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Master's Thesis

Trade and Specialisation in the Romanian Automotive Industry

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Abstract

The purpose of this thesis was to investigate international specialisation and trade patterns in the Romanian automotive industry. This was done in view of the Romanian EU accession in 2007, both in relation to the original 15 EU members and in the global context. The two measures used are Balassa's Revealed Comparative Advantage measurements and the Grubel-Lloyd measure for Intra-Industry Trade. The results of our findings show that Romania has comparative advantage in the production of parts and components, especially in relation to EU15, but not in finished vehicles. We did however find positive indicators that could lead to a comparative advantage in the production of finished vehicles after accession. Where trade patterns are concerned we found that the levels of Intra-Industry Trade were higher in products that showed comparative advantage. We also looked at product fragmentation and found an increased degree of product fragmentation related to a higher level of Multinational Corporation involvement and an increased inflow of Foreign Direct Investments.

Keywords: Romania, Automotive Industry, Revealed Comparative Advantage, Product Fragmentation, Intra-Industry Trade

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Abbreviations

BER – Block Exemption Regulation

CEC-5 – Central European Countries

CEEC-10 – Central East European Countries

CPI – Corruption Perception Index

DAR – Daewoo Automobile Romania

EIU – Economist Intelligence Unit

EU – European Union

EU15 – Original 15 EU members

FDI – Foreign Direct Investment

GDP – Gross Domestic Product

GNI – Gross National Income

IIT – Intra-Industry Trade

MNC – Multinational Corporation

OECD – Organisation for Economic Co-operation and Development

RCA – Revealed Comparative Advantage

SEE – South East Europe

SITC – Standard International Trade Classification

UN – United Nations

USD – United State's currency

Chapter 1 - Introduction

Recently Romania signed an agreement with the European Union (EU) setting their date of accession as January 1st 2007 if all economic and policy criteria are met. This agreement has been the push that Romania needed to undergo serious reforms in the past few years, thereby making it an attractive investment location and a trading partner of growing importance.

This thesis will investigate international specialisation in the Romanian automotive industry in relation to the original 15 EU members and in the global context. The purpose is twofold; to measure Romania's comparative advantage and degree of intra-industry trade, and to show the effects of regional integration. We have chosen the automotive industry as it is one of Romania's most important and dynamic sectors when it comes to trade and because of the growing interest from foreign investors in this sector.

The composition of this thesis is as follows. Chapter 2 will give a brief background about Romania's transition and their current economic situation. The chapter will also include Romanian trade performance and the development of Foreign Direct Investments (FDI). Chapter 3 will look at the situation in both the European and Romanian automotive sectors. Chapter 4 will discuss the three theories of relevance; Specialisation Theory, Product Fragmentation Theory and Intra-Industry Trade (IIT) Theory. Chapter 5 will look at the empirical evidence based on calculations of comparative advantage and intra-trade for the automotive sector at four different digit levels. It will also include the analysis based on previous chapters. Chapter 6 will include a summary of the thesis and we will look at the future prospects for the Romanian automotive sector.

Chapter 2 – Romania’s Background

2.1 Romania’s Transition

Romania is a lower middle-income country with Gross National Income (GNI) of 2310 USD per capita. With a population of roughly 22 million, which is greater than 19 of the EU’s 25 countries, Romania has one of the largest markets in Central and Eastern Europe. Romania is strategically situated between the EU, Russia and Turkey, it has a large port on the Black Sea and soon the Danube River will connect the Black Sea to the North Sea. The country benefits from an educated low-cost labour pool when it comes to technology, IT and engineering, and has good energy and agricultural resources.¹ In 2001 a gross monthly average salary in EU15² was 2191 euro, while in the same year it was an average of 460 euro in the 10 countries that have since joined the EU while only 165 euro in Romania.³ Romania is expected to join the EU on January 1st 2007 making it an even more attractive country to produce in.

According to the most recent Eurostat estimates, Romania's GDP per head at purchasing power parity was an estimated 7883 USD in 2004, which is half the level in Hungary. An estimated 35% of the population is living on or below the national poverty line, down from about 45% in 2000.⁴ In 2003 its GDP was 60.4 billion USD and the GDP growth was 7.6% a year.⁵ Romania has experienced economic growth in the last four years of over 5% per year, but there are still many challenges.

Romania’s transition after the fall of communism began in 1990. This transition was more difficult than for other countries in Central and Eastern Europe due to the pre-transition policies that emphasized self-reliance, putting large focus on heavy industry and large infrastructure projects. This led to the depletion of energy resources in the country which made Romania very dependant on energy and raw material imports from the West.⁶ In the early 1990s Romania was not an attractive investment destination because investments had

¹ ARIS Investor’s guidebook (2003) pp. 3-4.

² Original 15 EU members before the enlargement in 2004

³ WIR (2004) p. 77

⁴ Economist Intelligence Unit (2004)

⁵ World Bank, Country Brief (2004)

⁶ Dritsakis (2004) p. 121

been forbidden during the long communist era and after its collapse the investment environment remained undeveloped.

According to the most recent AT Kearney FDI Confidence Index, Romania has jumped from below the top 25 most attractive destinations for European investors to the 17th most attractive market which shows a significant success in attracting FDI.⁷ However, some obstacles remain. The risk of operating in Romania for foreign companies is rated as moderate to high, compared with low to moderate in the central European economies.⁸ Some of the most frequent obstacles to doing business in Romania are said to be administrative barriers, the inflexibility of the labour market, taxes, the judiciary and corruption.⁹ Romania ranks in place 87 out of 145 when it comes to Transparency International's Corruption Perception Index¹⁰ for 2004. Transparency International's CPI Score relates to perceptions of the degree of corruption as seen by business people and country analysts. The CPI ranges between 10 (highly clean) and 0 (highly corrupt); Romania's grade of 2.9 indicates severe corruption.

In December 2004 Romania held presidential elections, Traian Basescu, the mayor of Bucharest, defeated the current prime minister. Basescu made several pledges including: to make Romania an attractive investment destination, to reduce corruption and to cut taxes. The new government's first initiative was tax reform. The restructured tax system implies a flat rate of 16%, replacing three personal income tax rates ranging between 18 and 40%, and a corporate tax previously at 25%. The reasons are twofold; to simplify the current system and to lower the overall tax level so that tax evaders have more of an incentive to pay. Tax evasion is widespread, the underground economy is estimated at close to 50%¹¹ of the whole economy, making it a major issue for the government. The second initiative has been to begin a fight against corruption at high levels. Amongst other things, the government will review state contracts and will look into deals negotiated under less than transparent conditions.¹²

During the past four years the Romanian government has implemented both fiscal and monetary policies that are supportive of growth and these have led to a robust growth in GDP. Romania has achieved many goals; the fiscal deficit has decreased, the foreign reserves have

⁷ AT Kearney FDI Confidence Index (2003) p. 19

⁸ Economist Intelligence Unit (2004)

⁹ OECD Investment Policy Review (2005) p. 29

¹⁰ Transparency International (2004)

¹¹ Peterson (2005)

¹² Peterson (2005)

increased and there has been growth in both exports and imports. Further, both the unemployment rate and the inflation rate have steadily declined: in 2003 the unemployment level had fallen to 7.2%¹³ and the year-end inflation was brought below 10% in 2004 for the first time since 1989.¹⁴ All these factors have been very important for Romania, particularly in view of its EU accession in 2007. The main risks to accession in 2007 concern the implementation of EU law, especially the chapters on competition and on justice affairs. The accession treaty that was signed in April 2005 contains clauses so that the European Commission can recommend a one-year postponement of Romania's accession if there is enough evidence that Romania does not meet the accession criteria in these areas.¹⁵

2.2 Structure of Foreign Trade

Romania has a fairly liberal trade regime, as a member of the World Trade Organisation Romania has enforced the agreements concluded. At the end of 2002 its export volume had reached 13.9 billion USD, and its import volume 17.9 billion USD. Exports account for roughly one-third of GDP and the costs of imports roughly 38% of GDP.¹⁶ Romania's main export partners in 2002 were in the developed world (74.5%) and in particular the EU (67.1%).¹⁷ The main export partners in order of importance are Italy, Germany, France, the United Kingdom and the USA, while the main sources of imports are Italy, Germany, the Russian Federation, France and United Kingdom.¹⁸ Other important trade partners are Asia and Oceania. There are two sectors that comprise approximately 40% of Romanian trade and these are textile and textile articles, and machinery and mechanic appliances.¹⁹

The Standard International Trade Classification (SITC) has been adopted by, amongst others, the United Nations (UN), the Organisation for Economic Co-operation and Development (OECD) and the World Bank. This system classifies data about commodities in groupings of different levels of details, from one digit to six digit levels. Using data on the 1-digit level from the UN's COMTRADE database we compared Romania's total exports and imports. The three largest exports groups and import groups for 2004 are presented in **Figure 2.1** and **Figure 2.2** respectively, along with their development.

¹³ National Bank of Romania (2003)

¹⁴ Economist Intelligence Unit (2004)

¹⁵ Ibid

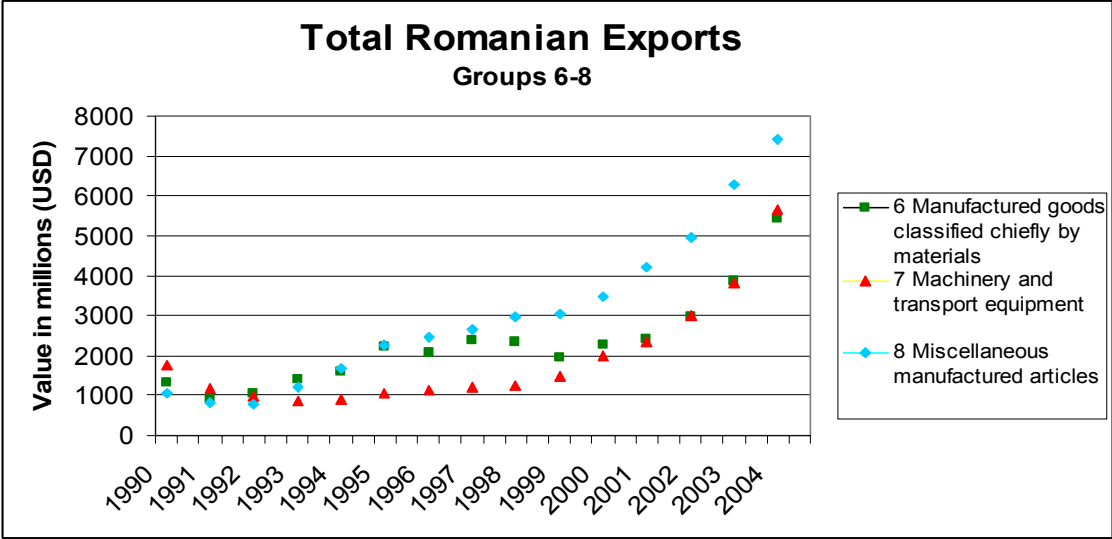
¹⁶ World Bank, Romania Data Profile, (2003)

¹⁷ Romanian Agency for Foreign Investments (2003) p. 28

¹⁸ Romanian Agency for Foreign Investments (2003) p. 29

¹⁹ Ministry of Public Information (2003) p. 82

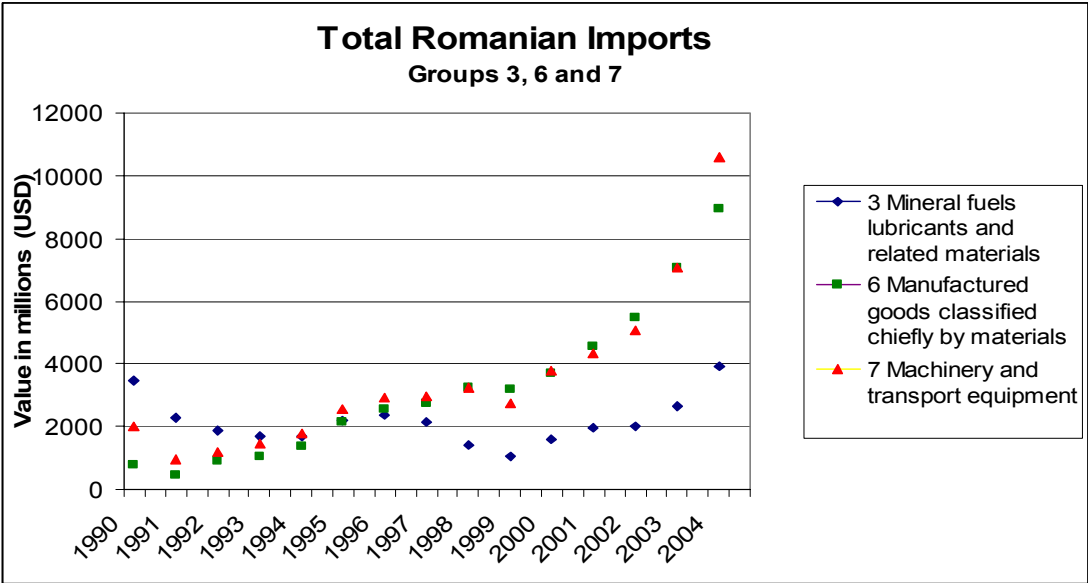
Figure 2.1: Total Romanian Exports (Groups 6-8)



Source of data: COMTRADE

The largest groups for exports are: group 6 *Manufactured Goods Classified Chiefly by Materials*, group 7 *Machinery and Transport Equipment* and group 8 *Miscellaneous Manufactured Articles* while for imports the largest groups are: group 3, *Mineral Fuels Lubricants and Related Materials*, group 6, *Manufactured Goods Classified Chiefly by Materials* and group 7, *Machinery and Transport Equipment*. This thesis will concentrate on group 7 and in particular its subgroup *Road Vehicles (78)*.

