Available online at www.sciencedirect.com

ScienceDirect

Procedia - Social and Behavioral Sciences 99 (2013) 658 – 664

Procedia
Social and Behavioral Sciences

9th International Strategic Management Conference

The Contribution of Technological Change on EU's Exports

Elisabeth T. Pereira[a] , João Paulo Cerdeira Bento[b] , Janis Priede[c*]

[a,b] University of Aveiro and GOVCOPP, Aveiro, 3810-193, Portugal
[c]University of Latvia, Riga, LV-1050, Latvia

Abstract

The competitiveness of European countries is a constant concern in an environment dominated by the globalization of markets. Export competitiveness is an important dimension of a country's competitiveness. On top of that, in support to competitiveness, innovation is considered as a strong variable according to the Schumpeterian framework. This paper explores the relationship between technological change and international trade according to the OECD technological classification and the United Nations International System of Industrial Classification third revision for the 2 and 3 digit divisions of the manufacturing sector industry. An exploratory analysis is carried out on four European countries, namely on Belgium, France, Germany and Italy, over the period 2000-2007. The comparative analysis reveals stylized evidence based on annual growth rates of the share of exports in production, and the share of R&D intensity in production. The inferred conclusions from this preliminary inspection point towards a link between technological change and exports, although the conclusions cannot be generalized.

Keywords: Innovation, Technical Change, Export Performance, R&D intensity, Competitiveness, European Union

"*In contrast to many other fields of economic theory, international trade theory has traditionally kept the importance of technical change in explaining international trade flows or the international 'competitiveness' of a country or an industry at the centre of much economic debate*"

Dosi and Soete (1990: 401)

1. Introduction

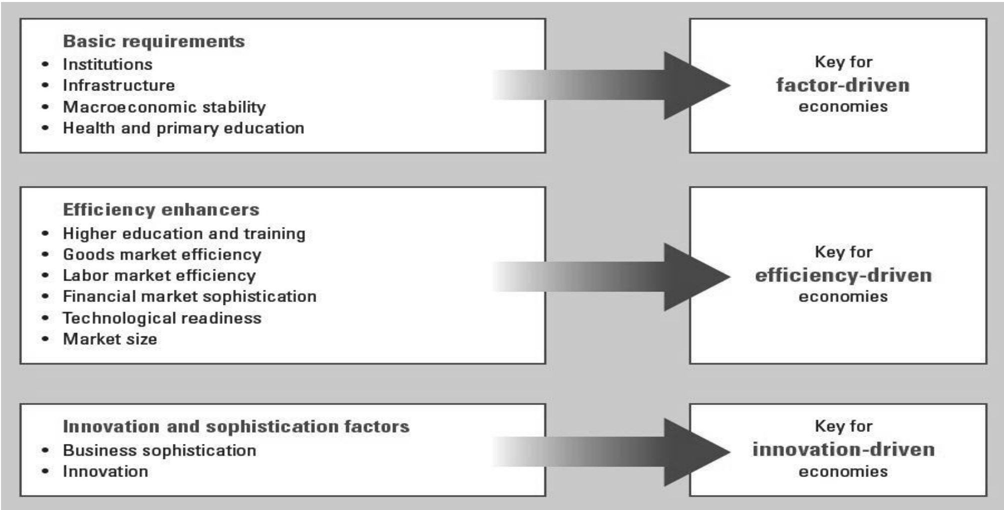
Competitiveness has increasingly gained currency across the globe. The international trade theories explain that different countries have different comparative advantages. Thus, if a country is rich in natural resources or capital, it has a comparative advantage over the others (Porter, 1990). However, in the current knowledge economy, knowledge as a resource has no natural home base and can be transferred easily anywhere in comparison to natural resources. This has made the XXI century more and more competitive (Pillania, 2009).

[*] Corresponding author. *Phone number: +371 29792305. E-mail: janis.priede@lu.lv*

1877-0428 © 2013 The Authors. Published by Elsevier Ltd. Open access under CC BY-NC-ND license.
Selection and peer-review under responsibility of the International Strategic Management Conference.
doi:10.1016/j.sbspro.2013.10.536

The concept of competitiveness thus involves static and dynamic components, being the determinants of competitiveness many and complex. In the Global Competitiveness Report (Schwab, 2011), several open-ended dimension providing a weighted average of many different components are grouped into 12 pillars of economic competitiveness (Figure 1). Innovation appears as a key factor for competitiveness of enterprises, research facilities and regions within the European Union to achieve goal of innovation – driven economies.

Figure 1. The twelve pillars of competitiveness



Source: Schwab (2011), The Global Competitiveness Report 2011-2012.

The European Union is continuously trying to enhance its international competitiveness and to find new sources of growth by using intangible assets such as innovation, science and entrepreneurship.

At the time of global financial and economic crisis, and mounting political and social pressures, innovations are increasingly seen as a vital boost to development, economic growth and job creation, and essentially, the key goal - competitiveness. This trend has been reflected in a shift in national policies and even supranational agendas like the EU's Innovation Union and the OECD's Innovation Strategy. It can be noted that increased concentration on the knowledge triangle – education, research, innovation – is in fact a common trait to all fast-growing and competitive economies (Vaidere, 2011).

It is important to perform an analysis on technological change and international trade in order to drive some conclusions on external competitiveness issues related to technological intensity of industrial manufacturing sectors and international trade. At this stage of the present study the focus will be on an exploratory study among the variables related to technological change and exports of selected EU leading countries in foreign trade.

The purpose of the present study is to investigate the contribution of technological innovation change, measured by annual rate of growth for R&D intensity, on the exports of four EU countries, measured by the annual rate of growth for export share in production by industry. To better understand this contribution a cross-correlation analysis will be used.

The present paper is organized as follows: after the introduction, section 2 briefly reviews the available literature on the relationship between technological change and international trade. Section 3 deals with the comparative and descriptive analysis, and presents stylized evidence on the empirical relationship between technological change and exports. Conclusions are presented in section 4.

2. Brief review of the literature on technological change and international trade

According to Belderbos, Duvivier and Wynen (2009), Cassiman and Martinez-Ros (2007) and Becker and Egger (2007), some determinants of successful exports are investments in capital and technologies which contribute to higher labour productivity, and the introduction of innovations, which are associated with export decisions. The relationship between innovation and foreign trade has been many times interpreted as an indicator of the non-price competitiveness of a nation's products (Buxton, Mayes and Murfin, 1991), and export success is used as one explanation for the nation's differences in world trade performances.

Several authors (e.g. Crepon, Duguet and Mairesse, 1998; Huergo and Jormandreu, 2004; Griffith et al., 2005) have associated the performance of exporting firms to firm-level technological advantages based on R&D. In recognizing the relationship between R&D and innovation as a driver for productivity, some empirical studies have examined the relationship between exports and various measures of innovation and technological capabilities (Belderbos, Duvivier and Wynen, 2009). Some of this studies, confirmed a positive relationship between exports and firms' R&D expenditures (e.g. Aw, Roberts and Winston, 2007; Aw, Roberts and Xu, 2008; Belderbos and Sleuwaegen, 1998; Basile, 2000; Sterlacchini, 1999). The study of Lefebvre, