologies), and **managerial and organizational factors**, both internal to the firm and external relationships with other bodies: customers, suppliers, public and private research institutes, and other firms.

Departing from Clark and Guy's (1997) perspective, Gustavsson et al (1996) argue that knowledge capital stocks are obtained by cumulating R&D expenditure for 13 OECD countries[8]. Results show that international competitiveness is determined not only by the R&D activity of the representative firm, but also by the size of the domestic industry as well as economy wide stocks of knowledge, indicating the presence of local externalities. Gustavsson et al. (1996) also shows that technology has a significant effect on international competitiveness.

Also Dalum et al. (1996) finds that international trade specialization in the OECD countries has decreased slightly in the near 30-year period 1965-92. Dalum expresses that the tentative explanations among the patents do only represent potential economic assets - not necessarily realized assets. Patenting activity of the

[8] OECD countries include 13 countries, which are Australia, Canada, Denmark, Finland, France, Germany, Italy, Japan, The Netherlands, Norway, Sweden, United Kingdom and United States.

large multinationals is still heavily concentrated in their perceived home countries. But production and hence exports may very well be more 'foot-loose' and less nationally embedded than the capability to develop new patents. The internationalization of production may thus have taken place at a higher speed than the internationalization of the capability of developing new technology.

Dalum et al. (1996) also observes strong differences and little change of national export specialization patterns over time for OECD countries. Furthermore, Lindegard (1997) improves these results for Central American countries (Costa Rica, El Salvador, Guatemala, Honduras and Nicaragua). Lindegaard (1997) observes the diversity in the patterns of national competitiveness of these Central American countries and specialization among these countries. Lindegaard (1997) explained this little change by the cost of innovation. Innovation is costly, since learning to use new technology absorbs time and effort.

Landesmann and Pfaffermayr (1997) estimate a demand system for OECD exports differentiated by country of origin for two ISIC industries (non-electrical machinery, electrical machinery) and for total manufacturing exports. They found that R&D effort affect competitiveness in principle via two channels: through movements in the quality spectrum of the products supplied and through cost competitiveness. One of the interesting points from their study is that `effectiveness' of R&D effort can differ much across different economies. It is also estimated that a country's position in an international catching-up process may be partly responsible for such differences as well as labor market dynamics which

link labor unit cost, wage rate, stock of knowledge and productivity and quality-improvements.

Carlin et al. (1997) analyses the impact of cost competitiveness and technology on export performance using a very rich panel dataset of 12 manufacturing industries in 14 OECD countries for the period between 1970 and 1992. Consistent with standard models, they find that changes in relative unit labor costs are a robust determinant of changes in export market shares. Despite this, they claim that the trends in national export performance cannot be fully explained by relative costs. Non-price factors are also important in explaining the trends of the export performance. To explain this, they allow for heterogeneity in the effect of relative costs in different industries, different countries and different time periods. They found that labor cost changes are less important in high technology industries, in periods of high demand and in countries within the European Monetary System.

Zou and Stan (1998) group the measures of export performance in seven categories, representing financial, non-financial and composite scales. The *sales category* includes measures of the absolute volume of export sales or the export intensity. The *profit category* consists of absolute measures of overall export profitability and relative measures such as export profit divided by total profit or by domestic market profit. While the *sales* and *profit* measures are static, the *growth* measures refer to changes in export sales or profits over a period of time. Compared to financial measures, which are more objective, the non-financial

measures of export performance are more subjective. The *success* category comprises measures such as the managers' belief that export contributes to a firm's overall profitability and reputation; *satisfaction* refers to the managers' overall satisfaction with the company's export performance; and *goal achievement* refers to the managers' assessment of performance compared to objectives. Finally, *composite scales* refer to measures that are based on overall scores of a variety of performance measures. Export sales, profits, and composite scales are probably the most frequently used measures of export performance, despite recent recommendations for using more perceptual measures of overall export success or success in achieving organizational goals (e.g. Cavusgil and Zou, 1994).

Mccombie and Thirlwall (1999) emphasizes that, in their demand-oriented approach, long run output growth in the open economy will be shown to be fundamentally determined export growth. In this view of growth performance, 'supply-siders' and 'demand-siders' united. Demand, determined by export performance and the balance of payments' position, governs output growth; but supply factors such as investment in new technology, research and development effort, education and training in skills determine the income elasticity of the demand for exports, and therefore how fast a country's exports grow as world demand grows.

On the other hand, R&D expenditures and competition have also stressed that problems of asymmetric information impose higher costs of finance in external financing (Klette and Grilliches, 1999). Moreover, R&D expenditures are

difficult to evaluate and monitor and accepted as high-risk investments. These are the reasons why the firms involved in R&D intensive activities should prefer equity financing to debt financing (Bah & Dumontier, 2001). Also, equity financing culture and availability (or the depth of stock markets) becomes important for the firms, which tries to increase their international competitiveness by R&D expenditures.

Lall (2000b) categorizes the manufactured export patterns of developing countries using a new and detailed classification by technological levels. It argues that export structures (an indicator of their quality), being path-dependent and difficult to change, have important implications for growth and development. Low-technology products (which have the least beneficial learning and spillover effects) tend to grow the slowest, and technology-intensive products (which have the most beneficial effects) the fastest in world trade. Also, Lall (2000b) argues that the technological specialization of different regions and the leading exporters differ greatly due to the strategies (autonomous, strategic foreign direct investment (FDI) dependent, passive FDI dependent, import substitute industrialization restructuring) used to achieve competitiveness.

Baldauf et. al (2000) define export performance as a firm's outcomes achieved in international sales and analyze the effects of multiple determinants of on different export performance measures in small open economies (Austria, Denmark, Netherlands, Belgium). They proposed predictors of export performance as *environment* (socio-cultural, political), *firm characteristics* (demographics,

management motives) and *business strategies* (differentiation and low cost). These predictors can be structured as external and internal forces to the firm. Their findings reveal that in addition to firm size, the most promising predictors of export performance are management's motives to internationalize and the use of a different strategy.

After the breakdown of the Bretton Woods system in 1973, many developing countries moved away from single currency pegging to more flexible exchange rate regimes. Nilsson and Nilsson (2000) examine the net effects of developing countries' choice of exchange rate regime on their exports. They classified the different exchange rate regimes into six categories, ranging from single currency pegging to independently floating. They include exports of some 100 developing countries to the EU, Japan and USA between 1983 and 1992. Their results indicate that the more flexible the exchange rate regime, the greater the exports of developing countries, ceteris paribus. Their results are stable over time. The fact that the number of developing countries under the various exchange rate regimes (peg to US dollar, peg to currencies other than US dollar, peg to composite currencies, limited flexibility, more flexible regimes, independently floating) has fluctuated substantially over the 1983-1992 period implies that their results are quite robust.

Ledesma (2000) has attempted to analyze the impact of R&D on growth through improved competitiveness to estimate long-run export demand functions. Ledesma's results for advanced OECD countries are just aggregate magnitudes

and would require further consideration and analysis especially making use of sectoral data. The patterns arise from this study firstly is domestic R&D is a very important factor determining exports in advanced economies. The impact of domestic innovation is considerably higher in the technologically advanced countries. Secondly, although its impact is lower than that of domestic R&D, trading partners' R&D has a positive and significant impact on export performance, that is, countries importing more from technologically advanced countries or with a higher degree of openness seem to benefit from their stock of knowledge. Finally, this impact seems to be stronger in small economies and increasingly important in recent years.

Hatemi (2000) investigates that there is a co-integration and causal relationship between export growth and economic growth for the Nordic economies. On the basis of Johansen's technique and the augmented Granger causality tests, Hatemi (2000) shows that these macroeconomic aggregates are causally related in the long run for each economy. Granger causality is unidirectional, running from economic growth to export growth in Denmark, and bi-directional in Finland, Norway, and Sweden. The established bi-directional causality suggests that the expansion of exports is an integral part of the economic growth process.

Plümper and Graff (2001) seek to understand if a country's trade specialization pattern has an impact on its economic performance by collecting a sample of 90 countries with population higher than one million throughout the

period of 1980 and 1990 including Turkey. They introduce a simple endogenous growth model that shows how governments can stimulate economic growth by implementing policies that successfully create competitive advantages in favorable sectors. Using a standard augmented aggregate production function they run a series of growth regressions including technological change and a proxy for trade specialization. Their results indicate that trade specialization does indeed have an impact on economic performance. Moreover, estimations imply that an increase in the high-tech export–total trade ratio from 0.5 to 0.6 (which requires a 50-percent increase in exports if imports are held constant) would increase the growth rate of an average country at about 0.8 percent. However, they add that selecting appropriate industries is difficult for policymakers and the government.

Funke and Ruhwedel (2001) try to find an answer to the link between export varieties with export performance. They investigated whether increasing export varieties have contributed to the export growth of 10 East Asian countries to OECD markets. In the study, direct measures of export variety calculated and pooled annual export equations for these 10 countries estimated. The results suggest that producing highly differentiated export goods gives a competitive advantage that allows selling more products. The improvements in the horizontal and vertical variety of exports may be as important as price competitiveness.

The dramatic GDP and export growth of the Republic of Ireland over the last decade forms a marked contrast with that of its nearest neighbor Northern Ireland. In the Republic of Ireland, export volume growth averaged 15.5 per cent

pa from 1991-99 compared to 6.3 per cent from Northern Ireland. Roper and Love (2001) use data on individual manufacturing plants throughout Ireland. Their study considers the determinants of export performance for Irish manufacturing sector.

The first notable finding of Roper and Love (2001) is the strong positive effect on export propensity of the strength of plants' internal resource base. Plants with a high proportion of graduate employees had higher export propensity, as did plants with an in-house R&D capability. Both R&D conducted informally and a more structured R&D department contributes to increased export propensity, with more structured R&D activity having a larger positive effect. This positive result for R&D reflects that found in other studies in the technology-based tradition which also suggest a strong positive relationship between non-price quality and plants' export competitiveness. They also highlight small firms' and larger firms' export propensity are both positively influenced by formal and informal R&D expenditures. Secondly, plant size also proves important, and they observe the expected relationship between export propensity and employment. Moreover, other plant characteristics also are proved to be important in determining export propensity. External-ownership in particular has a strong positive effect. Interestingly, plants' location also proves an important determinant of export propensity in this study.

In an OECD Trade Committee Paper (2001), it is emphasized that, although the potential benefits of export-oriented FDI are widely acknowledged, this does not necessarily lend support for policies aimed at targeting and

promoting export-oriented FDI. One reason for this is that multinational enterprises tend to take an incremental approach to foreign markets, especially new ones, and that their commitment to these over time will be conditioned to a significant extent by observed performance. Policies that aim to attract export-oriented FDI risk either neglecting or even discouraging FDI that might initially be oriented towards the domestic market but become more export-oriented over time. Indeed, policies that focus on attracting export-oriented FDI, to the extent that these either neglect or even discourage non-export oriented FDI, might actually detract from export competitiveness in the medium and long term.

Lefebrve and Lefebrve (2001) also examine the empirical data from a longitudinal survey of 3032 manufacturing small and medium enterprises (either low-medium or high technology industries) operating in Canada, USA, European Union and other countries over a three-year period. Their study indicates that R&D expenditures and knowledge intensity are the major determinants of export performance and behavior for manufacturing SMSEs. Import activities, distribution access and size are other strongest important factors in their study. They argue that international competitiveness is indeed knowledge based.

In the Vienna Global Forum (2001) participants conclude and recommend that financing technology pose special challenges because of uncertainty of outcome and related asymmetry in information. Therefore, governments are called upon to provide financing to technology development in addition to supporting financial institutions, capital markets and the private sector.

The estimates of Dijk (2002) shows that R&D in Indonesian manufacturing industry only benefits exports in relatively mature industries categorized under supplier dominated and scale intensive firms. This finding confirms Kumar and Siddharthan (1993) for India. However, Dijk (2001) suspects that this relation is especially relevant in some industries where R&D is required to assimilate new technology. The predictions of Heckser-Ohlin theory and product life cycle theory that developing countries compete on labor costs in mature industries are also uphold. Capital intensity does not influence export behavior of scale intensive firms, as Dijk (2002) expected.

Enterprises from developing countries compete in international markets on the basis of price-cutting and focus on the lower end of the markets or sell to multinational buyer groups. This is because they have no resource to engage themselves in the non-price rivalry with multinational enterprises. Nevertheless, enterprises with advertising and promotion activity are likely to do better in international markets than others. Hence, a positive relationship is expected between advertisement intensity (ADS) and export behavior. Dijk (2002) found that advertising intensity of firms is exerting a favorable and statistically significant influence on their export behavior in five Indonesian industries: fabricated metal products, paper, transport equipment, rubber products and drugs and pharmaceutical. Only in the case of textile industry is ADS significant with a negative sign. The higher local demand market can explain this sign.

Mody and Yılmaz (2002) analyze the relationship between export competitiveness and investment in machinery, allowing for imperfect substitution between domestically produced and imported machinery. They found that from the early 1980s, with the opening of trade regimes, import-substituting developing economies which were unable to harness imported machinery to reduce costs early in the period, were able to benefit from the cost-reducing effect. The results of their study imply that innovative effort-based on imported technologies can be a precursor to the development of domestic innovation capabilities.

Mackay and Phillips (2002) examine how intra-industry variation in financial structure relates to industry factors for United States firms, such as capital intensity, financial leverage etc. and whether debt, technology and risk decisions are jointly determined within competitive industries. They show that industry factors help explaining firm's financial structure, the diversity of firms that populate industries, and the simultaneity of real and financial decisions. They conclude that although there is not a single optimal industry financial structure, departures from the mean industry financial structure are systematically related to technology and risk choices relative to the industry. When firms depart from industry norms for financial structure they also systematically depart along technology and risk dimensions.

3.4 Conclusion

As the theoretical part of the study argues innovation has an important role in the determination of the growth and international competitiveness. Since, the aim of the thesis is to understand the effects of R&D expenditures on international competitiveness, its role in innovation should be well understood. The studies of Rothwell (1992), Kline and Rosenberg (1986), Tödtling and Kaufman (1999), Radnor and Robinson (2000) and Fischer (2000) imply that R&D expenditures have a vital role in the innovation process and an important part of the systems of innovation.

Moreover, the studies by Nadiri (1979), Evangelista et. al (1998), Segerström (1998), Elmslie and Vieira (1999), Ledesma (2000), Morales (2001), Zachariadis (2001), Griffith et. al. (2001) in different countries covering different parts of the world confirm that R&D expenditures contributes to the growth and export performance, which shows that there is a connection with R&D expenditures, export performance and major growth theories.

In addition to these studies, as seen from Table 1, Gruber et al. (1967), Parry (1974), Magas (1992), Kumar and Siddarthan (1993), Lall (2000a), Taymaz and Özçelik (2001), Lefebrve and Lefebrve (2001), Roper and Love (2001), Dijk (2001) etc. confirm that *R&D expenditures and other technological efforts* contribute to the international competitiveness. In the literature, also the role of other variables on international competitiveness is discussed. For instance, Parry

(1974) adds that *book value of direct investments abroad* contributes to the international competitiveness. Myers (1977), Hall (1992), Klette et.al. (1999), Mackay and Phillips (2002) emphasize the role of *finance* on international competitiveness. *Exchange rate regimes and effective exchange rates* are accepted as an important contributor by Nilsson and Nilsson (2001) and Magas (1992). Furthermore, Kumar and Siddarthan (1993), Lall (2000), Dijk (2001), Roper and Love (2001) and OECD Trade Committee (2001) show the role of FDI. The role of *capital intensity, advertising and plant size* is emphasized by Kumar and Siddarthan (1993), Roper and Love (2001) and Dijk (2001). Trade specialization, investment in machinery, plants' location, degree of openness, demand, profit, sales, unit labor cost, market share, economic growth, environment, business strategies and growth in export sales, productivity and wage rate etc. are also used in the literature to understand the determinants of international competitiveness.

Table 1. Determinants of Export Performance

Gruber, Mehta and Vernon (1967)	Research effort, number of scientists and engineers
Gruber et al. (1967)	R&D expenditures
Parry (1974)	Book Value of Direct Invesments Abroad, R&D expenditures
Myers (1977)	Borrowing opportunities, low leverage levels, short-term debt
Nelson and Winter (1982)	Technological efforts (routine behaviour, search, and selection)
Kazgan (1988)	Capacity utilization rate, unit costs
Magas (1992)	Relative prices, market share, R&D efforts, effective exchange rates, economies of scale
Kumar & Siddarthan (1993)	R&D, skills, capital intensity, firm size, advertising and promotion, Multinational enterprise association, policy factors
Gustavsson et al. (1996)	R&D activity, economy wide stocks of knowledge, technology
Pompolio (1996)	Investment
Dalum et al. (1996)	Trade specialization
Carlin et al. (1997)	Relative unit labour cost, high demand
Clarke & Guy (1997)	Ability to increase in size, market share and profitability, reducing labor costs and non-price factors (human resource endowments, technical factors (R&D capabilities, ability to adapt and use technologies))
Lindegaard (1997)	Cost of innovation
Landesmann and Pfaffermayer (1997)	R&D effort, quality, cost competitiveness (wage rate, unit labor cost), stock of knowledge, productivity, quality-improvements
Zou and Stan (1998)	Profits, sales, growth in export sales, satisfaction, success, goal achievement, performance achievement
Mccombie and Thirlwall (1999)	Demand, investment in new technology, R&D effort, education and training
Klette et al. (1999)	Higher costs of finance
Lall (2000)	FDI, Private R&D expenditures, skills, technological specialization
Nilsson and Nilsson (2000)	Exchange rate regimes
Hatemi (2000)	Economic growth
Baldauf et al. (2000)	Environment (socio-cultural, political), firm characteristics (demographics, management motives), business strategies (differentiation and low cost), firm size
Ledesma (2000)	Domestic R&D expenditures, trading partners' R&D expenditures, degree of openness, stock of knowledge
Lefebrve and Lefebrve (2001)	R&D expenditures, knowledge intensity, import activities, distribution access, size
Dijk (2001)	Relative firm size, share of skilled labor, training, multinational enterpise association, unit labor cost, firm's age, market share, R&D expenditures, capital intensity, advertising, promotion activity, local demand
Roper & Love (2001)	Internal resource base (high proportion of graduate employees), R&D capability, plant size, external ownership, plants' location
OECD Trade Committee (2001)	Export oriented FDI
Plümper and Graff (2001)	Country's trade specialization (favorable sectors)
Funke (2001)	Export varieties
Vienna Global Forum (2001)	Government financing
Mody and Yılmaz (2002)	Investment in machinery, openness, innovative effort
Mackay and Phillis (2002)	Financial structure

CHAPTER 4

INTERNATIONAL COMPETITIVENESS OF TURKISH MANUFACTURING SECTOR

4.1 On Export Performance of Turkish Manufacturing Sector

In 1980, Turkey changed its economic policy to an outward-oriented export policy from an inward-oriented import substitution industrialization policy. This represented a substantial change with Turkey's policy of the earlier decades. The main objectives of this fundamental change were to reduce the rate of inflation while not causing a reduction in the output of growth with the help of the international organizations, and to promote exports to reduce and eventually eliminate the high balance of payments deficit. Thus, Turkish government decided to implement a policy that combined export incentives with a real depreciation of the domestic currency (Uygur, 1990).

Uygur (1991) also adds that export success of Turkey was impressive. According to Uygur (1991), export subsidies and real devaluations were the major reasons of export boom in Turkey after 1980s, when Turkey changed its economic policy from an inward-oriented import substitution to an outward-oriented export policy. In 1983, export incentives came up to 36 percent of the export revenue and

from 1979 to 1984 Turkish lira was devalued against USD by 100 percent in real terms.

Yet, Rodrik (1995:2) explains the situation within a comparative study on the differences between the export-led growth strategies of South Korea and Taiwan on the one hand and Turkey and Chile on the other: Export booms in Turkey and Chile in the 1980s have required cumulative exchange rate depreciations contemporaneously of the order of 100 percent, a change in relative prices vastly in excess of anything observed in East Asia". The two East Asian countries in question were indeed able to blend export-orientation with successful investment and technology strategies, whereas Turkey and Chile solely relied on devaluations and export incentives without any significant efforts to feed up the infrastructure.

Also, Erzan and Filiztekin (1997, pp. 882) point out the change in 1980s of Turkey. Their results show that Turkish manufacturing industry experienced a robust growth in the 1980s in terms of output, employment, and most remarkably productivity. They argue that outward orientation of the economy was achieved by trade liberalization, a conducive exchange rate policy; export subsidies and suppressed wages as labor union was curtailed. Exports jumped from $3 billion in 1980 to $10 billion in 1987, while the share of manufactured goods in exports increased from 30 percent to 70 percent.

However, this enormous growth in the exports of Turkish economy could not be sustained after the second half of the 1990s. In the 1990s, Turkey's export performance altered and moved to more skill-intensive commodities. As far as the European market concerned, there was a substantial increase of intra-industry trade for skill-intensive products. This gives hope for the future development and increase in R&D investment (Lohrmann, 1998).

However, Lohrmann (2000) asks the questions that if Turkey sells the right products to the right markets and what are the most important factors that affected market shares of Turkey? While trying to find answer to these questions, Lohrmann (2000) found that Turkey did not meet the changing demand structure of the OECD countries very well, which influenced her situation negatively. This is so; the export incentive "scheme" did not discriminate in favor of "new" or high skill products and fast growing markets. In fact, it fostered a strong position for the low-skill textiles and apparel sector, which have low-income elasticity and where the international competition depends on lower costs of labor.

Taymaz and Özçelik (2001) are also in line with Lohrmann (1998 and 2000). They also point out that the impact of the insufficient investment in R&D expenditures began to be more severe on the international competitiveness (export performance) of Turkish manufacturing sector after 1990s (Taymaz and Özçelik, 2001). This was true both for the small and medium scale enterprises (SMSEs) and large establishments. The most interesting point in their study is the persistent insignificance of the real wage to export performance. Turkey has conventionally

implemented devaluations to improve her international competitiveness via real cost reductions (e.g., the alleged advantage of the availability of "cheap labor"). Nevertheless, the real wage variable was able to significantly affect export intensity in none of the six regressions they considered.

Indeed, Taymaz and Özçelik (2001) argue that, the invariably significant and positive impact of the capital intensity variable in the very same regressions is, in fact, a quite crucial warning to be obeyed by the policy-makers at all costs. And, they continued that, Turkey as well as similar developing countries must escape from the illusion of temporary export booms achieved by such ready-made tools as devaluations and export subsidies, and construct a coherent technology policy *cum* a national development strategy that will generate permanent increases in gross fixed capital formation, and thus in productivity and international competitiveness.

Also, Lall (2000a) emphasizes that Turkey should implement a comprehensive technology and innovation strategy to increase its international competitiveness. From this point of view, with insufficient investment and lowest private R&D expenditures, the international competitiveness of the manufacturing sector could not be sustained. The governments should not support the international competitiveness of Turkish manufacturing sector by devaluations only.

In parallel with these criticisms, the Turkish government began to take some measures since the second half of the 1990s. To increase the international

competitiveness of Turkish firms, The Money and Credit Co-ordination Committee systemize the R&D expenditures with "Decree on Research and Development Subsidization" in 1995. Till 1995, The Scientific and Technical Research Council of Turkey (TUBITAK) and Technology Development Foundation of Turkey (TTGV) manage these subsidization programs and these institutions aim to develop Turkish manufacturing industry quantitatively and qualitatively. This decree was also amended in 4 October 1998 (OECD, 2001). However, OECD also states that the effects of R&D direct support for R&D programs can be seen in the long-term.

In this framework, Table 2 summarizes the studies on export performance reviewed in this thesis for Turkey and furthermore will be supported by tables and graphs in section 4.2. These summary tables provide information about each study reviewed in the literature part. The studies reported in two tables summarize significant positive, negative, and non-significant findings for each factor influencing export performance, allow drawing conclusions on determinants of international competitiveness and the specialties of export performance of Turkish manufacturing industry.

Table 2. On Turkey's Export Performance

Kazgan (1988)	Capacity utilization rate, unit costs
Uygur (1990)	Real depreciation
Uygur (1991)	Export subsidies and real devaluation
Rodrik (1995)	Comparison of Chile and Turkey against S. Korea and Taiwan (Depreciation and export subsidies vs. successful investment and technology strategies
Erzan and Filiztekin (1997)	Trade liberalization, a conducive exchange rate policy, export subsidies, supressed wages
Lohrmann (1998)	Skill-intensive commodities, R&D investment
Lall (2000)	Private R&D expenditures, investment, FDI inflows, skills, devaluations
Lohrmann (2001)	Demand structure of OECD countries
Taymaz and Özçelik (2001)	R&D expenditures, real wages, devaluations, capital intensity, export subsidies, productivity, share of technicians, market share

4.2 Some Stylized Facts on Export Performance of Turkish Manufacturing Industry

In a liberalizing world, export success is more important than ever to economic performance. Thus, the importance of understanding the nature, stylized facts of Turkish manufacturing industry should be considered in understanding the determinants of export performance.

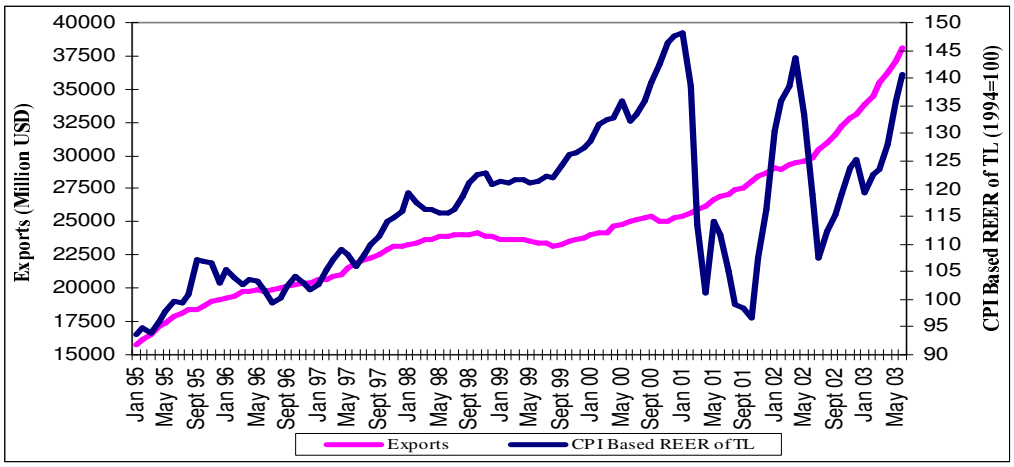

Figure 1. Total Exports of Manufacturing Industry (Annual, Million Dollars) and Real Value of Turkish Lira (1995=100)
Source: Central Bank of Turkey

Figure 1 gives total exports of manufacturing industry for the period between December 1989 and March 2003. The increases in total exports reflect the expansion by Turkey's manufacturing exports, which could be a result of devaluations, export subsidies, productivity, or faster technological progress. The export boom result also confirms that selling to foreign markets is profitable than selling to domestic markets. Furthermore, it should not be forgotten that 93 percent of the exports are classified under the manufacturing industry, as of end of 2002. Moreover, the relationship between the real value of Turkish lira and exports of manufacturing sector can be seen in Figure 1.

Figure 1 supports that the implementation of flexible exchange rate policy after February 2001 accelerated the increase in the exports despite the volatility of the CPI (consumer price inflation) based real effective exchange rate (1994=100). Before the flexible exchange rate policy, Central Bank of Turkey implemented managed and fixed exchange rate policies, which were affected the exports of manufacturing sector poorly. On the other hand, Figure 1 implies that there is no relationship between real effective exchange rate and exports.

Table 3. Export by Countries (Million Dollars)

	1998		1999		2000		2001	
Country	Value	Share (%)	Value	Share (%)	Value	Share (%)	Value	Share (%)
Germany	5460	20.24	5475	20.59	5180	18.65	5367	17.13
USA	2233	8.28	2437	9.17	3135	11.29	3126	9.98
Italy	1557	5.77	1682	6.33	1789	6.44	2342	7.47
England	1740	6.45	1829	6.88	2037	7.33	2175	6.94
France	1305	4.84	1570	5.91	1657	5.97	1895	6.05
Spain	513	1.90	763	2.87	714	2.57	950	3.03
Russia	1348	5.00	589	2.22	644	2.32	924	2.95
Holland	889	3.30	932	3.51	874	3.15	892	2.85
Israel	480	1.78	585	2.20	650	2.34	805	2.57
Belgium	670	2.48	624	2.35	647	2.33	688	2.20
Other	10779	39.96	10101	37.99	10447	37.61	12170	38.84
Total	**26974**	**100.00**	**26587**	**100.00**	**27774**	**100.00**	**31334**	**100.00**

Source: State Institute of Statistics

As we see from figure 1, there has been a trade boom in Turkey for manufacturing industry between 1989 and 2001. Table 3 implies that the continuity of this trade boom depends on the demand of the main importers of Turkish commodities, which are European Union countries, Russia and USA. Especially, the demand and value of the Euro determines the export performance of Turkey.

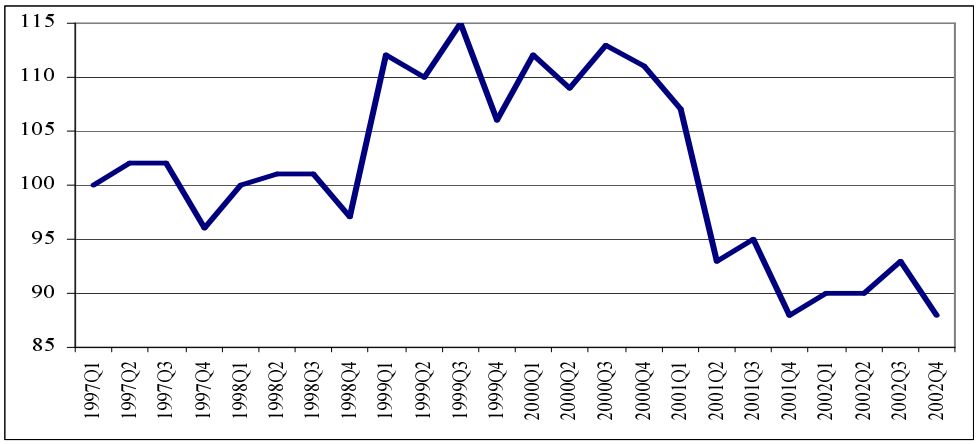

Figure 2. Real Index of Wages per Production Worked Hours in Manufacturing Industries (1997 = 100)
Source: State Institute of Statistics

Figure 2 shows that the real index of wages per production worked hours in manufacturing industries (1997 = 100) are stable between 1997 and 1998. It is higher between 1999 and 2000. And after the major devaluations experienced in the 2000-2001 crises, it dropped sharply below the year of 1997 levels. The trend of real wages imply that the lower unit labor costs able the Turkish manufacturing firms to sell its commodities at lower costs and makes them competitive in international markets. However, this result also shows that the real wages could not be increased in parallel with export booms due to the lower profit margins demanded by the exporters. In short, as Eser (1993) argues the export performance of Turkish increase could not help the profitability of the firms and real wages.

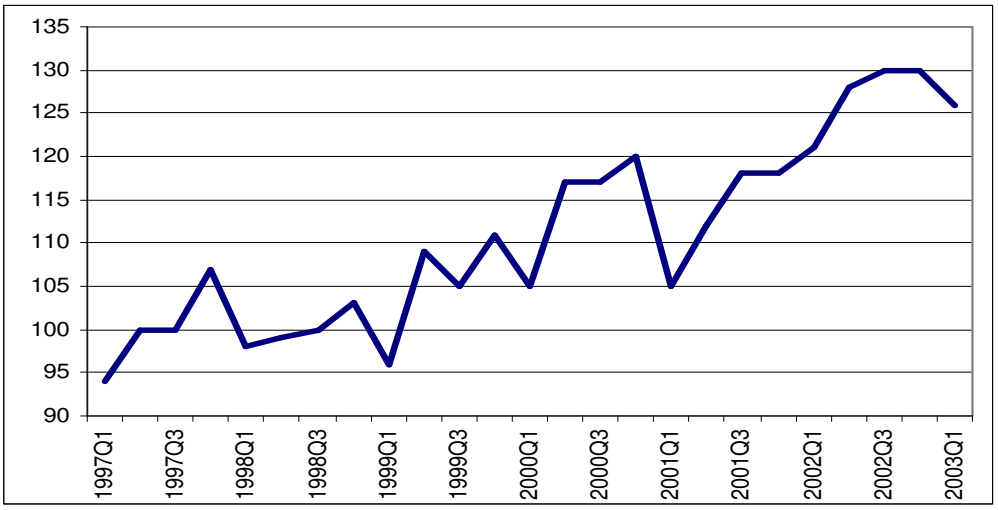

Figure 3. Index of Partial Productivity of Production Worked Per Capita (1997 = 100)
Source: State Institute of Statistics

As seen from figure 3, index of partial productivity of production worked per capita (1997 = 100) increased for the period between 1997Q1 and 2003Q1. This result is something in line with Figure 2. The relation between index of partial

productivity and real index of wages is not a result of causality. It's a result of definition (Eser, 1993).

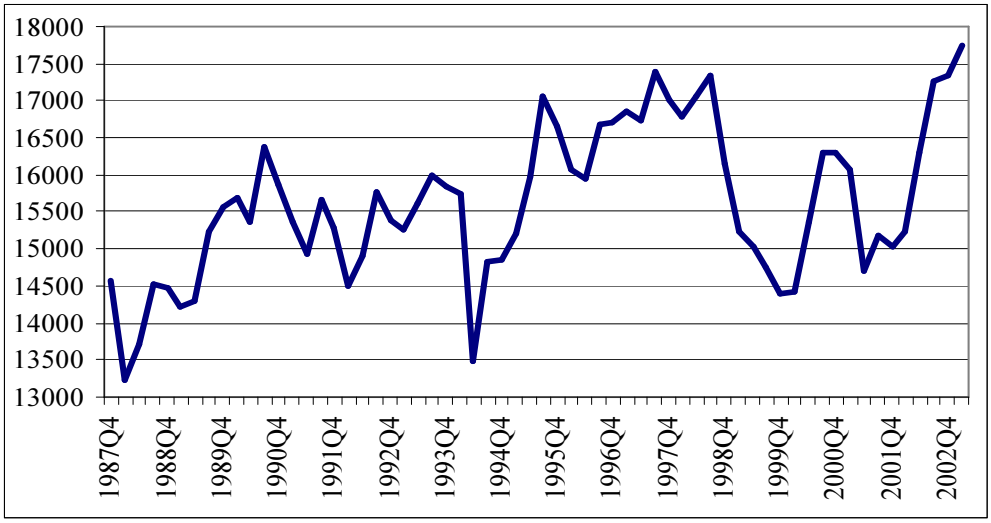

Figure 4. The Value of Manufacturing Industry in GNP (CPI 1987=100)
Source: State Institute of Statistics

Despite of the decreases in real wages, the value of manufacturing industry has increased over time confirming that the share of wages in total value is diminishing. When we compare the Figure 1 and Figure 4, it is seen that the decreases in the value of manufacturing industry encourages firms to export in the coming years.

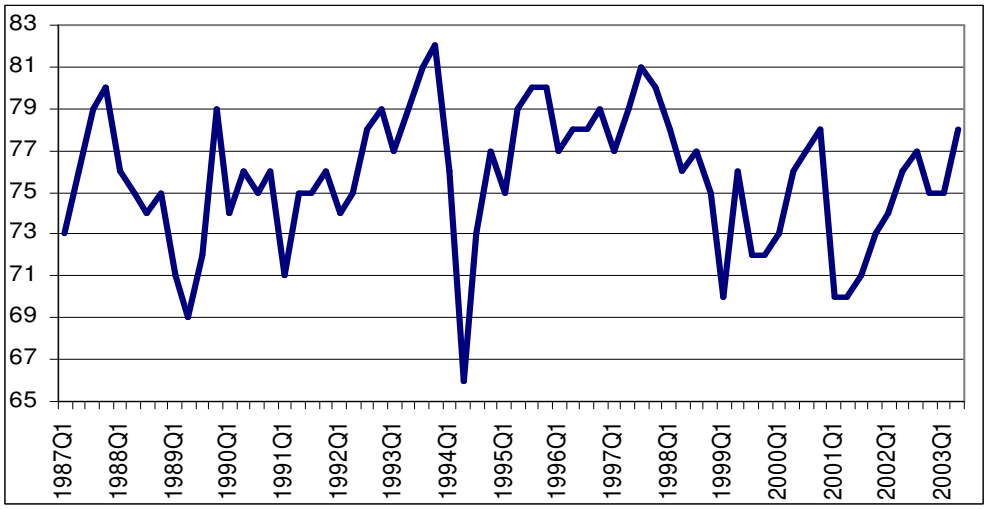

Figure 5. Capacity Utilization Rate (%)
Source: State Institute of Statistics

As Kazgan (1988) argues, it is seen that increases in capacity utilization rate of manufacturing sector has a positive effect on international competitiveness of Turkey. Turkish economy increases its capacity utilization rate by growing with increasing exports. This growth helps the economy to use the scale economy and decrease the unit costs. However, as seen from Figure 5, Turkish economy that reaches 80 percent of its capacity utilization rate could not receive any increase in its international competitiveness.

4.3 Conclusion

In short, in the framework of the findings in the literature, after the implementation of the flexible exchange rate policy, the increase in the exports accelerated despite the volatility of the CPI based real effective exchange rate (1994=100). Besides, there is no relation between the value of TL and exports. However, it must be kept in mind that the dynamics in EU countries, Russia and

USA is also important for Turkey. On the other and, it is clearly seen that the trend of real wages and productivity have an important contribution to the exports of the manufacturing sector. While the economy reaching 80 percent capacity utilization rate could not receive in international competitiveness. Furthermore, it is understood that the increases in the value of manufacturing signals a decline in the exports of manufacturing sector.

CHAPTER 5

A MODEL FOR INTERNATIONAL COMPETITIVENESS

5.1 Modeling International Competitiveness: Contribution of R&D Expenditures

It should be kept in mind that the main contribution of this thesis is to study the effects R&D expenditures on the international competitiveness of the manufacturing sector. With parallel to this objective, to estimate to what extent the international competitiveness (export propensity) is affected by R&D expenditures and other explanatory variables, applying an econometric model would be beneficial. Siddarthan and Kumar (1993), Dijk (2002), Roper and Love (2001), Taymaz and Özçelik (2001) and others recently review the way to model international competitiveness. Also, in the thesis, we take care of the findings of the previous studies in the neo-classical approach, technology gap theory, Schumpeterian view and evolutionary theory and technology-based approaches.

In all of these models, TOBIT estimation is the most popular (Kumar & Siddarthan, 1993; Lefebrve et al., 1998; Taymaz and Özçelik, 2001; Roper & Love, 2001; Dijk, 2002). The dependent variable assumes the value of zero for non-exporter firms, and positive values for exporter firms. Hence, the export

behavior of firms within an industry explained in the framework of TOBIT model. However, in this model, there is no anxiety about dividing the sub-sectors of manufacturing sector into exporters and non-exporters. On the other hand, the firm-level data is not available because of the confidentiality of the data. Thus, we use sub-sectoral data of manufacturing sector, and we prefer Ordinary Least Squares (OLS) Estimation, which is a single equation regression and one of the most versatile and widely used statistical techniques. Furthermore, in our model, the data contain information with pooled time series observed between 1990 and 2001 on cross-sections for the sub-sectors of the Turkish manufacturing sector. We term such data pooled time series and cross-section data.

Our model of export performance will include a number of indicators of the aggregated data of the firms' operating characteristics. These aggregated data of the firms classified under the sub-sectors of the manufacturing industry. However, the main drawback of this thesis is that it does not include organizational characteristics and macroeconomic variables. The model only tries to find the determinants of international competitiveness by using the micro data of firms provided by the CBRT's Company Accounts.

Generally speaking, pool objects can be used to estimate equations of the form of $\mathbf{y_{it}} = \boldsymbol{\alpha_{it}} + \boldsymbol{\beta'_i x_{it}} + \varepsilon_{it,}$ for i = 1,2,...,N cross-section units and periods t = 1,2,...,T (Further details and discussion are provided by Eviews 3.0 program). In this framework, our basic model is in the form of:

$$\mathbf{X_{it} = \alpha_{it} + \beta_0 SALES_{it} + \beta_1 RD_{it} + \beta_2 INV_{it} + \beta_3 CAP_{it} + \beta_4 FX_{it} + \beta_5 CRE_{it} + \beta_6 X_{it-1} + \varepsilon_{it}}$$

where, for i = 1,2,...,N sub-sectors and periods t = 1,2,...,T. where, X_{it} is the export intensity of sector i in period t. α_{it} is the intercept term and β_0, β_1, β_2, β_3, β_4, β_5, β_6 are the vectors of coefficients of independent variables and ε_{it} is the independently, identically and normally distributed error term. Moreover, in our model, the autoregressive specification X_{it-1} indicates vectors of autoregressive component, which lagged once with a first order autoregressive component. There are two reasons behind using an autoregressive specification. One of the reasons that we use X_{it-1} is that it eliminates possible danger of ex-ante autocorrelation, and the other reason is that previous export performance has something to contribute present export performance.

Furthermore, the independent variables of the model, which are the share of bank loans in total liabilities (CRE_{it}), the ratio of own funds to total assets (CAR_{it}), the share of gross fixed investment in total assets (INV_{it}), R&D intensity (RD_{it}), marketing intensity ($SALES_{it}$), and the share of net foreign exchange profits in total sales (FX_{it}), dummy variables for R&D intensity ($DUMRD_{it}$ and $DUMRD1_{it}$) are also available in the model. All of these independent variables potentially influencing the export performance of Turkish firms operating in manufacturing sector considered in this thesis are identified below along with the expected results.

5.1.1. Export Intensity

The data include the necessary determinants of export performance of the manufacturing sector in the estimation of the export performance, which is measured by the proportion of firms' exports sales to gross sales. The previous studies used export propensity (X) in their models as a dependent variable to measure export performance (Kumar & Siddarthan, 1993; Ledesma, 2000; Roper & Love, 2001; Taymaz & Özçelik, 2001; Dijk, 2002). Export intensity of a firm can be influenced by a number of factors. In this regard, the export intensity equations aim to estimate the determinants of export performance. The technology factor (R&D intensity will be used as a proxy), bank credits, capital ratio, ratio of net exchange profits in total sales, share of gross fixed investment in total assets and marketing intensity are likely to influence export performance.

5.1.2 Share of Bank Loans in Total Liabilities

One of the most important inputs into competitiveness is the share of bank loans in total liabilities (CRE). In Turkey, the export assistance programs by the governments towards export credits have lowered the real interest rates of export credits helping the firms reaching lower funding costs. Some of these export subsidies inherent in the bank loans. That's why, we expect to have a positive relationship between bank loans (CRE) and export propensity, as bank credits help the firms to enter foreign markets with lower funding costs from financial institutions. However, the non-availability of the export credit data in the balance

sheets of the sub-sectors, we use the bank loan data covering all kinds of bank loans. Myers (1977), Vienna Global Forum (2001), Klette et al. (1999), Uygur (1991) etc. point out the importance of funding costs of finance and borrowing opportunities for export performance. In this regard, the share of bank loans in total liabilities will be used as a determinant of export performance in this model.

Also, nominal taxation of profits decreases the real value of capital in the high inflationary environment of Turkey, which unlikely directed the firms toward alternative funding sources, such as bank loans. This behavior also validates the results of Kumar and Siddarthan (1993) and leads us to expect positive relationship between the share of bank loans in total liabilities and export intensity.

5.1.3 Capital Ratio

A higher capital ratio (CAP), which is the ratio of own funds to total assets, is unlikely to give the firm a competitive advantage in a developing country with high inflation, macroeconomic instability, labor abundance and relative scarcity capital (Kumar and Siddarthan, 1993). Hence, an inverse relationship expected between export performance and capital ratio due to the dependency of Turkish manufacturing sector to the resource-based and low technology products. However, Dijk's (2002) and Taymaz's (2001) findings contrasted with this inverse relationship.

Logically, the expected sign of the capital ratio is positive. However, I think that the expected sign of this variable for Turkish manufacturing sector is ambiguous. The reason behind the ambiguity is the nominal taxation of the profits, which are classified under the capital of the firms. Also, as we discussed in the share of bank loans in total liabilities, since the nominal taxation of the capital of the firms decreases the competitiveness of Turkish firms, an inverse relationship can be expected between capital ratio and export intensity.

5.1.4 Share of Fixed Investment in Total Assets

We capture the fixed investment, since it is widely accepted that fixed investment is one of the major contributors to export performance (Pomponio (1996), Mody and Yılmaz (2002), Mccombie and Thirlwall (1999) etc.). They argue that fixed investment, investment in machinery or tangible goods and export performance has a positive relationship. In our model, the share of fixed investment in total assets (INV) is employed.

5.1.5 R&D Intensity

The first group of determinants of export intensity included in the model relates to the R&D expenditures. Previous studies provide strong evidence that R&D capability contributes to plants' export competitiveness. Clearly, the availability of R&D expenditures is important for competitiveness. We expect, therefore, that for any given set of sub-sectors of manufacturing's characteristics,

the effect of R&D intensity (RD) on exporting is likely ceteris paribus to be positive. Essentially similar arguments suggest that we would also expect to observe a positive relationship between R&D intensity and export intensity.

5.1.6 Marketing Intensity

Marketing intensity (ADV) is defined as the proportion of marketing, selling and distribution expenses including advertisement expenses to gross sales. Marketing expenses is also including advertisement and promotion expenses. The quality consciousness, selling and transportation costs are an important factor in export effort. Hence, a positive relationship is expected between marketing intensity and export performance (Lefebrve 2001; Kumar and Siddarthan 1993; Landesmann et al. 2001, Dijk 2002, etc.).

5.1.7 Ratio of Net Foreign Exchange Profits to Total Sales

Uygur (1990 and 1991), Rodrik (1995), Erzan and Filiztekin (1997), Lall (2000a and 2000b), Taymaz and Özçelik (2001) and Nilsson (2000) point out the positive effects of real depreciation on Turkey's export performance. Hence, in the model, the ratio of net exchange profits to gross sales (FX) is used as an independent variable whether FX profits or losses have favorable effects on the export performance of manufacturing sector. The main aim here is to find an answer that net foreign exchange profits item in the income statement could also have effect on export performance like foreign exchange movements.

5.1.8 R&D Intensity Dummy for High Technology Industries

In the model, we use a dummy variable (DUMRD) that is equal to one if the sector's average R&D expenditure exceeds that average of the manufacturing sector's, zero otherwise. This dummy variable is, then, multiplied with the R&D expenditures of the sub-sectors of the manufacturing sector. As we argued, the sectors with high R&D intensity expected to have higher export intensity. Also, in our models, higher contribution of R&D intensity to export intensity of the manufacturing sector is expected in the medium and high technology industries.

5.1.9 R&D Intensity Dummy for Low and Medium Technology Industries

In our models, we also use another dummy variable (DUMRD1) that is equal to one if the sector's average R&D intensity falls that average of the manufacturing sector's, zero otherwise. After that, this dummy variable is multiplied with the R&D expenditures of the sub-sectors of the manufacturing sector. The sectors with lower R&D intensity expected to increase export performance much more compared to medium and high-technology industries. In our models, higher contribution of R&D intensity to export performance is expected in the low and medium technology industries in accordance with the neo-technological theories (Kumar and Siddarthan, 1993).

5.2 Data Set and Its Properties

The data used in this model is taken from the Central Bank of the Republic of Turkey (CBRT), which has been compiled the annual balance sheets and income statements of the firms since 1990, classified according to NACE (Nomenclature Generale des Activites Economique dans les Communautes Europeennes), Rev.1. These data have been published by the CBRT under the name of "Company Accounts".

The important drawback of this data is that the balance sheets and income statements of most of these firms are audited neither by independent audit firms nor by public authorities. Thus, the financial accounts provided to the CBRT are assumed to be correct for the R&D expenditures data and the other data. On the other hand, SIS (State Institute of Statistics) collects more reliable data for R&D. However, R&D data is recently added and number of observations is few.

The currently available data used in this thesis covers 1990-2001 periods. The number of the firms recorded in the dataset increases over this period. For instance, at 1990-1992, the number of firms was 3,939 and at 1999-2001, the number has increased to 7,729. The balance sheets and income statements of manufacturing sector relates to 14 main and 36 sub-sectors and is prepared by utilizing the financial accounts of those firms. However, since the firm-level accounts are confidential, the thesis will only cover 16 sub-sectors of manufacturing sector. The list of these sub-sectors and definitions, classified

according to NACE (Nomenclature Generale des Activites Economique dans les Communautes Europeennes), Rev. 1, is given below, in Table 4.

Table 4. The list of sub-sectors of manufacturing sector

DA15	Manufacture of Food Products, Beverages and Tobacco
DA16	Manufacture of Tobacco Products
DB17	Manufacture of Textiles
DB18	Manufacture of Wearing Apparel, Dressing and Dyeing of Fur
DC	Manufacture of Leather and Leather Products
DD	Manufacture of Wood and Wood Products
DE	Manufacture of Pulp, Paper and Paper Products and Publ. & Printing
DF	Manufacture of Coke, Refined Petr. Products & Nuclear Fuel
DG	Manufacture of Chemicals, Chemical Prod. & Man-made Fibers
DH	Manufacture of Rubber and Plastic Products
DI	Manufacture of Other Non-metallic Mineral Products
DJ	Manufacture of Basic Metals and Fabricated and Metal Products
DK	Manufacture of Machinery and Equipment N.E.C.
DL	Manufacture of Electrical and Optical Equipment
DM	Manufacture of Transport Equipment
DN	Manufacture of Furniture, Manufacturing N.E.C.

In a shorter way, to facilitate understanding of the descriptive statistics and the estimation results, the abbreviations of the dependent variable and explanatory variables and their formulization listed below in Table 5.

Table 5. Abbreviations of the dependent and explanatory variables

SALES	Export performance (Share of export sales in gross sales)
RD	R&D intensity (R&D expenditures / Gross sales)
DUM	A dummy variable that is equal to one if the sector's average R&D intensity exceeds that average of the manufacturing sector's, zero otherwise.
DUM1	A dummy variable that is equal to one if the sector's average R&D intensity is lower than that average of the manufacturing sector's, zero otherwise.
DUM1RD	DUM1*RD
DUMRD	DUM*RD
INV	Share of gross fixed investment in total assets
CAP	Capital ratio (Own funds over total liabilities)
FX	Net exchange profits over Gross sales
CRE	Share of bank credits in total liabilities
ADV	Marketing intensity (Marketing, selling and distr. expenses over gross sales)

Table 6. Descriptive Data

Manufacturing Sector	SALES	RD	CRE	CAP	FX	INV	ADV
Mean	20.77	0.21	24.07	36.83	0.44	30.31	3.84
Median	17.43	0.08	22.59	36.01	0.25	28.78	3.46
Maximum	74.50	1.40	80.53	69.83	3.40	62.60	12.95
Minimum	0.54	0.00	7.96	14.00	-2.33	8.21	0.22
Std. Dev.	15.31	0.31	10.29	9.65	0.79	10.87	2.64
Coefficient of Va	0.74	1.47	0.43	0.26	1.78	0.36	0.69
Skewness	1.12	2.19	2.19	0.25	0.79	0.32	0.98
Kurtosis	3.91	7.32	10.95	2.81	5.78	2.48	3.92
Observations	192	192	192	192	192	192	192

Industry Indicators (Mean)	SALES	RD	CRE	CAP	FX	INV	ADV
DA15	16.52	0.11	**29.34**	27.18	0.26	23.46	**4.41**
DA16	**36.46**	0.02	**45.18**	31.47	**1.16**	29.73	1.78
DB 17	**30.04**	0.07	**31.33**	33.79	0.27	**36.88**	2.30
DB 18	**54.86**	0.11	**34.59**	28.51	**0.76**	20.04	2.86
DC	**31.15**	0.05	**26.42**	33.03	0.05	13.74	2.60
DD	6.52	0.06	17.83	**37.62**	**0.66**	30.06	1.56
DE	5.73	0.08	18.10	**44.15**	0.19	**41.78**	**7.34**
DF	2.99	0.01	14.62	**49.67**	**0.45**	**48.43**	0.48
DG	10.39	**0.24**	22.48	34.26	0.29	27.21	**8.04**
DH	**22.69**	0.15	16.71	**48.16**	0.15	**37.03**	**4.72**
DI	16.89	**0.28**	19.93	**50.30**	**0.50**	**39.10**	**5.90**
DJ	**26.35**	0.09	22.95	33.68	-0.01	**44.41**	2.08
DK	13.81	**0.47**	23.31	29.87	0.29	19.83	**4.69**
DL	**26.41**	**0.93**	23.58	30.29	**0.76**	19.78	**3.89**
DM	18.02	**0.57**	16.60	**42.62**	**0.97**	30.12	2.98
DN	13.46	0.14	22.21	34.67	0.33	23.40	**5.85**
Manufacturing	**20.77**	**0.21**	**24.07**	**36.83**	**0.44**	**30.31**	**3.84**

Industry Indicators (St.Dev.)	SALES	RD	CRE	CAP	FX	INV	ADV
DA15	4.01	0.04	5.45	3.25	0.48	1.62	0.81
DA16	**20.56**	0.06	**22.45**	**11.75**	**1.43**	**12.97**	1.46
DB17	7.75	0.06	3.84	3.86	0.41	3.48	0.72
DB18	4.56	0.16	7.48	7.25	**0.94**	2.60	1.17
DC	4.70	0.04	4.46	5.11	0.78	1.86	1.14
DD	2.95	0.08	4.06	2.78	0.69	3.22	0.66
DE	2.01	0.10	3.88	7.20	0.45	3.35	**3.52**
DF	0.85	0.00	3.86	8.36	0.53	9.52	0.18
DG	2.35	0.11	4.11	5.74	0.32	1.60	2.40
DH	7.05	0.19	3.92	4.81	0.69	4.87	1.40
DI	5.37	0.15	2.80	3.05	0.50	3.21	1.27
DJ	9.01	0.04	3.87	**9.70**	**0.95**	2.84	0.77
DK	7.52	0.27	2.49	6.60	0.71	1.43	2.23
DL	11.33	**0.33**	2.92	4.21	0.77	2.07	1.27
DM	13.79	**0.53**	7.20	5.41	0.62	4.12	1.66
DN	8.36	0.20	4.53	5.10	**0.96**	3.13	**2.65**
Manufacturing	**15.31**	**0.31**	**10.29**	**9.65**	**0.79**	**10.87**	**2.64**

Industry Indicators (Coef. of Variation)	SALES	RD	CRE	CAP	FX	INV	ADV
DA15	0.24	0.40	0.19	0.12	**1.81**	0.07	0.18
DA16	0.56	**2.55**	**0.50**	**0.37**	1.23	**0.44**	**0.82**
DB17	0.26	0.95	0.12	0.11	1.50	0.09	0.31
DB18	0.08	**1.49**	0.22	0.25	1.24	0.13	0.41
DC	0.15	0.87	0.17	0.15	**14.26**	0.14	0.44
DD	0.45	1.29	0.23	0.07	1.05	0.11	0.42
DE	0.35	1.35	0.21	0.16	**2.37**	0.08	0.48
DF	0.28	0.67	0.26	0.17	1.18	0.20	0.37
DG	0.23	0.44	0.18	0.17	1.12	0.06	0.30
DH	0.31	1.27	0.23	0.10	**4.51**	0.13	0.30
DI	0.32	0.54	0.14	0.06	0.99	0.08	0.21
DJ	0.34	0.43	0.17	**0.29**	**-73.26**	0.06	0.37
DK	0.54	0.57	0.11	0.22	**2.44**	0.07	0.48
DL	0.43	0.35	0.12	0.14	1.01	0.10	0.33
DM	**0.77**	0.93	0.43	0.13	0.64	0.14	0.56
DN	0.62	1.43	0.20	0.15	**2.91**	0.13	0.45
Manufacturing	**0.74**	**1.47**	**0.43**	**0.26**	**1.78**	**0.36**	**0.69**

* The bold values indicate that the sub-sector's average exceeds the average of the manufacturing sector.

** DG, DI, DK, DL, DM are science based sub-sectors, whose average expenditures are higher than average of manufacturing sector. They are assumed as medium and high technology industries

*** All values are percentages.

For the purpose of comparison means, medians, maximum and minimum levels, standard deviations, coefficient of variations and distributions of the dependent and independent variables are given in Table 6. Means, standard deviations and coefficient of variations of its 16 sub-sectors are also available in Table 6. The bold values of indicators of the sub-sectors indicate that the sub-sector's average exceeds the average of the manufacturing sector. ***However, it should be reminded that our focus is inter-industry variations; descriptive statistics are accepted to be rather complementary to the model estimation.*** The estimation results of the model would be easily interpreted by the hints provided by the descriptive statistics.

Looking at the basic characteristics of the manufacturing sector between 1990 and 2001, it is seen that the mean of manufacturing sector's export share is 21 percent of all sales, which implies that export is an important item for the manufacturing sector' sale. However, R&D expenditures are very low and highly volatile[9] compared to other variables and compared to export intensity. Also, R&D intensity of the high technology sub-sectors is above the manufacturing sector average as expected. The bank loans and their own funds (capital) are important sources for the manufacturing sector. The manufacturing sector also gives importance to the fixed investments. The volatility of the shares of bank loans in total liabilities, capital intensities and the shares of fixed investment in total assets have relatively low volatility, which implies that these three variables are indispensable for the sector. Marketing intensity is also an important factor that

[9] See coefficient of variation

manufacturing sector concerns. The shares of net foreign exchange profits in total sales are also very high and volatile implying that currency risk is inherent in the manufacturing sector. The high ranges between maximum and minimum values of variables suggest that there are great variations between sub-sectors. This result is confirmed by highly positively skewed distribution of all variables. This result emphasizes that there is an asymmetry of the distribution of the variables around its mean. Moreover, export intensity, R&D intensity, the share of bank loans in total liabilities; the share of net foreign exchange profits in total sales and marketing intensity of the manufacturing sector are peaked relative to the normal distribution.

As seen from Table 6, Manufacture of Machinery and Equipment N.E.C., Manufacture of Electrical and Optical Equipment (DL), Manufacture of Transport Equipment (DM), Manufacture of Chemicals, Chemical Prod. & Man-made Fibers (DG) and Manufacture of Other Non-metallic Mineral Products (DI) have higher mean than manufacturing sector average. That's why, in this thesis, these sectors accepted as medium and high technology sectors and others accepted as low-technology industries. Furthermore, as seen from Table 6, the R&D intensity of Manufacture of Electrical and Optical Equipment (DL) and Manufacture of Transport Equipment (DM) have higher volatility than other sub-sectors. The possible reason is that the level of R&D intensity and other factors have not made these industries competitive in international markets yet.