Figure 2.2: Total Romanian Imports (Groups 3, 6 and 7)

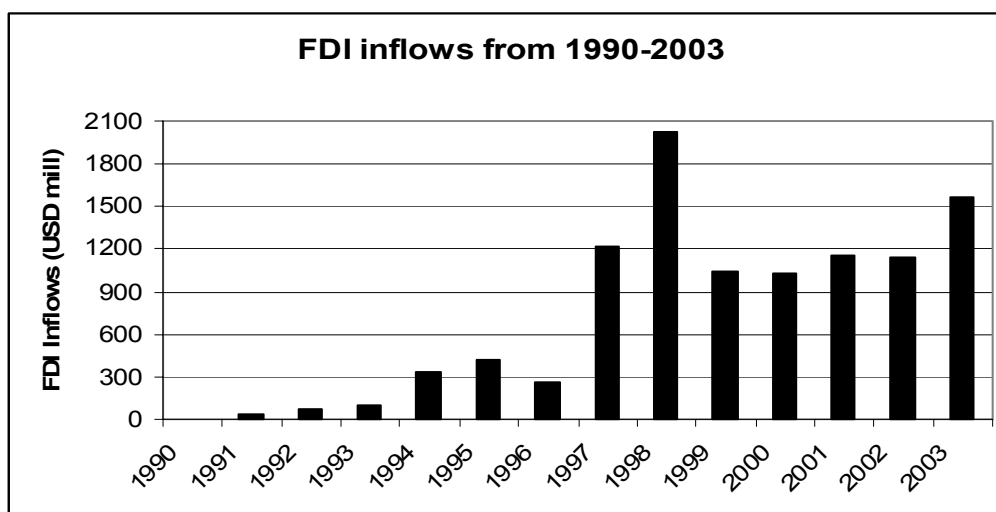


Source of data: COMTRADE

2.3 FDI Development

Foreign direct investment (FDI) in Romania was very restricted before 1990 but has since the fall of communism consistently increased. Romania's performance in attracting FDI has been inferior to expectations but FDI inflows have increased sharply following the election of the centre-right government in 1996, averaging 3.5% of GDP per year in 1997-2000. The rise in FDI was thanks to international support for the new government, as well as some large privatisations. Foreign investment has been concentrated in the automobile and automotive components industry, banking and finance, food processing, tobacco and brewing, retail stores, telecommunications, oil and gas, and construction materials. The top three foreign companies in Romania according to the Romanian Agency for Foreign Investments are owned by Renault (France), LMN Holdings (India-UK) and Rompetrol Group (Netherlands).

Figure 2.3: FDI Inflows in Romania from 1990-2003



Source of data: Three World Investment Reports; WIR1997, WIR2001 and WIR2004.

As can be seen in **Figure 2.3** FDI inflows have experienced large fluctuations, foreign investment inflows peaked at more than 2 billion USD, or 4.8% of GDP, in 1998, but declined to 1 billion USD per year in 1999-2001, picking up slightly to an estimated 1.3 billion USD in 2002.²⁰

In 2003, cumulative FDI per head in Romania was estimated at 600 USD while it was 657 USD for South East European (SEE) countries (Albania, Bosnia and Herzegovina, Bulgaria, Croatia, Macedonia, Moldova, Romania and Serbia-Montenegro) and 2611 USD for then

²⁰ Economist Intelligence Unit, (2004)

CEC-5 (Czech Republic, Hungary, Poland, Slovakia and Slovenia).²¹ The stock of FDI was estimated at approximately 10 billion USD in 2003.²²

By June 2004, there were 101 941 foreign companies in Romania with foreign capital totalling € 9 226 million in total subscribed capital. At the end of June 2004, 64.3% of all FDI were concentrated in the industry,²³ which is the largest percentage in SEE. This large percentage of investments in the Romanian industry reflects Romania's comparative advantages. Foreign firms invest in capital-intensive (steel and chemical) and labour-intensive (clothing) industries. The large concentration of FDI in manufacturing industry in Romania has resulted in increased levels of penetration of foreign companies as compared to other industries. Foreign controlled companies accounted in 2001 for almost one-third of the turnover. Foreign controlled companies also accounted for more than one-third of the share capital in manufacturing industry, which can be compared to 1995 when this number was less than 5 %.

²¹ OECD Investment Policy Review, (2005) p. 18

²² Romanian Agency for Foreign Investments, (2003) p. 82

²³ OECD Investment Policy Review –Romania, (2005) p. 22

Chapter 3 – The Automotive Sector

3.1 Introduction

This chapter will look at the Romanian automotive industry for finished vehicles and for car parts and components. To put things in perspective we will begin by looking at the European automotive industry since EU15 countries are the ones that trade most with Romania and are the countries that invest the most in the Romanian automotive industry.

3.2 The European Automotive Industry

In 2003 the EU had roughly one-third of the automotive production in the world, while America had roughly 30% and Asia-Oceania 36%.²⁴ The production includes cars, light trucks and vans, buses and coaches, medium and heavy trucks, motorcycles and agricultural and forestry tractors. The automotive industry comprised of 7.5% of the manufacturing sector in the EU and employed 2 million people. However the total employment effect (direct and indirect) was estimated to be about 10 million.

In 2002 the EU imported vehicles for a value of more than € 30.4 billion while it exported roughly double, € 66.2 billion. EU benefits from a trade surplus in this sector mainly due to its exports to the US and the Central and Eastern European countries.

Table 3.1: Automotive Products Exports and Imports in 2001 (billion USD)

	Total OECD	EU15	Japan	US	Poland/ Czech Republic/ Slovakia/ Hungary
Exports	523	270 ²⁵	80.8	56.7	13.6
Imports	486	231 ²⁶	9.6	159	11

Source: European Commission, (2005) p. 7

The ten largest global producers are presented in **Table 3.2**; the American companies General Motors and Ford Motors are the top two. The European automotive industry has few firms

²⁴ European Commission (2005) p. 5

²⁵ 85 outside EU15

²⁶ 46 outside EU15

that manufacture vehicles, but it has a large number of independent suppliers to which about two-thirds of the production is outsourced. The main European automotive industry is composed of Daimler-Chrysler, Volkswagen, BMW, Ford Europe, General Motors Europe, Renault, PSA, Fiat and Porsche. Since the year 2001, the motor vehicle production has decreased slightly in the European Union mainly due to falling consumer demand.

Table 3.2: Global Vehicle Production by Manufacturer (Cars & Trucks) – Output

	2000	2001	2002
1 General Motors ₁	8 494 000	7 786 000	8 276 000
2 Ford Motor Co. ₂	7 424 000	7 008 000	6 973 000
3 Toyota Motor Co. ₃	5 888 260	5 848 094	6 309 616
4 Volkswagen AG ₄	5 156 455	5 107 945	5 023 264
5 DaimlerChrysler AG ₅	4 677 894	4 424 200	4 471 900
6 PSA/Peugeot-Citroen SA	2 877 400	3 136 300	3 262 100
7 Hyundai Motor Co. ₆	2 545 958	2 517 719	2 913 726
8 Honda Motor Co.	2 485 213	2 651 661	2 900 787
9 Nissan Motor Co.	2 605 155	2 466 995	2 690 295
10 Renault SA ₇	2 444 370	2 375 084	2 343 954

Source of data: European Commission, (2005) p. 6

1 includes Holden, Opel, Vauxhall and Saab.

2 includes Aston Martin, Jaguar, Land Rover and Volvo Car Corp.

3 includes Daihatsu and Hino.

4 includes Audi, Bentley, Bugatti, Lamborghini, Rolls-Royce, Skoda, Seat and Volkswagen.

5 includes Chrysler group, Freightliner, Mercedes-Benz, Setra, Smart, Sterling, Thomas Built Buses and Western Star.

6 includes Hyundai Motors and Kia Motors.

7 includes Dacia and Samsung Motors.

The European Commission recently implemented new regulation to give consumers better choice and value when they buy “visible” replacement vehicle parts, such as bonnets, bumpers, doors, lamps, rear protection panels, windscreens and wings. The proposal, the Block Exemption Regulation (BER), removes Member States’ possibility to maintain design protection for such goods. The BER has been designed to accomplish several objectives: to promote intra-brand competition and the harmonisation of prices across the EU, to give dealers more independence from vehicle manufacturers, and to liberalise after-sales services and the procurement of spare parts. The BER would allow independent part manufacturers, not linked to the producers of finished vehicles, to compete throughout the EU market for visible replacement parts, with a potential worth of € 10 billion per year. The Commission estimates that these parts are 6-10 % more expensive in Member States where they are subject

to design protection. Non-visible parts, like engine or mechanical parts, are not concerned by the proposal. Neither are components in new vehicles.²⁷

According to Price Waterhouse Coopers, the number of dealers operating in the EU will fall dramatically as a result of this new proposal, from 60 000 outlets to perhaps 30 000 outlets or less since the carmakers will consolidate their distribution networks. And though some ex-dealers will become authorised repairers, the overall number of authorised repairers will also decline.²⁸

3.3 The Romanian Automotive Industry

According to the Economist Intelligence Unit (EIU) the Romanian automotive industry has been one of the most profitable branches of the economy in recent years and has been attracting increasing foreign investor interest. However the industry is still underdeveloped, and has a small production of which only 12% is exported. In 2003 roughly 60% of the sold cars in Romania were domestically manufactured. The two main actors that have contributed to domestic production are Dacia, owned by Renault (France), and in second place Daewoo Automobile Romania (DAR) that is South Korean owned. Car ownership in Romania has risen quickly between 1990 and 2004, from 56 cars per 1 000 inhabitants to 174 per 1 000. This is however extremely low compared with other countries in the region, and it is much below the developed country rates of 400-500 per 1 000 inhabitants.²⁹

Table 3.3: Top automotive companies by share of volume sales, 2003

Company	Market Share (%)
Renault	49.7
Daewoo	17.3
Volkswagen Group	9.0

Source: Economist Intelligence Unit, (2004)

Renault accounted for 38.4% of automobile sales in volume terms in 2003 and had a 49.7% share of total vehicle sales (see **Table 3.3**). Renault currently controls 99% of the Romanian Dacia. In 2003 Dacia recorded a loss of 116 million USD, however, the company anticipates

²⁷ European Commission Press Release (2004)

²⁸ Price Waterhouse Coopers, (2003)

²⁹ Economist Intelligence Unit, (2004)

that financial results will be much better in 2004 following the launch of the new car model, the Logan. Sales of the Logan since its launch in September 2004 have exceeded all expectations; the company had received orders for more than 25 000 units by early December 2004, more than double the initial expectations (10 000).³⁰

DAR sold 23 137 cars in 2003, equivalent to 21.7% of the passenger car market. DAR's future in Romania is unsure; domestic producers are facing difficult financial circumstances. DAR has invested 870 million USD in its Romanian car plant since 1994, but its debts are reported to be more than 400 million USD. DAR had to close down production of one of its main models after Dacia's launch of Logan in 2004 and now has only one main model remaining, making its position on the market very weak.³¹

3.4 The Romanian Car Parts Industry

The Romanian car parts industry has experienced rapid growth in recent years. Over 25 companies from Germany, France, Italy, Japan, the US, the UK and Sweden have invested more than 600 million USD in production plants in the country thanks to the country's cheap skilled workforce and geographical location.³² The prospects for the further expansion of the industry are good and some Western car parts producers have re-located to Romania from other locations in Eastern Europe as labour costs in those countries that have since joined the EU have risen. Without foreign capital, technology and marketing the entry into the car parts supplier industry or even the survival of existing suppliers would be inconceivable for local suppliers. Thanks to foreign capital, the productivity has increased and performances have improved significantly. It seems that an increase in FDI has expanded the trade in automotive products and parts. The case of Romania shows that even with a relatively small FDI stock in manufacturing it is possible to participate in automotive networks. Kaminski finds that by 2003 most CEEC-10³³ countries have joined the new global division of labour that is driven by product fragmentation, exceptions being Bulgaria, Latvia and Romania. However he finds that these three exceptions are following the general pattern, in Romania's case specially the automotive and IT sectors.³⁴

³⁰ Ibid

³¹ Economist Intelligence Unit, (2004)

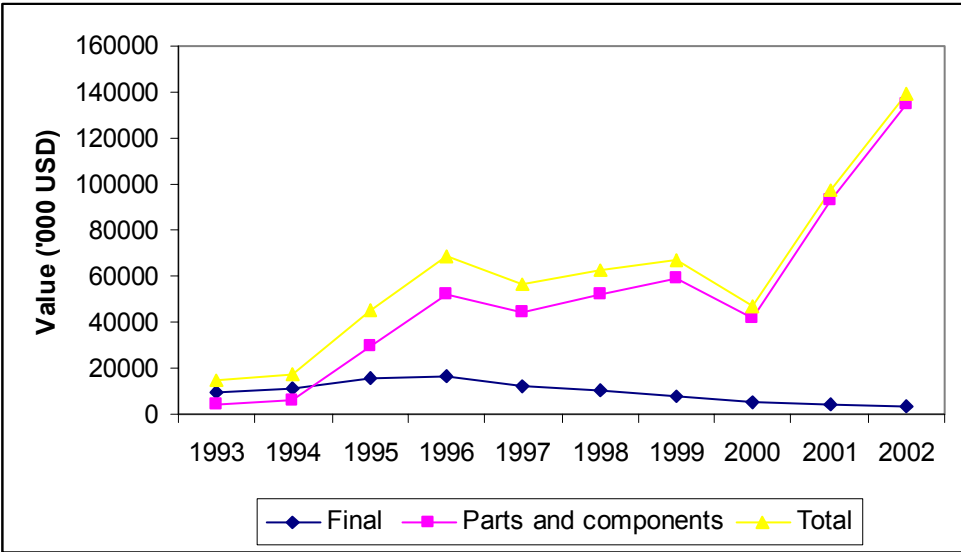
³² Ibid.

³³ Bulgaria, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Slovak Republic, Slovenia and Romania.

³⁴ Kaminski, (2004) p. 3

Dacia is the market leader on the Romanian automotive sector, as previously mentioned their sales of the new model Logan launched in September 2004 have exceeded expectations. In order to produce cars Renault have a large amount of suppliers of car parts, many of which are local. Renault created a supplier park near their factory in Pitesti where seven of Renault’s suppliers agreed to locate, and another nineteen agreed to locate nearby.³⁵ Some of these suppliers are Michelin, Cabléa, Continental, Johnson Control, Magneto and Ficosa. The plan is to produce more than 700 000 Logan cars annually in five production locations by 2010 for global export, a large number of which will be produced in Romania. The investments for this program have exceeded 350 million euros. There are 42 suppliers involved in this production that originate from 16 different countries.³⁶ DAR also uses domestically produced spare parts, roughly 58%. DAR co-operates with 226 Romanian producers who supply more than 1 000 parts.³⁷

Figure 3.1: Romanian Export Values to EU in Automotive Industry (1993-2002)



Source: Kaminski and Ng, (2004)

As can be seen in **Figure 3.1**, the exports of parts and components in the automotive industry to the EU have risen tenfold while the exports of finished cars are very low and have even decreased slightly.

³⁵ Lewis, (2005)
³⁶ Dacia Group, (2005)
³⁷ US Department of Commerce, (2005)

Chapter 4 – Measuring Trade Specialisation

4.1 Introduction

In order to investigate trade specialisation in the Romanian automotive industry we will measure Romania's comparative advantage in this sector and we will measure the degree of intra-industry trade in relation to inter-industry trade. This chapter will look at the theories and measurements concerning trade specialisation and product fragmentation and it will also look at the theories and measurements concerning intra-industry trade.

4.2 Specialisation Theory and Measures

What determines the commodity composition and direction of trade in the models of international trade? The theory of comparative advantage is widely accepted as the cause, it implies that a country specialises in the export of the product that it can produce at the lowest relative price under autarky.³⁸ However it is difficult to quantify. Different models use different approaches to determine trade patterns; one of these models is of great significance in the theory of international trade and that is the Heckscher-Ohlin model. In this model, trade arises because countries are endowed with different factor supplies. Some countries are labour-abundant, some are capital-abundant and so relative factor prices in these countries will differ since for example the labour-abundant countries will have a relatively cheap labour. A country that is labour-abundant should focus on the production of labour-intensive products and export the surplus and in turn import capital-intensive products. Conversely capital-abundant countries should produce and export capital-intensive products and import labour-intensive ones.³⁹ However the concept is very difficult to quantify and test because of the non-observable autarky relative prices in different countries which is a result that most countries have been engaged in international trade for a long time.

In the simplest Heckscher-Ohlin model with two countries, two products and two factors it is possible to calculate comparative advantage but in the real world it is more complicated. Since there is no measurement of “true” comparative advantage, some economists have used

³⁸ Greenaway & Milner, (1993) p. 181

³⁹ Todaro & Smith, (2003) p. 527

indirect methods for measuring the comparative advantage for a country. Therefore many models and suggestions have been made on how to analyse trade data between countries. One model developed in the 1980s has shown that autarky prices and net exports are negatively correlated but it did not find satisfactory answers regarding why.⁴⁰ Another suggestion was to look at several factors such as export-to-production ratios and share-of-imports in total consumption but this has been shown to give ambiguous results. Another of these indirect methods is Bela Balassa's (1965) measurement of Revealed Comparative Advantage (RCA) that is based on trade data and this is the measurement that we will use in our calculations.

Balassa suggests that "revealed" comparative advantage can be calculated through the trade performance of individual countries for manufacturing products since he believes that it reflects relative costs and therefore comparative advantage which in turn should determine the structure of exports.⁴¹ A problem with using indirect methods is that the RCA will not correspond to "true" comparative advantage, due to policy distortions and aggregations distortions.⁴² Policy distortions can include various instruments such as tariffs, quotas, standards and regulations, etc. Other distortive factors are for instance transport costs. The level of aggregation chosen for calculations should be carefully reflected upon as a too disaggregated level may reflect policy distortions due to some specific groups being victims of high trade barriers while not other groups. Products may be found to have both a comparative advantage and disadvantage while looking at different aggregation levels simply because of trade barriers. To avoid these policy and aggregation distortions Balassa has excluded imports from his calculations, since imports are more restrictive, and thus constructed RCA_1 .

Excluding imports, however, removes some of the bias though not the entirety. This is because exports are affected by the import restrictions of other countries and because the measure may dismiss the intra-industry trade and distort true specialisation. As a complement to RCA_1 , the measurement RCA_2 has been constructed that includes imports, making it a measurement of the home country's trade performance. This measure takes into account the possibility of intra-trade. Balassa's two measures are:

⁴⁰ Greenaway & Milner, (1993) p. 183

⁴¹ Balassa, (1989) p. 44

⁴² Greenaway & Milner, (1993) p. 185

$$RCA_1 = (X_{ij} / \sum_{j=1}^n X_{ij}) / (X_{wj} / \sum_{j=1}^n X_{wj})$$

$$RCA_2 = (X_{ij} - M_{ij}) / (X_{ij} + M_{ij})$$

where i = country, j = commodity and w = world.

RCA_1 measures country i 's relative export performance. If country i 's share of world exports of commodity j is larger than country i 's share of total world exports, then $RCA_1 > 1$ and comparative advantage is revealed. If $0 < RCA_1 < 1$ then a comparative disadvantage exists. RCA_2 on the other hand includes imports and measures country i 's own trade performance. This index ranges from -1 ($X_{ij} = 0$) which is revealed comparative disadvantage, to 1 ($M_{ij} = 0$) which is revealed comparative advantage and values around zero are ambiguous.⁴³ Since the measure uses only the country's own export and import figures, looking at the fluctuations in the measurement over time can show increases in exports relative to imports if the measure rises over time and congruently it shows a fall in exports relative to imports if the measure decreases over time. According to Balassa, a country's comparative advantage is said to constantly change over time as a result of the accumulation of physical and human capital as well as due to improved technological capabilities.⁴⁴

4.3 Product Fragmentation

Product fragmentation is the situation where the parts and components of manufactured goods are produced in several different countries before being assembled. Production locations are chosen based on where each component can be produced most efficiently, i.e. where the intensively used inputs are cheap. Production processes where fragmentation is possible result in a finer and more complex division of labour than production processes without fragmentation. The different phases of production are located in different places where the costs are the lowest for every production step. The division of labour matches factor intensities of components with the factor abundance of locations.⁴⁵

⁴³ Greenaway & Milner, (1993) p. 186

⁴⁴ Greenaway & Milner, (1993) p. 196

⁴⁵ Arndt & Kierzkowski, (2001) p. 2

There are two important factors in the theory of product fragmentation. These are service activities and technology progress. Lowered service costs and advances in technology encourage product fragmentation and make the production process a global process where national boundaries are less important than before. Separating the production process into several production steps in different countries leads to possibilities for exploiting gains of specialisation. The theory of fragmentation is related to the one of geography and trade, where fragmentation is about geography and where distance is being reduced between countries and regions thanks to technological advances and the reductions of service costs. In order for the fragmented production to function there must be several service links involved to generate efficient output. These service links can take the form of for example transportation, insurance, telecommunication, quality control and management control. They contribute to the organisation and coordination so that the production of every component takes place at the “best” possible location.⁴⁶

Product fragmentation is driven by many factors, for instance, wider markets, greater specialisation, lower costs of communications and transportations, and progress in technology.⁴⁷ The combination of factor intensity of the production fragments and the relative prices of factors in comparison to their productivity determines which country produces what components. Thanks to product fragmentation it is no longer necessary for producers to specialise in entire production chains and to organise them within each single firm. Fragmentation encourages producers to specialise and focus on component production which makes it possible for small and medium sized firms to compete internationally. Firm size is now less important than before,⁴⁸ this facilitates access for developing and transition countries into the global production network since they can now specialise in only one aspect of production and compete internationally. These countries may begin by competing in components that are more labour-intensive and then eventually progress and compete in the production of more capital and knowledge-intensive activities. The production-sharing relationships may make it easier for developing and transition countries to acquire knowledge and have better access to advanced technologies.⁴⁹

⁴⁶ Arndt & Kierzkowski, (2001) pp. 17-18

⁴⁷ Arndt & Kierzkowski, (2001) p. 105

⁴⁸ Arndt & Kierzkowski, (2001) p. 7

⁴⁹ Arndt & Kierzkowski, (2001) pp. 7-8

4.4 FDI and Product Fragmentation

A multinational corporation (MNC) is a corporation or enterprise that conducts and controls productive activities in more than one country. Two central characteristics of MNCs are their large size and that their worldwide operations and activities are controlled by parent companies in their home countries. The majority of these firms are from North America, Europe and Japan.⁵⁰ MNCs control a major part of the world's production and trade of goods and services.⁵¹ Earlier, MNCs focused on primary industries in developing countries, like agriculture and petroleum. But more recently there has been a shift towards investing in manufacturing and services.