The interesting point in the descriptive statistics is that the industries with higher R&D intensity have lower export intensity compared to manufacturing sector's average. Manufacture of Electrical and Optical Equipment (DL) is the only industry, which has higher R&D expenditures and export intensity. Export intensity at the sectoral level is slightly lower for high and medium technology sectors; and is higher for low technology industries. This finding is contradicting with the results of the previous studies that low technology industries with lower R&D has lower export intensity and medium and high technology industries with higher R&D has higher export intensity. This result is something that we expect, since as Uygur (1990 and 1991), Rodrik (1995), Lall (2000a) argues, the Turkish manufacturing sector's export performance is not determined by technological capability like the Asian Tigers.

Meanwhile, Table 6 clearly reflects that the sectors with higher R&D intensity (except Manufacture of Electrical and Optical Equipment (DL)) have lower export intensity. There are some hints in the descriptive statistics. These sectors subsidize their R&D expenditures without applying bank loans. On the other hand, as seen from Table 6, Manufacture of food products (DA15), Manufacture of tobacco products (DA16), Manufacture of textiles (DB17), manufacture of wearing apparel dressing and dyeing of fur (DB18), manufacture of leather and leather products (DC), which are accepted as the low technology sectors, could have access to bank loans and incentive schemes easily, since they are traditional export sectors. That's why these sectors have relatively higher export intensity. Simply, higher R&D intensity sectors are obliged to aim domestic

markets since their competitiveness depending on their low R&D intensity. On the other hand, low and medium technology sectors are aiming foreign markets due to their advantage in real wages and productivity.

Moreover, the effects of the share of lower fixed investment rates in total assets on the export performance are ambiguous. Behind this ambiguity, interestingly, in the medium and high technology industries, the sub-sectors except manufacture of other non-metallic mineral products (DI) have a lower fixed investment tendency. In the low technology industries, besides, most of them have higher fixed investment rates, the effects on export performance is still ambiguous.

It is expected that the emphasis on the share of marketing, selling and distribution expenses including advertisement cost in total sales generally result with lower export intensity. However, this finding is some how true. In 6 sub-sectors, DA15, DE, DG, DI, DK and DN, there is higher marketing intensity with lower export intensity. Moreover, in 5 sub-sectors, DA16, DB17, DB18, DC and DJ, there is lower marketing intensity with higher export intensity. Interestingly, these five sub-sectors are low technology industries. On the other hand, only DH and DL have higher marketing intensity with higher export intensity. Also, DC, DF, DM have lower marketing intensity with lower export intensity. The results show that the general tendency in the Turkish manufacturing sector is ambiguous for the expectations waiting lower marketing intensity brings higher export performance.

Another interesting point is that the sub-sectors with higher capital ratio tend to have lower export intensity. This might be the result of Turkish manufacturing sector's reliance on labor abundance in the export markets or the preference to transfer their profits towards their domestic market expectations. One exception to this finding is manufacture of rubber and plastics products. Also, four of the sub-sectors (Manufacture of food products beverages and tobacco (DA15), manufacture of chemicals, chemical prod. and man-made fibers (DG), manufacture of machinery and equipment N.E.C. (DK) and manufacture of furniture (DN) with lower capital ratio have lower export intensity.

When we look at the standard deviation as a measure of dispersion or spread in the variables, manufactures of tobacco has higher dispersion than the manufacturing sector with respect to most of the variables. This implies that developments in manufactures of tobacco products (DA16) have the highest contribution to the manufacturing sector's dispersion. Most of the sectors have lower dispersion than the manufacturing sector due to manufacturing sector's high spread.

However, the standard deviation would probably be found to be more variable for higher mean values and less variable for lower mean values. To have a fairer test of volatility, the coefficient of variation would be useful. According to the results of the coefficient variation, there is not such a clear distinction between the highest percentage of sub-sectors engaged in R&D and other sub-sectors.

Table 7. Correlation Coefficients: Share of Exports in Gross Sales, 1990-2001

	DA15	DA16	DB17	DB18	DC	DD	DE	DF	DG	DH	DI	DJ	DK	DL	DM	DN
DA15	1															
DA16	-0.14	1														
DB17	0.68	-0.42	1													
DB18	0.59	0.23	0.62	1												
DC	0.60	0.21	0.53	0.47	1											
DD	0.27	-0.48	0.52	0.09	0.34	1										
DE	-0.51	-0.26	-0.32	-0.58	-0.60	0.28	1									
DF	-0.29	0.24	0.01	0.25	-0.33	0.06	0.43	1								
DG	0.67	-0.11	0.32	0.32	0.30	0.48	0.14	0.05	1							
DH	0.74	-0.03	0.70	0.88	0.51	0.22	-0.46	-0.03	0.57	1						
DI	0.67	0.12	0.47	0.71	0.60	0.40	-0.42	-0.16	0.61	0.83	1					
DJ	0.65	-0.33	0.85	0.73	0.55	0.59	-0.31	0.05	0.51	0.82	0.70	1				
DK	0.39	-0.38	0.60	0.48	0.26	0.30	-0.04	0.02	0.46	0.73	0.54	0.77	1			
DL	0.42	-0.32	0.59	0.32	0.29	0.06	-0.31	-0.33	0.10	0.56	0.46	0.45	0.66	1		
DM	0.58	-0.21	0.58	0.56	0.38	0.12	-0.26	-0.14	0.52	0.84	0.65	0.65	0.86	0.79	1	
DN	0.50	-0.48	0.60	0.39	0.33	0.46	-0.14	-0.18	0.52	0.68	0.67	0.76	0.89	0.73	0.83	1

Source: CBRT

In the Table 7, differences in export behavior between sub-sectors are analyzed, since sub-sectors differ substantially in their technological base (Gustavsson et al. 1996). Table 7 contains the correlation coefficient matrix of the share of exports in gross sales for the 16 sub-sectors of the manufacturing sector. Most of the sub-sector's (except three) correlation coefficients are positive and high, indicating that the export performance of the sub-sectors changed in the same way. However, three sectors (Manufacture of Tobacco Products – DA16; Manufacture of Pulp, Paper and Paper Products and Publ. & Printing – DE; Manufacture of Coke, Refined Petr. Products & Nuclear Fuel - DF) have displayed different export behavior from other sub-sectors between 1990 and 2001. This result also implies that the technology based industries or the sub-sectors with higher R&D intensity than the average of the manufacturing sector changed in the same way with general trend of manufacturing sector.

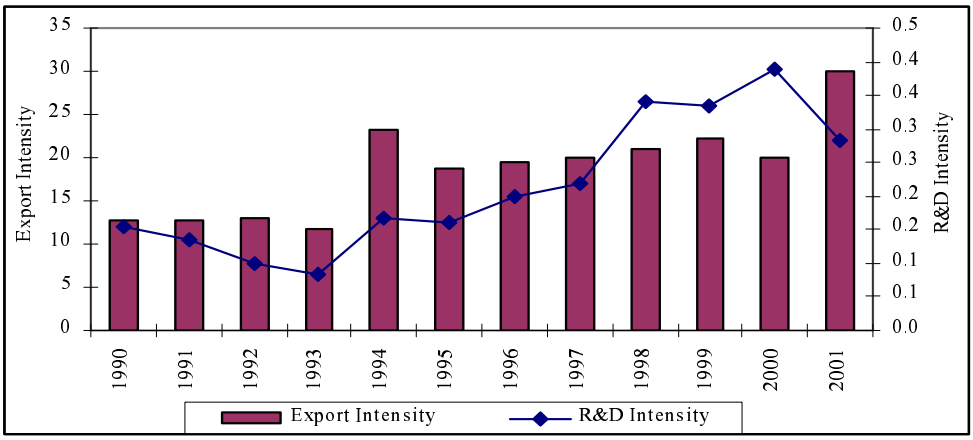

Figure 6. Export Intensity and R&D Intensity of the Manufacturing Sector (%)
Source: CBRT

Despite our concern is not the effects of macro economic factors on export performance, as seen from Figure 6, the crises experienced in 1994 and 2000-2001 that major devaluations took places, have favorably positive effects on export intensity. Despite any relation between value of TL and volume of exports, this result suggests that one of the major engines of the export intensity of manufacturing sector is still devalued local currency, which decreases the cost of the labor automatically. After the 1994 and 2000-2001 crises, exports intensity of the manufacturing sector increased enormously. The same result is valid for most of the sub-sectors of the manufacturing sector. These results also validate the findings of Uygur (1991), Rodrik (1995) and Erzan and Filiztekin (1997). However, these aspects could not be still something hindering both the neo-classical approaches and the technology-based theories. On the other hand, Figure 6 also implies that there is no relation between R&D intensity and export performance in Turkish manufacturing industry.

As Figure 7 in Appendix A provides, in the medium and high technology sub-sectors, where R&D expenditures are higher, there is an upward trend in export intensity for the last decade. Furthermore, medium and high technology sectors, except manufacture of chemicals, increase their export intensity in the years of the revaluation of the local currency. However, some sub-sectors of low technology, manufacture of tobacco products (DA16) and manufacture of coke, refined petr. products and nuclear fuel (DF), have not increased their export performance. All of the sub-sectors with higher R&D expenditures increase their export intensity enormously.

5.3 Estimation Results

The primary purpose of this thesis is to investigate the presence of any significant influence of R&D intensity on export performance. However, it should be kept in mind that capital intensity, share of bank loans in total liabilities, share of fixed investment in total assets, net foreign exchange profits, marketing, selling and distribution expenses could also be important factors in determining export performance. Table 8 gives the results of the OLS models per sectors of manufacturing industry demonstrating that whether R&D intensity of manufacturing sector, R&D intensity of low technology industries, R&D intensity of medium and high technology industries and other explanatory variables have significant impacts on the export performance of the sub-sectors of the Turkish manufacturing sector.

Table 8. Estimation Results (OLS Estimation, Pooled Data, No weighting) (Dependent Variable: Export Intensity)

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
C	25.99 (10.19; 0.01)	24.48 (10.7; 0.02)	23.89 (10.3; 0.02)	25.61 (9.97; 0.01)	27.93 (0.107;	22.96 (9.8; 0.02)
RD	3.94 (2.85; 0.17)	5.39 (4.44; 0.23)			4.31 (2.81; 0.12)	
CRE	0.35 (0.12; 0.01)	0.32 (0.12; 0.01)	0.32 (0.12; 0.01)	0.35 (0.12; 0.01)	0.37 (0.12; 0.01)	0.44 (0.11; 0.00)
FX	0.62 (0.62; 0.25)	0.64 (0.54; 0.24)	0.67 (0.53; 0.21)	0.65 (0.54; 0.23)		
CAP	-0.17 (0.11; 0.12)	-0.16 (0.11; 0.13)	-0.15 (0.11; 0.15)	-0.16 (0.11; 0.13)	-0.17 (0.11; 0.12)	
INV	0.06 (0.13; 0.65)	0.06 (0.13; 0.66)	0.06 (0.13; 0.65)	0.06 (0.13; 0.65)		
ADV	0.20 (0.46; 0.66)	0.19 (0.46; 0.68)	0.23 (0.46; 0.61)	0.24 (0.46; 0.61)		0.24 (0.45; 0.59)
DUM		18.67 (17.8; 0.29)	18.94 (16.32;			
DUMRD		-4.12 (5.87; 0.48)		3.13 (3.64; 0.39)		
DUMRD1						6.01 (4.52; 0.19)
X (-1)	0.91 (0.04; 0)	0.92 (0.04; 0)	0.92 (0.04; 0)	0.91 (0.04; 0)	0.91 (0.04; 0)	0.92 (0.04; 0)
Adjusted R^2	**0.848**	**0.847**	**0.854**	**0.853**	**0.849**	**0.847**
# of Observations	**176**	**176**	**176**	**176**	**176**	**176**
F-Statistics	**139.97**	**108.89**	**140.12**	**138.8**	**108.89**	**242.58**
Tests						
Durbin's H Test	**-1.72**	**-2.02**	**-2.20**	**-1.84**	**-1.83**	**-1.97**
Wald (Joint)Test	**46.14**	**25.52**	**112.40**	**23.85**	**131.00**	**140.50**
Sargan Test	**6.00**	**3.09**	**19.69**	**3.10**	**20.74**	**28.70**
DW	**2.220**	**2.258**	**2.281**	**2.236**	**2.234**	**2.252**

* The values in parantheses represent standard errors and p-values, respectively

Table 8 reports the standard OLS estimation results of the models for international competitiveness among the explanatory variables (R&D intensity, R&D intensity dummies, share of bank loans in total liabilities, marketing intensity, capital ratio, the ratio of net foreign exchange profits to sales, share of fixed investment in total assets) derived from the data compiled by CBRT under

the name of "Company Accounts". These six models presented in Table 8 give brief information about the models. More results can be obtained about the other models and other efforts during the construction of the model from Table 10 in Appendix A.