For a long time product fragmentation has been seen as a domestic phenomenon rather than an international one. This is because of trade and regulatory barriers that made it impossible for firms to move parts of their production abroad. There has been a noticeable increase in the international fragmentation of production in recent years which has been explained as a result of many factors, including: low labour costs in developing and transition countries that have recently opened up to foreign investments, reduced transport costs, technological innovation, liberalisation of international trade in services and convergence of rules and laws in different countries.⁵² As a result, trade in components has been increasing and many final products are now global, pulling together components and parts from many different regions in the world. Product fragmentation is often used by MNCs that are able to separate labour-intensive production from capital-intensive production. For example, Japanese car producers export engine parts to their associates in Thailand where they are assembled into engines, using some other components procured from other countries in the region and then exported back to Japan and also sold to other markets.⁵³

Outsourcing is an example of FDI where a MNC from a developed country decides to establish a subsidiary in a developing or a transition country, where it produces labour-intensive intermediate goods which are transported back to the MNC's home country for assembly. The MNC can choose whether it will concentrate the whole production in one country or break the production process and take some of the steps of production to some

⁵⁰ Todaro & Smith, (2003) p. 635

⁵¹ Kokko, (1992) p. 1

⁵² Long, et al., (2001) p. 4

⁵³ Athukorala, (2003) p. 2

different countries. If the MNC divides production into several steps, then this can lead to technology transfer when the subsidiary brings new technology and better knowledge to a country.⁵⁴ However, not all countries are capable of benefiting from these technology transfers and spillovers.

There are many variables that influence technology transfer through spillovers in the host country. Amongst others is the level of education in the host country, labour skills and learning capability.⁵⁵ There are studies that show that these factors facilitate the transfer of technology⁵⁶. If there is higher level of education in the country and if the labour is skilled, then the training will take less time and it will be less expensive, which leads to lower costs of technology transfer and thus leads to higher transfer of technology. A country's general development level is a major determinant of how the technology will be transferred and absorbed. Weak infrastructure, uncertain property rights, and political risks are also country characteristics that influence and may deteriorate the transfer of technology from a MNC affiliate. Benefits of technology transfer in the host country are related to the development level and the competition in that country. If there is competition between affiliates and local firms and if local firms choose not to invest then the technology gap between affiliates and local firms will not be altered.

4.5 Intra-Industry Trade Theory and Measures

Comparative advantages imply that every country should export goods which are produced by their abundant factors, and therefore international trade is expected to take place among countries with different comparative advantages. However, over the last two decades, it has been noticed that countries with similar factor endowments and comparative advantages do more trade amongst themselves than with countries with differing factor endowments. This intra-industry trade is the result of imperfect competition and economies of scale. The determinants of IIT are based on country and industry characteristics. Country characteristics include; GDP per capita, income differences, country size, distance, borders and language, while industry characteristics include; product differentiation, marketing costs, variety in profit rates, FDI, economies of scale.⁵⁷ IIT can be both vertical and horizontal. Vertical IIT is

⁵⁴ Arndt & Kierzkowski, (2001) pp. 165-166

⁵⁵ Kokko, (1992), p. 82

⁵⁶ Ibid.

⁵⁷ Balassa, (1989) p. 140

a term that is used to describe the IIT of goods that are of different qualities and usually involving trade in parts and components within an industry, whereas horizontal IIT is used to define IIT of differentiated products of similar qualities. There is also something called the vertical specialisation of production which is trade in similar goods at different stages of production.⁵⁸ The country with relative labour abundance will tend to export lower quality labour-intensive products and import higher quality capital-intensive products. Some models show that there is correlation between IIT and FDI that results from intra-firm transactions and this correlation is evident in both horizontal and vertical IIT.⁵⁹ One of the most agreed-upon empirical findings concerning IIT, is that the index falls steeply when the distance between trading partners increases.⁶⁰ The reasons behind this are less agreed-upon.

The most common measurement of IIT is the Grubel-Lloyd index which measures if and how exports and imports match for a given industry relative to total trade in one specific commodity.⁶¹ As shown below the measure only looks at exports and imports of the home country.

$$IIT_i = \frac{(X_{ij} + M_{ij}) - |X_{ij} - M_{ij}|}{(X_{ij} + M_{ij})}$$

where X_{ij} = exports of country i in j commodity and M_{ij} = imports to country i of j commodity

IIT is defined as a share of total trade minus inter-industry trade. This index ranges from 0 to 1, where 0 implies no intra-industry trade and 1 implies that all trade is intra-industry trade and so values above 0.5 can be said to imply prevalence in intra-industry trade. The disadvantage of this measure is that it cannot measure the IIT of differentiated goods. This is because there is an overstatement of the true amount of IIT when it is calculated for an aggregated commodity group where the goods that are not very similar are lumped together.⁶²

⁵⁸ OECD, (2002) p. 160

⁵⁹ Martin & Blanes, (1999) pp. 5-6

⁶⁰ Balassa, (1986) p. 111

⁶¹ Greenaway & Milner, (1993) p. 1

⁶² Markusen et al., (1995) p. 235

Chapter 5 – Empirical Evidence for the Romanian Automotive Industry

5.1 Introduction

This chapter will look at the empirical results from our calculations and will analyse the past and current situations. This will be done with regards to our empirical results and the theories discussed in Chapter 4; Specialisation Theory, Product Fragmentation Theory and Intra-Industry Trade Theory. First there will be a presentation of the data that was used and the results of the calculations. The remainder of this chapter is split into two main sections, the first will analyse comparative advantages and international specialisation patterns at four different digit levels, while the second section will look at trade specialisation also at four different digit levels.

5.2 Background to Empirical Analysis

In order to measure Romania's comparative advantage in the automotive industry, we used the database Source OECD's SITC Revision 3. This was the most complete dataset of exports and imports that we could find for the years 1995 to 2003 with up to five-digit levels for the commodities. We decided not to look at the period 1990 to 1995 because those were Romania's first few years as a market economy, hence the figures would have been very low. To remove extreme fluctuations we also split the calculations into three different three-year periods, which are 1995-1997, 1998-2000 and 2001-2003 and our analysis is based on these time periods. Balassa's method asks for "world export" figures which we were unable to find and therefore we chose to use the totality of the OECD's⁶³ export rather than the world's. This choice is solely based on the access of data but since a large majority of Romania's trading partners belong to the OECD we feel that using the OECD as the "world" should not bias the data in any way. Romania does not belong to the OECD itself and consequently we used import figures from individual OECD countries as Romania's export figures from these countries and then added the amounts to obtain a total value. This as well is not the ideal

⁶³ OECD member countries are EU15, Norway, Turkey, Slovak Republic, Poland, Hungary, United States, Mexico, Czech Republic, Switzerland, Australia, Korea, Iceland, Hong Kong, Canada, Chinese Taipei, New Zealand, Japan and China.

method to obtain these figures, but once again the figures we have used should not differ greatly from “real” figures. A minor setback with the data, however, is that the SITC Revision 3 does not include all parts and components of cars that can be produced. Some parts, for example piston engines, can be used in the making of several goods but are only included in one subgroup and in this case not the group that we are looking at⁶⁴.

Once we had all the data, we proceeded to calculate Balassa’s RCA_1 and RCA_2 . We then redid the calculations but exchanged the “world” for EU15; we call these measures RCA_1^{EU} and RCA_2^{EU} . This will show us Romania’s comparative advantage in relation to EU15 and enable us to see the effects of regional integration between them. All four formulas are presented below.

$$RCA_1 = (X_{ij} / \sum_{j=1}^n X_{ij}) / (X_{wj} / \sum_{j=1}^n X_{wj})$$

$$RCA_1^{EU} = (X_{ij}^{EU} / \sum_{j=1}^n X_{ij}^{EU}) / (X_{EUj} / \sum_{j=1}^n X_{EUj})$$

$$RCA_2 = (X_{ij} - M_{ij}) / (X_{ij} + M_{ij})$$

$$RCA_2^{EU} = (X_{ij} - M_{ij}) / (X_{ij} + M_{ij})$$

where $i = \text{country}$, $j = \text{commodity}$, $X_{ij}^{EU} = \text{country } i\text{:s export of } j \text{ to the EU}$, $X_{EUj} = \text{is the EU:s export of } j \text{ and } w = \text{world}$.

We then proceeded to calculate IIT for the Romanian automotive industry in relation to the “world” for the same three time periods (1995-1997, 1998-2000 and 2001-2003) at four different digit levels (2, 3, 4 and 5 digit) by using the Grubel-Lloyd method, as explained in Chapter 4. We have also redone the calculations in relation to EU15 rather than in relation to the world and we have called this measurement IIT^{EU} , both measurements are presented below.

$$IIT_i = \frac{(X_{ij} + M_{ij}) - |X_{ij} - M_{ij}|}{(X_{ij} + M_{ij})}$$

$$IIT_i^{EU} = \frac{(X_{ij}^{EU} + M_{ij}^{EU}) - |X_{ij}^{EU} - M_{ij}^{EU}|}{(X_{ij}^{EU} + M_{ij}^{EU})}$$

where $X_{ij} = \text{export of country } i \text{ in } j \text{ commodity}$, $M_{ij} = \text{import to country } i \text{ of } j \text{ commodity}$, $X_{ij}^{EU} = \text{export of commodity } j \text{ from country } i \text{ to EU15}$ and $M_{ij}^{EU} = \text{import of commodity } j \text{ to country } i \text{ from EU15}$.

⁶⁴ Kaminski and Ng, (2001) p. 7

The group we have chosen to look at is group 78, *Motor Vehicles*. At the three-digit level it is made of six groups; groups 781, 782 and 783 comprise mainly entire vehicles and groups 784, 785 and 786 comprise mainly parts and components of vehicles. The group has sixteen subgroups at the four-digit level and thirty-four subgroups at the five-digit level. All group and subgroup names are presented in **Appendix 1**. We will look at the interesting subgroups of each level in this chapter.

5.3 Specialisation Analysis

This section will look at the results from our calculations based on Balassa's methods. We will discuss the results and analyse the findings at every digit level with the aid of Specialisation Theory and Product Fragmentation Theory. First we will repeat the highlights from the theories while putting them into perspective by taking into consideration facts discussed in Chapters 2 and 3.

The Heckscher-Ohlin Theory of Comparative Advantages suggests that countries have different factor supplies, where some are labour-abundant while others are capital-abundant. Since different relative prices arise, countries should specialise in the products using their abundant factor. Romania has relatively cheap low-skilled and high-skilled labour and should therefore specialise in labour-intensive products and hence import capital-intensive products. We assume that the production of parts and components is both low-skilled and high-skilled labour-intensive, while the production of finished cars is capital-intensive, which would explain why Romania exports more car parts and components than finished cars. It has been found that the exports of unskilled labour-intensive goods grew significantly faster than other exports in Romania between 2000 and 2003.⁶⁵ Product Fragmentation Theory has gained importance in recent years thanks in part to MNCs. The use of product fragmentation enables companies to produce parts where it is most cost effective. Due to product fragmentation it is no longer necessary for countries to specialise in whole production chains to be able to compete internationally. This is important especially for transition and developing countries, because their entry into global markets is not as limited as before.

According to Balassa, a country's comparative advantages are constantly changing over time as a result of accumulated physical and human capital, and as a result of progress in

⁶⁵ Kaminski & Ng, (2001) p. 11

technology. As previously seen, FDI has increased remarkably in the Romanian automotive sector over the last few years thanks to, for example, the investments made by Renault and their car parts suppliers. The increase in FDI in the automotive sector has led to improvements in production efficiency and has led to changes in comparative advantages.

5.3.1 Results at the Two-digit and Three-digit Levels

As can be seen in **Table 5.1** Romania has an overall comparative disadvantage in all periods in relation to both EU15 and to the world. This is reflected by RCA_1 being below 1 and by RCA_2 being below 0. The results at two-digit level reflect the combination of parts and components where Romania has a partial comparative advantage and entire vehicles where Romania does not have a comparative advantage. The comparative disadvantage in finished vehicles prevails over the comparative advantage in parts and components at aggregated levels. This is because the comparative advantage in parts and components does not exist in all subgroups, as will be seen in the following sections, and so can not counterbalance the comparative disadvantage in finished vehicles.

Table 5.1: Motor Vehicles (Group 78)

	In Relation to EU15			In Relation to World		
	1995-1997	1998-2000	2001-2003	1995-1997	1998-2000	2001-2003
RCA_1	0.1086	0.1150	0.2642	0.1532	0.1438	0.1995
RCA_2	-0.5270	-0.6913	-0.6767	-0.6564	-0.6743	-0.6576

Looking at the three-digit level we find that the only three groups that have shown or currently show comparative advantage are the ones concerned with simple vehicles (motorcycles, cycles and trailers) or parts and components. The remaining three groups that we will not discuss, groups 781, *Motor Vehicles for the transport of persons*, 782, *Motor vehicles for transport of goods* and 783, *Road motor vehicles*, show no comparative advantages.

Group 784, *Parts and accessories of vehicles*, shows a very mixed picture (see **Table 5.2**). Looking at RCA_1 there is comparative disadvantage in all time periods, while looking at RCA_2 shows a comparative advantage in relation to EU15 in all time periods but that is falling and shows a slight advantage in relation to the world between 1995 and 1997 which has become comparative disadvantage in the last period.

Table 5.2: Parts and Accessories of Vehicles of 722, 781, 782 and 783 (Group 784)

	In Relation to EU15			In Relation to World		
	1995-1997	1998-2000	2001-2003	1995-1997	1998-2000	2001-2003
RCA₁	0.2907	0.3684	0.9994	0.3531	0.4116	0.5556
RCA₂	0.1384	0.1959	0.0753	0.0086	-0.1171	-0.0321

Group 785, *Motorcycles and cycles*, shows a comparative disadvantage in all time periods but shows a progression towards comparative advantage in relation to EU15 (see **Table 5.3**) looking at both RCA₁ and RCA₂. However, in relation to the world, comparative advantage is still far from reach.

Table 5.3: Motorcycles & Cycles (Group 785)

	In Relation to EU15			In Relation to World		
	1995-1997	1998-2000	2001-2003	1995-1997	1998-2000	2001-2003
RCA₁	0.0150	0.0380	0.7774	0.0085	0.0182	0.2790
RCA₂	-0.6782	-0.4851	-0.1034	-0.8635	-0.8178	-0.3084

As shown in **Table 5.4**, group 786, *Trailers and semi-trailers*, has had a comparative advantage in the first period in relation to both the world and to EU15, but has successively lost it over time according to RCA₁. RCA₂ shows a similar progression though comparative advantage was never achieved.

Table 5.4: Trailers & Semi-trailers (Group 786)

	In Relation to EU15			In Relation to World		
	1995-1997	1998-2000	2001-2003	1995-1997	1998-2000	2001-2003
RCA₁	1.1448	1.0831	0.7988	1.2843	0.9675	0.5530
RCA₂	-0.1121	-0.5489	-0.7136	-0.0975	-0.5501	-0.6910

Already at the three-digit level we find that comparative advantage exists only in groups that concern parts and components. This follows the specialisation and product fragmentation theories regarding where production is located. For Romania, that has relatively cheap labour, this implies larger production and international specialisation in parts and components than in finished vehicles.

5.3.2 Results at the Four-digit Level

Results at the four-digit level show comparative advantage in just a few groups in the last period. Looking at RCA_1 we find four groups out of the sixteen with comparative advantage (groups 7843, 7853, 7863 and 7868) in relation to EU15 and only one group (7868) in relation to the world. The remaining groups show no indication of comparative advantage or movement in that direction. Looking at RCA_2 we find two groups with comparative advantage in relation to EU15 (groups 7843 and 7863) and only one group in relation to the world, though not the same as for RCA_1 (7863). Group 7841 had a strong comparative advantage in the first period in relation to the world according to RCA_1 and RCA_2 but this has turned into a comparative disadvantage by the third time period. We will now have a closer look at the five groups of interest.

Group 7841, *Chassis fitted with engines*, had a clear comparative advantage according to RCA_1 and RCA_2 in relation to the world in the first time period but this fell and has become a disadvantage. This fall in advantage is relative to the world and could imply improving foreign competition relative to Romanian efficiency. In relation to EU15 however, this group has not had a comparative advantage in any time period. The differences seen in the first period in relation to the world and to EU15, can be due to many reasons. One reason can be greater exports from Romania to non-EU countries, for instance the United States, in comparison to exports to EU15. A second reason could be that EU15 imported relatively little *Chassis fitted with engines* from Romania and instead imported more from other current or future member countries, for instance Germany or Hungary.

Table 5.5: Chassis Fitted with Engines of 722, 781, 782 and 783 (Group 7841)

	In Relation to EU15			In Relation to World		
	1995-1997	1998-2000	2001-2003	1995-1997	1998-2000	2001-2003
RCA_1	0.0220	0.0121	0.0417	2.7422	0.9481	0.0290
RCA_2	-0.7364	-0.6583	-0.7575	0.9160	0.3498	-0.7444

Group 7843, *Other parts and accessories*, shows a comparative advantage in relation to EU15 in the last time period. However, according to RCA_1 the advantage has increased while according to RCA_2 the already small advantage has fallen. In relation to the world no advantage is visible though RCA_1 is growing. The discrepancies seen while comparing RCA_1 and RCA_2 are probably due to import restrictions between Romania and EU15. There is a

significant difference in the comparative advantage in relation to the world and EU15 in the last time period; this probably reflects a larger integration with EU15.

Table 5.6: Other Parts and Accessories of 722, 781, 782 and 783 (Group 7843)

	In Relation to EU15			In Relation to World		
	1995-1997	1998-2000	2001-2003	1995-1997	1998-2000	2001-2003
RCA₁	0.3049	0.3883	1.0452	0.2910	0.4106	0.5679
RCA₂	0.1445	0.2114	0.0789	-0.0969	-0.1166	-0.0230

Group 7853, *Invalid carriages*, gives a mixed picture concerning comparative advantage. Looking at RCA₁ in relation to EU15 we find comparative advantage in the last period while RCA₂ shows an improvement but no comparative advantage. In relation to the world we find a positive trend but the group remains with a comparative disadvantage in the last time period. There is significant improvement in both RCA₁ and RCA₂ between the second and third time periods, in particular in relation to EU15. The shift from comparative disadvantage to large comparative advantage can possibly be attributed to the large increase in FDI inflows which began 1998 and which lead to technology transfer. The significant increase in MNC involvement in Romania and product fragmentation may have contributed to the large increase in comparative advantage.

Table 5.7: Invalid Carriages; Parts of the Articles of 785 (Group 7853)

	In Relation to EU15			In Relation to World		
	1995-1997	1998-2000	2001-2003	1995-1997	1998-2000	2001-2003
RCA₁	0.0364	0.1081	2.3221	0.0188	0.0464	0.7807
RCA₂	-0.5688	-0.3114	-0.0370	-0.7678	-0.5921	-0.1596

Group 7863, *Containers*, showed the largest comparative advantage (RCA₁=9.13) of all the groups. However this large comparative advantage was in relation to EU15 in the first time period and has since fallen, while still maintaining an advantage in the last time period (RCA₁=2.94). Looking at RCA₂, we also see that comparative advantage exists in all time periods in relation to EU15. Looking at comparative advantage in relation to the world we find none with RCA₁ but find advantage with RCA₂. The fall in comparative advantage may reflect the transition from labour-intensive production to more capital and knowledge intensive production that is suggested in Product Fragmentation Theory. The large fall in comparative advantage that can be seen in **Table 5.8**, can reflect that Romanian production of

labour-intensive goods has become relatively less efficient in relation to other countries that produce these goods.

Table 5.8: Containers (Group 7863)

	In Relation to EU15			In Relation to World		
	1995-1997	1998-2000	2001-2003	1995-1997	1998-2000	2001-2003
RCA₁	9.1283	5.1601	2.9410	0.9978	0.5338	0.2280
RCA₂	0.7620	0.8255	0.5910	0.7238	0.7744	0.5289

Group 7868, *Other vehicles, not mechanically propelled, parts*, shows a falling comparative advantage while looking at RCA₁ and we find a shift from comparative advantage to comparative disadvantage for RCA₂, in relation to both the world and EU15. This fall may reflect a shift from labour-intensive production and may reflect that Romania has become relatively less efficient in the production of goods in this group.

Table 5.9: Other Vehicles, not mechanically propelled; parts (Group 7868)

	In Relation to EU15			In Relation to World		
	1995-1997	1998-2000	2001-2003	1995-1997	1998-2000	2001-2003
RCA₁	1.5414	1.4862	1.1700	2.9782	2.0536	1.2248
RCA₂	0.5364	0.3551	-0.0318	0.5060	0.2828	-0.0601

We have looked at the five subgroups of interest and found that three of them have had falling comparative advantage while the remaining two have increased. According to Balassa's theory of changing comparative advantage, the witnessed increase in comparative advantage may have occurred due to improving technology and increased production resources, while decreasing comparative advantage may reflect a fall in relative efficiency or a shift in specialisation towards goods made with a different factor abundance.

5.3.3 Results at the Five-digit Level

There are thirty-four subgroups at the five-digit level and a large number of them have experienced interesting movements in comparative advantage. To recount the movements of each and one of them would be fastidious so we will present the information in a different manor than previously.

Firstly we will look at interesting results from RCA_1 calculations. As can be seen in **Table 5.10**, five groups had comparative advantage in the last period in relation to the world, of which four also had comparative advantage in relation to EU15 and the fifth nearly had comparative advantage. We have market in bold the highest value for each measure in relation to EU15 and to the world. Four groups have had increasing comparative advantages over the three time periods; 78432, *Other parts and accessories of bodies*, 78537, *Parts and accessories of other vehicles of motorcycles and cycles*, 78621, *Self-loading trailers and semi-trailers, agricultural*, and 78685, *Vehicles not mechanically propelled, parts*. The final group, 78689, *Parts of headings 7861, 7862, 78683 and 78685*, shows an opposite trend with falling comparative advantage over time. At this digit level we observe similar trends in relation to EU15 and to the world. On average the comparative advantage in the third period has been larger in relation to EU15. One noticeable group is group 78621 where the comparative advantage is 7.99 in final period in relation to the world, while the result for the same group in relation to EU15 is 3.98. The international specialisation is stronger at this digit level with higher RCA_1 results than for the four-digit level. The significant increase in comparative advantage may in part be due to the increased inflow of FDI that occurred in second period and due to the increased involvement of MNCs in the Romanian automotive industry.

Table 5.10: RCA_1 for Selected Groups

Group Nr.	In Relation to EU15			In Relation to World		
	1995-1997	1998-2000	2001-2003	1995-1997	1998-2000	2001-2003
78432	1.8786	1.3849	3.2843	0.9422	0.7380	1.1545
78537	0.0525	0.1736	5.7705	0.0257	0.0549	1.6120
78621	0.3942	5.1601	3.9815	1.5707	10.3591	7.9915
78685	0.3816	2.4338	3.2380	0.3273	1.4930	1.3500
78689	1.8808	1.4776	0.9767	4.6245	2.6592	1.2665

Calculations from RCA_2 show slightly different results as shown in **Table 5.11**. More subgroups were involved in movements from advantage to disadvantage and vice versa than shown from the RCA_1 results. The highest values for every group are often in the second time period. In relation to both EU15 and to the world, four groups progressed from disadvantage to advantage, 78421, *Bodies for motor vehicles for the transport of persons*, 78433, *Brakes and servo-brakes and parts thereof*, 78536, *Parts and accessories of invalid carriages*, and 78685, *Parts for Vehicles not mechanically propelled*. Once again this is probably the result of the increased FDI inflow. Five of the groups we have chosen to look at had falling

comparative advantages in relation to EU15, however, only two of those groups transitioned from comparative advantage to disadvantage over the time periods, 78435, *Drive-axles with differential*, and 78519, *Other motorcycles and cycles with auxiliary motor*. In relation to the world only one group transitioned from comparative advantage to disadvantage (78519) and two had falling comparative advantage; group 78432, *Other parts and accessories of bodies*, and 78689, *Parts of headings 7861, 7862, 78683 and 78685*. This result is probably due to decreased relative efficiency in relation to the world. The group 78621 shows an increasing comparative advantage in relation to the world and to EU15, while 78689, shows a decreasing comparative advantage, however neither of the groups have had comparative disadvantage over any of the time periods.