Before introducing the results of these models, it should be kept in mind that, despite Durbin-Watson (DW) indicating that there is no auto correlation, according to Durbin's H test, only in the 2^{nd}, 3^{rd} and 6^{th} models, there is no auto correlation at the 5 percent level.

The coefficients of determination (adjusted R^2) of all models are also around 0.85. On the contrary, model is jointly significant, but most of the variables are insignificant. Besides, the joint Wald test is significant at 1 percent significance level indicating that the parameters associated with a group of explanatory variables are not zero. Therefore, there is no need to omit the variables from the models.

Furthermore, the instruments should be orthogonal to the error terms from equations in order to be valid instruments, if the instrumental variables estimation technique is going to be used (for more information, see Sargan, 1976). Therefore, the row introducing the results of the Sargan Test, which is already provided by dynamic panel data package data of Ox of GIVEWIN2 software, in order to find out whether the instruments used in the equations are valid. The critical values for

Sargan Test according to Chi-Square distribution are provided in the Table 8, where in parenthesis are probability ratios.

In the model 1 of Table 8, all explanatory variables included ignoring R&D intensity dummies. This simple model is able to demonstrate that the bank loans have favorable and statistically significant and positive influence on the export performance of the manufacturing sector at the 1 percent level. The sectors with higher share of bank loans in their liabilities have more contributions to export performance. One unit increase in the share of bank loans a year ago increased the export intensity by 0.35 units. R&D intensity has the highest positive contribution to the export intensity, as it is expected. One unit increase in R&D intensity a year ago increased the export intensity by 3.94 unit, ceteris paribus. However, R&D intensity variable is insignificant. In the same way, capital ratio of the firms has adverse effects on export performance is insignificant. One of the possible reasons is that, the highly dependency of export performance on the low technology products (58 percent) and resource-based products (15 percent), as seen in Table 11 in Appendix A. This result also implies that profits of the firms, which are a part of capital of firms, have also adverse effects on export performance. In the first model, more interestingly, the model implies that net foreign exchange profits, marketing intensity and share of gross fixed investment in total assets are insignificant and have a positive sign. Also, the intercept in the regression, which is the base level of the prediction when all of the other independent variables are zero, is significant.

Also, in the first model, previous export intensity has favorable and statistically significant and positive influence on the export performance of the manufacturing sector at the 1 percent level indicating that previous export intensity has something to contribute present export performance.

In the model 2 of Table 8, all of the variables provided including R&D intensity dummy (DUM) and its multiplication with R&D intensity (DUMRD). As in the 1st model, the 2nd model finds exactly the same results for share of bank loans in total liabilities, R&D intensity, capital ratio, marketing intensity, share of fixed investment in total assets, and share of net foreign exchange profits in total sales. In the second model, a dummy variable (DUM) and multiplication of this dummy variable with the R&D intensity of the sub-sectors of the manufacturing sector (DUMRD) is included. The model suggests that DUM is insignificant and has a positive effect on export intensity. Furthermore, DUMRD is insignificant and has a negative sign. We could not claim that in the R&D intensive sub-sectors, increases in R&D intensity positively affect the export performance of these sub-sectors. This result is something contrasted with findings of Kumar and Siddarthan (1993), Ledesma (2000), Roper & Love (2001) and Dijk (2002).

In the model 3 and 4, all variables provided as in model 1. However, in model 3, an R&D expenditure dummy variable (DUM) is included; and in model 4, multiplication of this dummy variable with the R&D expenditures of the sub-sectors of the manufacturing sector (DUMRD) is included. In these two models, we could not still claim that R&D intensity positively or negatively affect the

export performance of the medium and high technology sectors. This result is also something contrasted with findings of Kumar and Siddarthan (1993), Ledesma (2000), Roper & Love (2001) and Dijk (2002). However, R&D intensity dummy is insignificant in our model. In the other variables, the results are nearly the same with the results of the model 1 and the model 2.

In the fifth model, we restricted the model through including the explanatory variables to R&D intensity, share of bank loans in total liabilities and capital ratio only. Though simple, the fifth model able to demonstrate the coefficient of the variables those are statistically significant. Again, R&D intensity has the highest positive contribution to export performance. Share of bank loans in total liabilities also have significant and favorable positive effects on export performance. On the contrary, capital ratio of sub-sectors has negative effects on export performance. This result is contrasted with the literature. This could be a result of high-inflationary environment that threatens the value of capital by nominal taxation and the dependency of Turkish firms to cheap labor.

In the last model (Model 6), differently, a dummy variable (DUM1) is introduced and multiplied by R&D intensity. In this respect, we try to validate that export behavior of low technology sectors is much more affected by R&D intensity compared to medium and high technology industries. The estimation results suggest that, insignificantly, one unit increase in R&D intensity in low technology industries previous year export performance increased the export intensity by 6.06 unit. Hence, we could claim that R&D intensity influences the

export performance of the low technology sectors much more than overall performance of the manufacturing sector. This result is still something in line with neo-technology theories. For other explanatory variables, the results are exactly the same with the results of Model 1.

As a conclusion, the share of bank loans in total liabilities have significant and positive influence on export performance at the 1 percent level due to the different government policy measures for export credits, which are accounted in the bank loans, for encouraging Turkish firms to export. R&D intensity has the highest positive contribution to the export intensity, as it is expected. One unit increase in R&D intensity a year ago increased the export intensity by 3.94 unit. However, R&D intensity variable is insignificant. Also, previous export intensity has favorable, statistically significant and positive influence on the export performance of the manufacturing sector at the 1 percent level indicating that previous export intensity has something to contribute present export performance. Furthermore, we find that capital ratio, marketing intensity; the share of fixed investment in total assets and the ratio of net foreign exchange profits in total sales are insignificant.

CHAPTER VI

POLICY IMPLICATIONS AND CONCLUSION

This thesis has analyzed the determinants of export performance by using a unique data set covering the balance sheets and income statements of the sub-sectors of Turkish manufacturing sector. Another aim of the thesis is to analyze differences in export behavior between industries, since industries differ substantially in their technological base. In order to reach this target, it was necessary to combine the new approaches to the analysis. In this respect, the neo-technology theories have been adapted for explaining the export behavior of sub-sectors of Turkish manufacturing sector. In these theories, it is argued that technological activities of enterprises from developing countries like Turkey would be important in explaining the overall export performance of manufacturing sector. The thesis also puts effort to explain the differences between the effects of R&D intensity on export performance for low technology sectors and medium and high technology industries. Hence, a model using pooled time series and cross section data is applied to construct our estimations on the determinants of international competitiveness of Turkish manufacturing sector. However, ignoring organizational characteristics and macro economic variables and depending on the

balance sheets and profit loss tables of firms, which are collected by the CBRT is the main drawback of this estimation.

Our main findings are summarized as follows: The estimated OLS models validate our prediction that in Turkey, it should be recognized that there is no significant relationship between a sub-sector's R&D intensity and its export intensity. This finding is true both for the low technology industries and for the high and medium technology industries. Thus, this result is something what we are not expecting. However, the result could be realized due to the underestimation of R&D expenditures in income statements.

In the estimation results, the share of bank loans in total liabilities has significant and positive influence on export performance at the 1 percent level. The different government policy measures for export credits, which are accounted in the bank loans, and low costs of export credits are encouraging Turkish firms to export. The availability of funding by the banks to these firms increases the export capability of these sub-sectors. Thus, the government policies should target the well functioning of the financial system, which decreases the funding costs of the manufacturing firms. Lowered funding costs will assure that the manufacturing firms are likely to be competitive in the international markets. From a policy perspective, a well-functioning financial system will make the subsidies provided to the export credits unnecessary. However, as a widely accepted fact, financing technology pose special challenges because of uncertainty of outcome and related asymmetry in information. It must be kept in mind that a well-functioning

financial system at reasonable costs will also support export intensity via supporting risky R&D projects.

The estimation results also validate that the capital intensity does not have significant effect on export performance. This is also an interesting result for policy makers. It is waited that due to (1) nominal taxation of the capital in the high inflationary environment and (2) preferences of firms to emphasize on cheap labor, capital intensity has adverse effects on export performance. Such nominal taxation adversely influences the capital accumulation of the firms and channels the entrepreneurs to compete with cheap labor. If the governments demand the capital intensity to positively influence the export performance of the firms, they should avoid the heavy emphasis of income from capital by nominal taxation in the high inflationary environments. On the contrary, the governments should give favors to the firms to accumulate capital.

Marketing intensity, share of fixed investment in total assets and net foreign exchange profits to gross sales ratio have insignificant and positive effects on export performance. The positive effects on export performance of these explanatory variables is what we are expected, but the insignificance is a result what we are not expecting from our estimation results.

Also, from our descriptive analysis, it is understood that the crises experienced in 1994 and 2000-2001 have favorably influenced the export performance. In these crises, Turkey implemented great devaluations to allow

export booms by restricting domestic demand via real cost reductions. Despite the arguments of Taymaz and Özçelik (2001), the export booms were not an illusion; on the contrary, their effects have been permanent. On the other hand, the major devaluations have no effect on the volume of exports. It is seen that, after the implementation of flexible exchange rates, the increase in the volume of exports accelerated.

As seen from Figure 6, after the crises with major devaluations, the export intensity (not volume) of the manufacturing sector increase sharply, and afterwards the manufacturing sector preserve its export intensity. Simply, the illusion is not the exports, but as Eser (1993) argues, it is the decreasing profitability of the exports. Furthermore, it should be kept in mind that, Turkey should escape from the export intensities achieved by devaluations to prevent the decreases in the welfare of the society. ***She should give emphasis on (1) the flexibility of exchange rate (not devaluations) (2) supporting R&D subsidy programs, and (3) a well-functioning financial system.***

In short, in policy terms, the results of our estimations emphasize that there is no significant relationship between export performance and R&D intensity, which could be a result of underreport of R&D expenditures in income statements and realization of its effects in the long run. The same results are also true for marketing intensity, foreign exchange profits, fixed investment intensity, capital intensity. On the other hand, a well functioning financial system must also be regarded as a must for international competitiveness for Turkey. Further some

stylized facts on export performance of Turkish manufacturing industry confirm that the increase in volume of exports accelerated after the implementation of flexible exchange rate policy. While, export intensity is affected by the major devaluations experienced in 1994 and 2001.

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APPENDIX A

TABLES AND FIGURES

Table 9. The Details of the Questionnaires prepared by the CBRT

INFORMATION ABOUT THE FIRM		
1- SECTOR		
2- YEAR - QUARTER		
3- BREAKDOWN OF THE FIRM ACC. TO LEGAL STATUS		
	JOINT-STOCK COMPANY	SOLE PROPRIETORSHIP
	HOLDING COMPANY	LIMITED PARTNERSHIP
	LIMITED LIABILITY COMPANY	COOPERATIVE
	LIMITED PARTNERSHIP WITH SHARES	FOUNDATION
	GENERAL PARTNERSHIP	PUBLIC INSTITUTION
4- CLASSIFICATION BY SIZE		
	No. of EMPLOYMENT	
	NET TURNOVER	
	NET SALES	
	OWN FUNDS	
	TOTAL ASSETS	

Table 9 (Cont.)