Table 5.11: RCA₂ for Selected Groups

Group Nr.	In Relation to EU15			In Relation to World		
	1995-1997	1998-2000	2001-2003	1995-1997	1998-2000	2001-2003
78421	-0.7333	-0.6993	0.0632	-0.3455	-0.8492	0.1667
78432	0.7866	0.8049	0.4573	0.6544	0.7126	0.4281
78433	-0.5381	0.2552	0.1881	-0.5906	0.1450	0.1013
78435	0.4715	-0.3141	-0.8736	-0.5273	-0.0343	-0.2600
78519	0.6667	-0.6440	-0.8595	0.0444	-0.9774	-0.8800
78535	-0.0190	0.3920	-0.6103	-0.1132	0.1828	-0.6358
78536	-0.3333	-0.0531	0.9210	-0.3333	-0.0521	0.9074
78621	0.2939	0.8895	0.6450	0.4679	0.8843	0.6867
78685	-0.2585	0.3988	0.3402	-0.3677	0.2779	0.1917
78689	0.6906	0.5129	0.0432	0.6873	0.4579	0.0057

As has been shown, the five-digit level presents a mixed picture with a majority of groups showing comparative disadvantage. The groups we have investigated in this section have been subgroups to 784, 785 and 786 and have all had comparative advantage in at least one time period in relation to EU15 or the world. Some of the groups have only had interesting results using one of the measurements, and are therefore only presented either in **Table 5.10** or **Table 5.11**. Several of the groups have shown different results in relation with EU15 compared to the world, which has been noticeable with both measures used. Certain groups have shown opposite results when comparing RCA₁ and RCA₂, such as groups 78432 where RCA₁ shows an increasing advantage while RCA₂ shows falling advantage. Some groups have shown similar results with both RCA measures, such as group 78685 that showed increasing comparative advantage and group 78689 that showed decreasing comparative advantage.

5.3.4 Comments

Results of our calculations have shown similar pictures concerning RCA_1 and RCA_2 , but there have been discrepancies. Amongst the reasons for these discrepancies is that RCA_2 includes imports and takes into consideration IIT while RCA_1 does not. Taking into account imports may distort results because imports are more restrictive. Excluding imports, on the other hand, means that comparative advantage of some groups will be neglected. Results have also shown differences in the comparative advantage of Romania in relation to EU15 and to the world. In general we have found higher levels of comparative advantage in relation to EU15 and the reason behind this is most likely to be their integration and increased trade amongst each other.

We have looked at results at four different levels of aggregation and have seen that the results are quite different at each level. While the two-digit level painted a very pessimistic picture of the Romanian automobile industry with no comparative advantage in any time period, we find eleven subgroups out of thirty-four at the five-digit level that have had comparative advantage in at least one time period. Both the two-digit and five-digit level are probably too aggregated and disaggregated respectively to show a good picture and so the three and four-digit levels are more interesting. At the three-digit level we found that half of the subgroups had had comparative advantage in some time period or come very close. However only one group had comparative advantage in the 2001-2003 time period and that is 784 in relation to EU15 according to RCA_2 . The four-digit level was more nuanced, it showed that a quarter of the groups we looked at had comparative advantage in the final period while looking at RCA_1 in relation to EU15 though only half that amount while looking at RCA_2 . Our empirical findings found that many groups had experienced changes in comparative advantage over time, according to Balassa's theory. At the five-digit level we found that RCA_2 had changed for a number of groups, several had gone from comparative advantage to disadvantage and several had made the reverse movement over the three observed time periods.

Kaminski and Ng expect production to move to CEEC-10 countries thanks to their lower wages, thereby increasing the specialisation in the manufacturing of parts. In their paper they conclude that this has indeed occurred.⁶⁶ Our empirical findings concerning comparative advantage in Romania's automotive sector support this theory, we found at both the four-digit and five-digit levels that the groups concerned with the production of finished vehicles had

⁶⁶ Kaminski & Ng, (2001) p. 25

comparative disadvantage, while the groups concerned with the production of parts and components showed some degree of comparative advantage during the time periods investigated. Previously, countries were forced to be efficient in the whole production chain of a good, but now a country can profit from comparative advantage in a single production stage and still compete in the international market. This is in part thanks to MNCs that enable the fragmentation of a production chain and that localise wherever the efficiency is greatest. The Romanian automotive industry has taken advantage of this opportunity and specialised in certain parts and components. This is true especially in relation to EU15, where we have observed increasing comparative advantage in some parts and components, which can be attributed to the ever increasing integration between Romania and the EU.

Some groups concerned with parts and components have had falling comparative advantage, which we have explained as a result of decreased efficiency in the global sense. This however may also be explained with the Theory of Product Fragmentation that suggests a shift from labour-intensive production to capital and knowledge intensive production. In Romania's case this would mean a shift from the production in parts and components to the production of finished vehicles.

5.4 Intra-Industry Trade Analysis

This section will look at the results from our calculations based on the Grubel-Lloyd measurement Intra-Industry Trade. We will discuss the results and analyse the findings at every digit level with the aid of IIT Theory and relevant facts discussed in Chapters 2 and 3.

5.4.1 Results at Two-digit and Three-digit Levels

IIT suggests that countries with similar factor endowments will trade with one another because of imperfect competition and economies of scale. **Table 5.12** presents the results for the whole group 78 and three interesting groups at the three-digit level. We have marked in bold the highest levels of IIT per category.

Looking at group 78 we can conclude that roughly one-third of Romania's trade with the world has been intra-trade during the whole time period, while Romania's intra-trade with EU15 has fallen from 47% to 32%. Group 78 includes both parts and components, and finished vehicles which is the reason why the results for IIT are this low in this group.

Table 5.12: IIT for Selected Groups (Two and Three-digit)

	In Relation to EU15			In Relation to World		
	1995-1997	1998-2000	2001-2003	1995-1997	1998-2000	2001-2003
78	0.4730	0.3087	0.3233	0.3436	0.3257	0.3424
784	0.8616	0.8041	0.9247	0.9467	0.8829	0.9261
785	0.3218	0.5149	0.8727	0.1365	0.1822	0.6916
786	0.8081	0.4511	0.2864	0.8242	0.4499	0.3090

A prevalence of IIT is found when the index is above 0.5. At the three-digit level there has been a prevalence of inter-industry trade in groups 781, 782 and 783. These are the same groups that showed no comparative advantage from RCA_1 and RCA_2 calculations and are the groups that only include finished vehicles. We will look at the remaining three groups, 784, *Parts & accessories of vehicles of 722, 781, 782, 783*, group 785, *Motorcycles and cycles; invalid carriages*, and group 786, *Trailers and semi-trailers; transport containers*, which mainly include parts and components and simple vehicles. The groups 784 and 785 show prevalence of IIT in relation to EU15 and in relation to the world. However group 784 has shown a stable level of IIT, while group 785 has had an increasing share of IIT and has shifted from inter-industry trade to IIT. An opposing transition has been observed in group 786, where the results have shifted from prevalent IIT to prevalent inter-industry trade in both the relations to EU15 and to the world.

5.4.2 Results at the Four-digit and Five-digit Levels

Results at the four-digit level are presented in **Table 5.13**. Out of 16 groups only three show prevalence of IIT, group 7843, *Other parts & accessories of 722, 781, 782, 783*, group 7853, *Invalid carriages; parts of motorcycles and cycles*, and group 7868, *Parts of other vehicles not mechanically propelled*, while the others show a significant prevalence of inter-industry trade in relation to EU15 and to the world. The group 7863, *Containers*, has shown an increased share of IIT over the three time periods, slightly more so in relation to the world. The group 7842, *Bodies, for the motor vehicles of 722, 781, 782, 783*, is the only group that

shows significant difference in the last time period between EU15 and the world. This group shows prevalence of IIT in relation to EU15 and prevalence of inter-industry trade in relation to the world.

Table 5.13: IIT for Selected Groups (Four-digit)

	In Relation to EU15			In Relation to World		
	1995-1997	1998-2000	2001-2003	1995-1997	1998-2000	2001-2003
7842	0.3158	0.1254	0.5174	0.0988	0.0579	0.1721
7843	0.8555	0.7886	0.9211	0.9031	0.8834	0.9329
7853	0.4312	0.6886	0.8927	0.2322	0.4079	0.8404
7863	0.2380	0.1745	0.4090	0.2762	0.2256	0.4711
7868	0.4636	0.6449	0.8125	0.4940	0.7172	0.7873

Selected results from IIT calculations are presented in **Table 5.14**, the remainder of the 34 groups have had prevalent inter-industry trade over the three time periods. As can be seen eight groups have shifted from prevalent inter-industry trade to prevalent IIT in relation to EU15 and ten groups in relation to the world. There are two groups that have transitioned to prevalence of IIT in relation to the world, but not in relation to EU15, and these are group 78434, *Gear Boxes*, and group 78435, *Drive-axles with differential*. One of these groups, 78435 has a falling share of IIT in relation to EU15, but increasing share in relation to the world. Looking at groups that have shifted from intra-trade to inter-trade, we find five in relation to EU15 (78435, 78439, 78515, 78535, and 78621) and three in relation to the world (78516, 78535 and 78621).

Table 5.14: IIT for Selected Groups (Five-digit)

Group Nr.	1995-1997	1998-2000	2001-2003	1995-1997	1998-2000	2001-2003
78421	0.2667	0.3007	0.6664	0.0295	0.1508	0.6119
78432	0.2134	0.1951	0.5427	0.3456	0.2874	0.5719
78433	0.4619	0.7448	0.8119	0.4094	0.8550	0.8987
78434	0.1285	0.1077	0.0561	0.1434	0.2940	0.5838
78435	0.5285	0.4736	0.1264	0.4727	0.6475	0.7288
78439	0.4902	0.8419	0.8433	0.4279	0.4317	0.7185
78515	0.4901	0.0983	0.1416	0.3801	0.0846	0.1351
78516	0.5758	0.0487	0.0635	0.5479	0.0475	0.0504
78531	0.1605	0.3006	0.5861	0.1605	0.2254	0.7442
78535	0.7079	0.6080	0.3897	0.7668	0.8172	0.3642
78537	0.3599	0.4524	0.8968	0.1920	0.2922	0.8493
78621	0.7061	0.1105	0.3550	0.5321	0.1157	0.3133
78685	0.5567	0.6012	0.6598	0.5481	0.7221	0.7791
78689	0.3094	0.4871	0.7824	0.3127	0.5421	0.7960

5.4.3 Comments

The groups that we found interesting when calculating RCA_1 and RCA_2 were generally the same groups that showed prevalence of IIT. At the two-digit level we found a prevalence of inter-industry trade, but when looking at the three-digit level we found that only the three groups concerned with the production of finished vehicles had a prevalence of inter-industry trade. The three remaining groups concerned with the production of parts, components and simple vehicles have prevalence of IIT in at least one time period. A similar trend has been seen at the four-digit and the five-digit levels, but at more disaggregated levels we could see which specific groups that have made the different transitions as opposed to the three-digit level. One possible reason for the transition from inter-industry trade to IIT could be increased FDI and increased MNC involvement in the Romanian automotive industry. Affiliates of MNCs tend to split production and trade these parts and components with other affiliates before assembling the goods and they will base their production where it is most efficient in terms of labour-intensive and capital-intensive. A shift of labour-intensive production phases to low labour-cost countries has become more frequent while the producers maintain fundamental phases of design and distribution in their home countries⁶⁷. Vertical IIT and the demand for differentiated goods can also be an explanation behind increased levels of IIT in Romania, since Romania might export automotive goods of lower quality and import similar goods of higher quality.

An important determinant of IIT is geographical proximity, which affects important factors such as transport costs. Another important factor behind increased levels of IIT is the integration of legislation and standards such as the current integration between Romania and the EU. As previously mentioned, Romania's most important trading partners are Italy, Germany and France. Increased levels of IIT in relation to EU15 in a few groups concerning parts and components can be a result of geographical proximity and integration, and thus a result of facilitated trade. However, one surprising result of our calculations was that we did not *generally* find a higher degree of IIT in relation to EU15 than to the world. This was expected because of Romania's upcoming accession to the EU and thus increasing integration. There are two possible explanations. The first is that levels of IIT in relation to the world include IIT in relation to EU15 and to CEC-5 countries, which makes up a large amount of Romania's trade partners. Therefore the figures in relation to the world are

⁶⁷ Baldone et al. (2001) p. 81

relatively high and the figures in relation to EU15 are not low. Another possible explanation could be that our figures end in 2003 and do not yet show changes in Romania's trade patterns. These changes will probably be more visible in the near future.

5.5 Concluding Remarks of the Empirical Analysis

Results from RCA calculations and IIT calculations generally show increased revealed comparative advantage simultaneously as increasing IIT. The opposite also generally holds; inter-industry trade and comparative disadvantage are found simultaneously in many groups. This opposes earlier theories that found that comparative advantage lead to increased inter-industry trade and so the link between comparative advantage and IIT appears to be product fragmentation. Previously firms were forced to have comparative advantage in entire products, but today they are able to specialise in the production of a single production stage. Since the different production stages are located in different countries, this forces the firms to trade internationally in order to assemble the finished good. One example of this is Renault owned Dacia in Romania. Dacia has today suppliers from at least seven different countries, most of them originating from Europe, some of these export parts and components to Romania and some have moved to the country. Different suppliers specialise in different production stages and then the assembly takes place in Romania. Product fragmentation in many countries, including Romania, has been enabled by the ever increasing involvement of MNCs and the increasing inflows of FDI. Vertical IIT and differentiated goods have also positively affected these developments.

There are instances where IIT increases but at the expense of decreasing RCA, one explanation for this can be the use of transfer pricing in the intra-firm trade. MNCs set prices between their subsidiaries at levels that lead to their highest possible overall profit and in some cases this may give the appearance that export oriented foreign firms operating in Romania make losses from their export operations.⁶⁸ In our empirical findings we found groups that have made transitions of this sort, such as group 78689, *Parts of headings 7861, 7862, 78683 and 78685*, where RCA_1 has fallen from advantage to disadvantage while the IIT has risen from 31 % to 78%, but this has not generally been the case.

⁶⁸ Voinea, (2002) p. 11

Chapter 6 – Summary and Future Prospects

The purpose of this thesis has been to investigate whether Romania has comparative advantages in the automotive sector and to investigate the possible trade specialisation in this sector. To begin with we looked at the current situation in the Romanian economy. We found that Romania has a relatively low-cost labour pool and that its strategic geographical location makes it very attractive as a recipient of FDI. Romania has benefited from high economic growth in recent years and its unemployment and inflation have both fallen. Romania has historically suffered from high levels of corruption which the new president has vowed to eradicate. International integration has improved and Romania has liberalised its trade in recent years. We then looked at the Romanian automotive sector and found that it has been one of the most profitable in recent years and it has attracted large amounts of FDI since 1997. It is still underdeveloped though, and its production is relatively low compared to other countries in the region. Two main actors are involved in this industry, the French-owned Dacia and the South Korean-owned DAR, and these fulfil most of the local demand. The Romanian car parts industry has experienced rapid growth lately; over 25 companies from several developed countries have invested more than 600 million USD in production plants in Romania.

The following chapters described relevant theories for the analysis such as; Specialisation Theory, Product Fragmentation Theory and Intra-Industry Trade Theory and our own empirical findings and analysis followed. We found that generally our results were supported by the theories. Our empirical results show generally improved comparative advantage in parts and components, but not in finished vehicles. This product fragmentation is a result of MNC involvement and has also lead to increased IIT in both the relation to EU15 and to the world.

Romania's accession to the EU in 2007 will bring about many changes to the automotive sector. There are two different viewpoints. The first suggests positive changes and increased production and trade, while the second suggests that production costs will increase leading to production movement to cheaper locations, for instance Turkey or countries in Asia. The evolution of the Romanian automotive sector is unclear. The Economists Intelligence Unit predicts that accession to the EU is likely to lead to an inflow of second hand cars and a major

fall in the sales of new cars as observed in Poland and other countries that joined the EU in 2004.⁶⁹ If this is the case then the Romanian production of car parts is likely to profit and should see a boom, while the production of finished vehicles is likely to fall.

Another positive factor for the Romanian car parts production is the European Commission proposal BER. This proposal will enable Romania to produce “visible” replacement parts and components for any car brand, which will give them a much larger market to supply. The Romanian exports of parts and components to the EU show a remarkable increasing trend which should continue. Our empirical findings from RCA_1 indicate that several groups at four-digit and five-digit levels have increasing comparative advantages, especially in relation to EU15. RCA_2 findings also show the same pattern, however the results are sometimes better in relation to the world rather than to EU15. This indicates differences in import restrictions.

As discussed in Product Fragmentation Theory, product fragmentation is driven by many factors. Some of these factors will be affected by the EU accession, for instance wider markets, greater specialisation and the progress in technology. When Romania joins the EU it will have access to a larger market to which it can export more goods without trade barriers and thus their trade specialisation will be greater. With this integration more MNCs will be interested in Romania, and their presence will lead to technology transfer through spillovers.

Despite a fear that there will be an inflow of second hand cars and a fall in the sales of new cars, there are some factors that show a brighter future for the production of the latter as well. Romania currently has comparative advantage in the production of car parts and components and no comparative advantage in the production of finished vehicles. However, thanks to technology transfer many transition and developing countries may shift from labour-intensive to more capital and knowledge-intensive production, indicating that comparative advantage in the production of finished vehicles might improve. This will depend on Romania’s ability as a host country to profit from technology transfer. Important factors are, amongst others, the level of education in the host country, labour skills and learning capability. This indicates that the specialisation patterns may change. Other positive factors are the increasing car ownership in Romania which roughly tripled in fifteen years and the launch of the new € 5000 car, Logan, which has exceeded expectations. Though there are positive indicators for the future

⁶⁹ Economist Intelligence Unit, (2004)

of the production of finished vehicle, our empirical findings do not show any shifts towards improved comparative advantages as yet, though they may occur in the future.

Regarding trade specialisation for car parts and components we have seen an increase in IIT at the four-digit and five-digit levels, especially in relation to the world, whereas the IIT for finished vehicles has been very low and is decreasing. Motorcycles are the only finished motorized products that had a high degree of IIT in the first time period; this has however fallen dramatically to nearly only inter-industry trade in the last time period. We believe that the general trend of increasing IIT for parts and components in relation to the world should continue, but it should increase at a faster pace in relation to EU15 especially after accession. Assuming that the production of finished vehicles increases as predicted then the levels of IIT should also rise, especially in relation to EU15.

As explained in our analysis, there are several positive factors that might lead to an increase in the production of finished vehicles. It is possible that the Romanian automotive industry will shift from labour-intensive to capital-intensive in the future as result from technology transfer from foreign producers and suppliers that are producing locally. Accession to the EU in the near future seems to be a very good prospect for Romania. The alleviation of trade and inflows of FDI will also benefit the automotive sector.

To conclude, Romania's accession to the EU will bring about many changes in the automotive industry as well as the whole economy. The integration with the EU will probably lead to increases in comparative advantages for the production of parts and components and possibly for finished vehicles in the future. Increases in comparative advantages will also lead to higher levels of IIT. It remains to be seen whether Romania can benefit from all advantages that the integration will bring.

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Appendix 1 - SITC Product Category for Road Vehicles

78	Road vehicles
781	Motor vehicles for the transport of persons
7811	Vehicles for travelling on snow; golf cars & simil.
7812	Motor vehicles for the transport of persons,
782	Motor vehic. for transport of goods, special purpo.
7821	Motor vehicles for the transport of goods
78211	Dumpers designed for off-highway use
78219	Motor vehicles for the transport of goods, n.e.s.
7822	Special purpose motor vehicles
78221	Crane lorries
78223	Mobile drilling derricks
78225	Fire fighting vehicles
78227	Concrete-mixer lorries
78229	Other special purpose vehicles
783	Road motor vehicles, n.e.s.
7831	Public-transport type passenger motor vehicles
78311	Public-transport vehicles (diesel or semi-diesel)
78319	Other public transport type motor vehicles
7832	Road tractors for semi-trailers
784	Parts & accessories of vehicles of 722*, 781, 782, 783
7841	Chassis fitted with engines of 722*, 781, 782, 783
7842	Bodies, for the motor vehicles of 722*, 781, 782, 783
78421	Bodies, for the vehicles of group 781
78425	Bodies, for the vehicles of groups 722*, 782 & 783
7843	Other parts & accessories of 722*, 781, 782, 783
78431	Bumpers & parts thereof
78432	Other parts & accessories of bodies
78433	Brakes & servo-brakes & parts thereof
78434	Gear boxes
78435	Drive-axles with differential
78436	Non-driving axles & parts thereof
78439	Other parts & accessories of motor vehicles
785	Motorcycles & cycles; invalid carriages
7851	Motorcycles, cycles fitted with auxiliary motor
78511	Motorcycles, cycles with reciproc. piston, < 50 cm ³
78513	Motorcycles, with reciproc. piston, 50cm ³ <cyl<250cm ³
78515	Motorcycles, with reciproc. piston, 250cm ³ <cyl<500cm ³
78516	Motorcycles, with reciproc. piston, 500cm ³ <cyl<800cm ³
78517	Motorcycles, with reciproc. piston engine>800 cm ³
78519	Other motorcycles & cycles with auxiliary motor
7852	Bicycles & other cycles, not motorized
7853	Invalid carriages; parts of the articles of 785
78531	Invalid carriages, whether or not motorized
78535	Parts & accessories of motorcycles
78536	Parts & accessories of invalid carriages
78537	Parts & accessories of other vehicles of group 785
786	Trailers & semi-trailers; transport containers
7861	Trailers & semi-trailers, for camping or housing
78621	Self-loading trailers & semi-trailers, agricultural
7862	Trailers & semi-trailers for transport of goods
78622	Tanker trailers & semi-trailers
78629	Other trailers, semi-trailers for transp. of goods
7863	Containers
7868	Other vehicles, not mechanically propelled; parts
78683	Trailers & semi-trailers, n.e.s.
78685	Vehicles, not mechanically propelled
78689	Parts of headings 7861, 7862, 78683, 78685

* *Tractors*

Appendix 2 – RCA₁

Group Nr.	RCA ₁ ^{EU}			RCA ₁		
	1995-1997	1998-2000	2001-2003	1995-1997	1998-2000	2001-2003
78	0.1086	0.1150	0.2642	0.1532	0.1438	0.1995
781	0.0276	0.0081	0.0044	0.0350	0.0247	0.0473
782	0.0315	0.0194	0.0156	0.1517	0.0345	0.0234
783	0.0165	0.0195	0.0326	0.0284	0.0245	0.0307
784	0.2907	0.3684	0.9994	0.3531	0.4116	0.5556
785	0.0150	0.0380	0.7774	0.0085	0.0182	0.2790
786	1.1448	1.0831	0.7988	1.2843	0.9675	0.5530
7811	0.0000	0.0021	0.0000	0.0000	0.0003	0.0000
7812	0.0276	0.0081	0.0044	0.0342	0.0247	0.0472
7821	0.0315	0.0173	0.0107	0.1578	0.0338	0.0216
7822	0.0298	0.0442	0.0767	0.0191	0.0417	0.0429
7831	0.0489	0.0229	0.0048	0.0356	0.0197	0.0102
7832	0.0082	0.0188	0.0406	0.0213	0.0278	0.0493
7841	0.0220	0.0121	0.0417	2.7422	0.9481	0.0290
7842	0.0087	0.0062	0.0306	0.1775	0.0164	0.0693
7843	0.3049	0.3883	1.0452	0.2910	0.4106	0.5679
7851	0.0038	0.0022	0.0043	0.0021	0.0013	0.0017
7852	0.0018	0.0002	0.0311	0.0023	0.0111	0.0126
7853	0.0364	0.1081	2.3221	0.0188	0.0464	0.7807
7861	0.0012	0.0023	0.0044	0.0038	0.2022	0.0074
7862	0.0556	0.5030	0.4135	0.1508	0.6350	0.4427
7863	9.1283	5.1601	2.9410	0.9978	0.5338	0.2280
7868	1.5414	1.4862	1.1700	2.9782	2.0536	1.2248
78211	0.0019	0.0132	0.0000	0.0004	0.0048	0.0000
78219	0.0320	0.0173	0.0110	0.1664	0.0354	0.0228
78221	0.0008	0.0004	0.0743	0.0006	0.0045	0.0711
78223	0.0000	0.0000	0.0000	0.0000	0.0596	0.0000
78225	0.0000	0.0000	0.0004	0.0000	0.0000	0.0001
78227	0.0844	0.0858	0.1280	0.0302	0.0607	0.0453
78229	0.0654	0.1017	0.0841	0.0368	0.0676	0.0399
78311	0.0498	0.0236	0.0042	0.0446	0.0150	0.0108
78319	0.0177	0.0000	0.0243	0.0010	0.0373	0.0072
78421	0.0086	0.0081	0.3141	0.2819	0.0083	0.1089
78425	0.0087	0.0060	0.0172	0.1075	0.0213	0.0474
78431	0.0099	0.0207	0.0288	0.0182	0.0204	0.0202
78432	1.8786	1.3849	3.2843	0.9422	0.7380	1.1545
78433	0.0429	0.2675	0.3795	0.0627	0.2856	0.2705
78434	0.0125	0.0054	0.0042	0.0093	0.6762	0.1337
78435	0.0279	0.0157	0.0044	0.0637	0.1341	0.0462
78436	0.0162	0.0076	0.0142	0.0337	0.0194	0.0257
78439	0.0856	0.2373	0.7916	0.1405	0.2454	0.4903
78511	0.0003	0.0002	0.0028	0.0009	0.0007	0.0037
78513	0.0034	0.0054	0.0046	0.0010	0.0020	0.0013
78515	0.0235	0.0063	0.0143	0.0076	0.0011	0.0031
78516	0.0137	0.0013	0.0052	0.0059	0.0005	0.0019
78517	0.0000	0.0028	0.0025	0.0000	0.0015	0.0009
78519	0.0701	0.0073	0.0719	0.0041	0.0006	0.0047
78531	0.0075	0.0376	0.6894	0.0072	0.0206	0.1884
78535	0.0248	0.0672	0.0662	0.0122	0.0395	0.0283
78536	0.0048	0.0713	0.2406	0.0036	0.0419	0.1036
78537	0.0525	0.1736	5.7705	0.0257	0.0549	1.6120
78621	0.3942	5.1601	3.9815	1.5707	10.3591	7.9915
78622	0.0000	0.1434	0.0802	0.0000	0.1448	0.0720
78629	0.0258	0.1667	0.1560	0.0708	0.2014	0.1531
78683	0.0451	0.0506	0.2576	0.1179	0.0455	0.7388
78685	0.3816	2.4338	3.2380	0.3273	1.4930	1.3500
78689	1.8808	1.4776	0.9767	4.6245	2.6592	1.2665