SECTOR INCOME STATEMENT (TL BILLIONS)
A-GROSS SALES
1-Domestic Sales
2-Exports
3-Other
B-DEDUCTIONS FROM SALES (-)
1-Sales Returns (-)
2-Sales Discounts (-)
3-Other Deductions (-)
C-NET SALES
D-COST OF GOODS SOLD (-)
1-Cost of Finished Goods Sold (-)
2-Cost of Merchandise Sold (-)
3-Cost of Services Sold (-)
4-Other Cost of Sales (-)
GROSS PROFIT OR LOSS
E-OPERATING EXPENSES (-)
1-Research and Development Expenses (-)
2-Marketing, Selling and Distribution Expenses (-)
3-General Administration Expenses (-)
OPERATING PROFIT OR LOSS
F-INCOME FROM OTHER OPERATIONS
1-Dividends from Participations
2-Dividends from Affiliated Enterprises
3-Interest Income
4-Commissions
5-Provisions that are Cancelled
6-Income from Sale of Securities
7-Exchange Profits
8-Discount Income
9-Other Income
G-EXPENSES FROM OTHER OPERATIONS (-)
1-Commissions (-)
2-Provision Expenses (-)
3-Loss from Sale of Securities (-)
4-Exchange Losses (-)
5-Discount Costs (-)
6-Other Expenditures (-)
H-FINANCING EXPENSES (-)
1-Short-term Financing Expenses (-)
2-Long-term Financing Expenses (-)
PROFIT BEFORE EXTRAORDINARY ITEMS
I-EXTRAORDINARY INCOME AND PROFITS
1-Profits and Income from Previous Period
2-Other Extraordinary Profits and Income
J-EXTRA ORDINARY EXPENSES AND LOSSES (-)
1-Losses from non-Operating Parts (-)
2-Losses from Previous Periods (-)
3-Other Extraordinary Expenses (-)
PROFIT OR LOSS BEFORE TAXES
1-Profit for the financial year
2-Loss for the financial year (-)
K-PROVISIONS FOR INC.TAX & OTH.LIAB.TO GOV.
NET PROFIT OR LOSS FOR THE FINANCIAL YEAR

Table 9 (Cont.)

SECTOR
BALANCE SHEET (TL BILLIONS)
ASSETS
I-CURRENT ASSETS
A-Liquid Assets
B- Marketable Securities
C- Short-Term Trade Receivables
D- Other Short-Term Receivables
E- Inventories
F- Constr.& Restor.Costs Spread Over Yrs.
G- Prepaym.& Accr. Inc.for the Next Months
H- Other Current Assets
II- FIXED ASSETS
A- Long-Term Trade Receivables
B- Other Long-Term Receivables
C- Financial Fixed Assets
D- Tangible Fixed Assets
E- Intangible Fixed Assets
F- Assets Subject to Depletion
G-Prepaym.& Accrued Inc. for the Next Yrs.
H- Other Long-Term Assets
TOTAL ASSETS
LIABILITIES
I- SHORT-TERM LIABILITIES
A- Financial Liabilities
B- Trade Debts
C- Other Short-Term Debts
D- Advances Received
E- Remunerations Spread Over Years
F- Taxes and Other Liabilities Payable
G- Provisions for Liabilities and Charges
H- Defer.Inc.& Accr.Exp.for the Next Months
I- Other Short-Term Liabilities
II- LONG-TERM LIABILITIES
A- Financial Liabilities
B- Trade Debts
C- Other Long-Term Debts
D-Advances Received
E- Provisions for Liabilities and Charges
F- Defer.Inc.& Accr.Exp.for the Next Yrs.
G- Other Long-Term Liabilities
III- OWN FUNDS
A- Paid-in Capital
B- Capital Reserves
C- Reserves from Retained Earnings
D- Profit Brought Forward
E- Loss Brought Forward (-)
F- Net Profit or Loss for the Financial Year
TOTAL LIABILITIES

Source: CBRT, Company Accounts

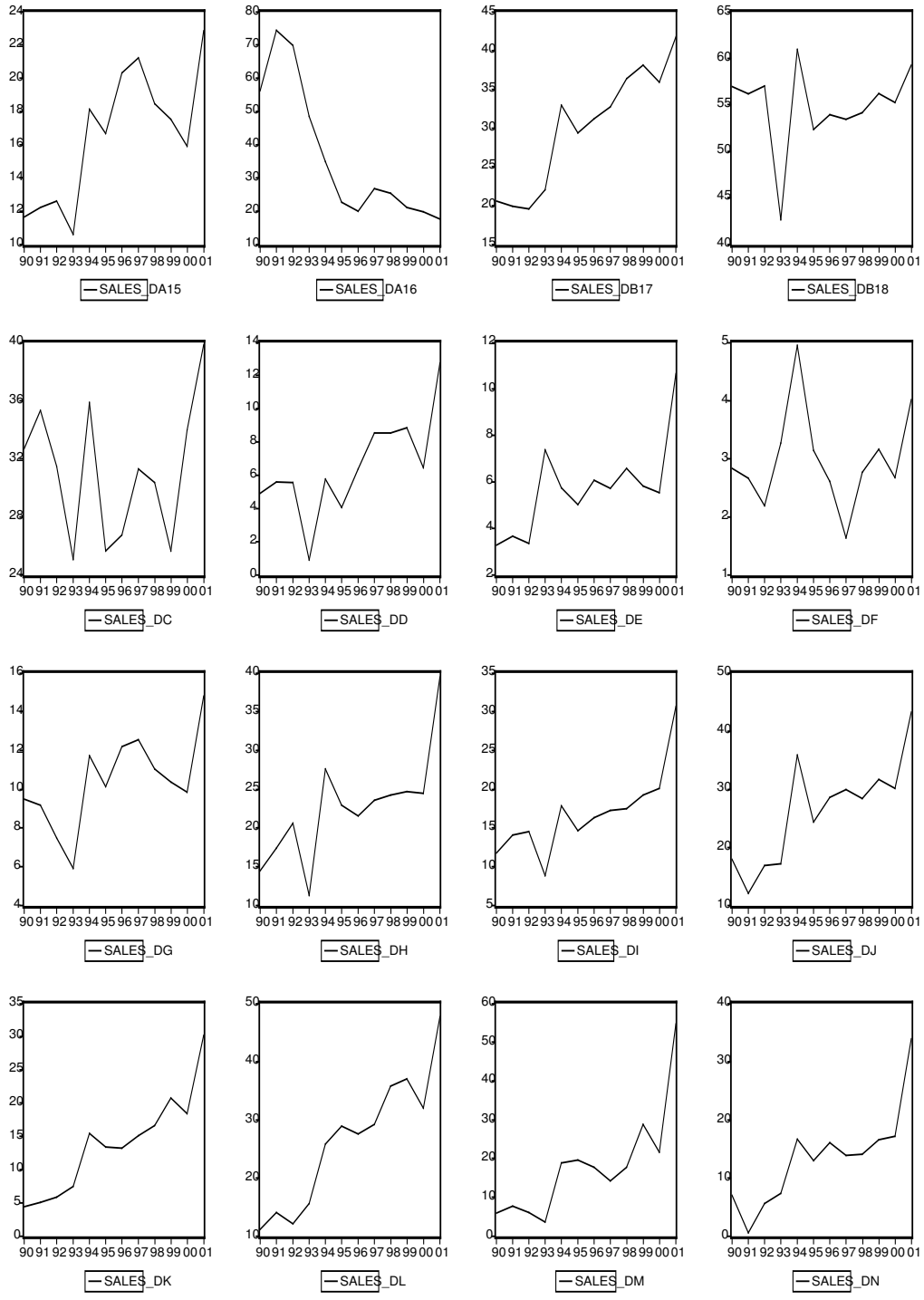

Figure 7. Graphs of Export Intensity of Sub-sectors between 1990 and 2001

Table 10. Other Estimation Results (OLS Estimation, Pooled Data, No Weighting) (Dependent Variable: Export Intensity)

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
C	15.8**	25.99*	23.3*	16.8*	24.6*	27.93*
RD	-2.38	3.94**				4.31***
CRE	0.43*	0.35*	0.37*	0.42*	0.39*	0.37*
CAP	-0.21*	-0.17**	-0.18*	-0.2*	-0.18*	-0.17***
FX	0.25	0.62	0.55	0.28		
INV	-0.07	0.06	0.05	-0.08		
ADV	-0.24	0.20	0.12	-0.21		
DUM2	9.24*			10.0*		
DUM2RD	5.85		8.38*		8.76*	
AR(1)	0.90*	0.91*	0.91*	0.91*	0.90*	0.91*
Adjusted R^2	**0.8753**	**0.8475**	**0.8524**	**0.8755**	**0.8539**	**0.8487**
# of Observations	**176**	**176**	**176**	**176**	**176**	**176**
DW	**1.89**	**2.22**	**2.18**	**1.89**	**2.19**	**2.23**

* p value is statistically significant between 0 and 0.05
** p value is statistically significant between 0.05 and 0.1
*** p value is statistically significant between 0.1 and 0.15.

Table 11. Leading Developing Exporters in 1998; distribution by technological category and growth rates (1985-98)

	Total manufacturers	RB total (%)	LT total (%)	MT total (%)	HT total (%)
Shares of total manufactured exports by technological categories 1985					
China	100	38,8	43,7	12,2	5,2
Korea	100	8,6	41,4	37,2	12,8
Taiwan	100	9,9	52,9	21,1	16,2
Mexico	100	21,1	13,2	43,2	22,5
Singapore	100	43,5	8,6	23,4	24,5
Malaysia	100	53,7	8	11,4	26,9
Thailand	100	37,9	35,4	22	4,7
Brazil	100	44	21,3	29,8	4,9
Phillipines	100	56	24,1	9	11
Indonesia	100	75,2	15,5	6,4	3
India	100	40,6	45,3	10,1	4,1
Hong Kong	100	3,2	63	19,1	14,8
Turkey	100	21,8	53,1	23,5	1,6
Shares of total manufactured exports by technological categories, 1998					
China	100	9,9	50	20,2	20
Korea	100	10,7	21	38,5	29,8
Taiwan	100	5,5	30,4	27,5	36,6
Mexico	100	6,7	19,1	44	30,1
Singapore	100	14,1	7	18,7	60,2
Malaysia	100	16,7	11	20,3	52,1
Thailand	100	19,3	25,3	20,5	34,8
Brazil	100	39,7	15,2	36,9	8,2
Phillipines	100	7,2	14,5	10,9	67,4
Indonesia	100	38,8	33	18,5	9,7
India	100	30,2	48,7	14,6	6,6
Hong Kong	100	4,5	56,3	13,2	26
Turkey	100	14,6	57,8	21,3	6,3
Rates of annual export growth 1985-98					
China	29,1%	16,2	30,5	34,2	43,2
Korea	11,6%	13,5	5,9	11,9	19,1
Taiwan	10,4%	5,5	5,8	12,7	17,6
Mexico	21,4%	11,2	24,9	21,6	24,2
Singapore	13,9%	4,5	12,1	12	22,1
Malaysia	16,9%	6,9	19,8	22,2	23
Thailand	21,2%	15,1	18,2	20,6	41,4
Brazil	6,3%	5,4	3,5	8,1	10,6
Phillipines	20,7%	3,1	16,1	22,5	38,8
Indonesia	16,1%	10,4	23,1	26	27,2
India	11,6%	9,1	12,2	14,8	15,8
Hong Kong	2,9%	5,7	2	0	7,5
Turkey	11,2%	7,8	11,9	10,3	23,6
Total above	14,2%	9,1	14,2	17,8	23,7
All developing	12,7%	6,2	12,0	14,6	21,5

* RB (Resource based), LT (Low technology), MT (Medium technology), HT (High technology)
(For more information, see Lall, 2000b)