Appendix 3 – RCA₂

Group Nr.	RCA ₂ ^{EU}			RCA ₂		
	1995-1997	1998-2000	2001-2003	1995-1997	1998-2000	2001-2003
78	-0.5270	-0.6913	-0.6767	-0.6564	-0.6743	-0.6576
781	-0.7590	-0.9537	-0.9906	-0.9195	-0.9103	-0.8825
782	-0.9311	-0.9687	-0.9886	-0.6878	-0.9394	-0.9712
783	-0.9783	-0.9902	-0.9881	-0.9749	-0.9886	-0.9873
784	0.1384	0.1959	0.0753	0.0086	-0.1171	-0.0321
785	-0.6782	-0.4851	-0.1034	-0.8635	-0.8178	-0.3084
786	-0.1121	-0.5489	-0.7136	-0.0975	-0.5501	-0.6910
7811	-1.0000	-0.9867	-1.0000	-1.0000	-0.9918	-1.0000
7812	-0.7588	-0.9536	-0.9906	-0.9208	-0.9102	-0.8825
7821	-0.9199	-0.9720	-0.9918	-0.6477	-0.9388	-0.9721
7822	-0.9778	-0.9203	-0.9606	-0.9780	-0.9230	-0.9639
7831	-0.9134	-0.9728	-0.9982	-0.9081	-0.9573	-0.9912
7832	-0.9841	-0.9914	-0.9858	-0.9831	-0.9916	-0.9861
7841	-0.7364	-0.6583	-0.7575	0.9160	0.3498	-0.7444
7842	-0.6842	-0.8746	-0.4826	-0.3439	-0.9421	-0.8279
7843	0.1445	0.2114	0.0789	-0.0969	-0.1166	-0.0230
7851	-0.7682	-0.8980	-0.9516	-0.8584	-0.9186	-0.9609
7852	-0.9709	-0.9940	-0.7150	-0.9889	-0.9685	-0.9675
7853	-0.5688	-0.3114	-0.0370	-0.7678	-0.5921	-0.1596
7861	-0.8469	-0.9394	-0.9512	-0.8844	-0.3530	-0.9564
7862	-0.9691	-0.8964	-0.9272	-0.9439	-0.8955	-0.9170
7863	0.7620	0.8255	0.5910	0.7238	0.7744	0.5289
7868	0.5364	0.3551	-0.0318	0.5060	0.2828	-0.0601
78211	-0.9946	-0.9175	-1.0000	-0.9948	-0.9175	-1.0000
78219	-0.9195	-0.9721	-0.9918	-0.6455	-0.9385	-0.9718
78221	-0.9932	-0.9500	-0.7602	-0.9933	-0.8492	-0.7779
78223	-0.6667	0.0000	0.0000	-0.6667	-0.3126	0.0000
78225	-1.0000	-1.0000	-0.9993	-1.0000	-1.0000	-0.9993
78227	-0.9487	-0.9800	-0.9814	-0.9492	-0.9802	-0.9833
78229	-0.9757	-0.8957	-0.9754	-0.9759	-0.9051	-0.9776
78311	-0.9105	-0.9715	-0.9984	-0.9002	-0.9757	-0.9918
78319	-0.9888	-1.0000	-0.9896	-0.9944	-0.7748	-0.9689
78421	-0.7333	-0.6993	0.0632	-0.3455	-0.8492	0.1667
78425	-0.7031	-0.8846	-0.6395	-0.4084	-0.9478	-0.9124
78431	-0.8562	-0.8491	-0.9168	-0.7571	-0.8296	-0.8843
78432	0.7866	0.8049	0.4573	0.6544	0.7126	0.4281
78433	-0.5381	0.2552	0.1881	-0.5906	0.1450	0.1013
78434	-0.8715	-0.8923	-0.9439	-0.8566	0.7060	0.3654
78435	0.4715	-0.3141	-0.8736	-0.5273	-0.0343	-0.2600
78436	-0.8759	-0.9353	-0.8757	-0.8083	-0.9032	-0.8090
78439	-0.5098	-0.1581	-0.1567	-0.5721	-0.5683	-0.2815
78511	-0.9801	-0.9848	-0.9797	-0.9960	-0.9936	-0.9849
78513	-0.7364	-0.7603	-0.9521	-0.8041	-0.8329	-0.9630
78515	-0.5099	-0.9017	-0.8584	-0.6199	-0.9154	-0.8649
78516	-0.4242	-0.9513	-0.9365	-0.4521	-0.9525	-0.9496
78517	-1.0000	-0.8457	-0.9597	-1.0000	-0.8083	-0.9641
78519	0.6667	-0.6440	-0.8595	0.0444	-0.9774	-0.8800
78531	-0.8395	-0.6994	0.4139	-0.8395	-0.7746	0.2132
78535	-0.0190	0.3920	-0.6103	-0.1132	0.1828	-0.6358
78536	-0.3333	-0.0531	0.9210	-0.3333	-0.0521	0.9074
78537	-0.6401	-0.5476	-0.0231	-0.8080	-0.7078	-0.1507
78621	0.2939	0.8895	0.6450	0.4679	0.8843	0.6867
78622	-1.0000	-0.9826	-0.9897	-1.0000	-0.9840	-0.9909
78629	-0.9862	-0.9667	-0.9731	-0.9717	-0.9670	-0.9718
78683	-0.9513	-0.9564	-0.8853	-0.9068	-0.9628	-0.6437
78685	-0.2585	0.3988	0.3402	-0.3677	0.2779	0.1917
78689	0.6906	0.5129	0.0432	0.6873	0.4579	0.0057

Appendix 4 – IIT

Group Nr.	IIT _i ^{EU}			IIT _i		
	1995-1997	1998-2000	2001-2003	1995-1997	1998-2000	2001-2003
78	0.4730	0.3087	0.3233	0.3436	0.3257	0.3424
781	0.2410	0.0463	0.0094	0.0805	0.0897	0.1175
782	0.0689	0.0313	0.0114	0.3122	0.0606	0.0288
783	0.0217	0.0098	0.0119	0.0251	0.0114	0.0127
784	0.8616	0.8041	0.9247	0.9467	0.8829	0.9261
785	0.3218	0.5149	0.8727	0.1365	0.1822	0.6916
786	0.8081	0.4511	0.2864	0.8242	0.4499	0.3090
7811	0.0000	0.0133	0.0000	0.0000	0.0082	0.0000
7812	0.2412	0.0464	0.0094	0.0792	0.0898	0.1175
7821	0.0801	0.0280	0.0082	0.3523	0.0612	0.0279
7822	0.0222	0.0797	0.0394	0.0220	0.0770	0.0361
7831	0.0866	0.0272	0.0018	0.0919	0.0427	0.0088
7832	0.0159	0.0086	0.0142	0.0169	0.0084	0.0139
7841	0.2636	0.3258	0.2425	0.0840	0.4738	0.2556
7842	0.3158	0.1254	0.5174	0.0988	0.0579	0.1721
7843	0.8555	0.7886	0.9211	0.9031	0.8834	0.9329
7851	0.2318	0.1020	0.0484	0.1416	0.0814	0.0391
7852	0.0291	0.0060	0.2850	0.0111	0.0315	0.0325
7853	0.4312	0.6886	0.8927	0.2322	0.4079	0.8404
7861	0.1531	0.0606	0.0488	0.1156	0.1186	0.0436
7862	0.0309	0.1036	0.0728	0.0561	0.1045	0.0830
7863	0.2380	0.1745	0.4090	0.2762	0.2256	0.4711
7868	0.4636	0.6449	0.8125	0.4940	0.7172	0.7873
78211	0.0054	0.0825	0.0000	0.0052	0.0825	0.0000
78219	0.0805	0.0279	0.0082	0.3545	0.0615	0.0282
78221	0.0068	0.0500	0.2398	0.0067	0.1508	0.2221
78223	0.0000	0.0000	0.0000	0.0000	0.3126	0.0000
78225	0.0000	0.0000	0.0007	0.0000	0.0000	0.0007
78227	0.0513	0.0200	0.0186	0.0508	0.0198	0.0167
78229	0.0243	0.1043	0.0246	0.0241	0.0949	0.0224
78311	0.0895	0.0285	0.0016	0.0998	0.0243	0.0082
78319	0.0112	0.0000	0.0104	0.0056	0.2252	0.0311
78421	0.2667	0.3007	0.6664	0.0295	0.1508	0.6119
78425	0.2969	0.1154	0.3605	0.1750	0.0522	0.0876
78431	0.1438	0.1509	0.0832	0.2429	0.1704	0.1157
78432	0.2134	0.1951	0.5427	0.3456	0.2874	0.5719
78433	0.4619	0.7448	0.8119	0.4094	0.8550	0.8987
78434	0.1285	0.1077	0.0561	0.1434	0.2940	0.5838
78435	0.5285	0.4736	0.1264	0.4727	0.6475	0.7288
78436	0.1241	0.0647	0.1243	0.1917	0.0968	0.1910
78439	0.4902	0.8419	0.8433	0.4279	0.4317	0.7185
78511	0.0199	0.0152	0.0203	0.0040	0.0064	0.0151
78513	0.2636	0.2397	0.0479	0.1959	0.1671	0.0370
78515	0.4901	0.0983	0.1416	0.3801	0.0846	0.1351
78516	0.5758	0.0487	0.0635	0.5479	0.0475	0.0504
78517	0.0000	0.1543	0.0403	0.0000	0.1917	0.0359
78519	0.0000	0.0226	0.1405	0.2890	0.0226	0.1200
78531	0.1605	0.3006	0.5861	0.1605	0.2254	0.7442
78535	0.7079	0.6080	0.3897	0.7668	0.8172	0.3642
78536	0.0000	0.0531	0.0790	0.0000	0.0521	0.0926
78537	0.3599	0.4524	0.8968	0.1920	0.2922	0.8493
78621	0.7061	0.1105	0.3550	0.5321	0.1157	0.3133
78622	0.0000	0.0174	0.0103	0.0000	0.0160	0.0091
78629	0.0138	0.0333	0.0269	0.0283	0.0330	0.0282
78683	0.0487	0.0436	0.1147	0.0932	0.0372	0.3563
78685	0.5567	0.6012	0.6598	0.5481	0.7221	0.7791
78689	0.3094	0.4871	0.7824	0.3127	0.5421	0.7960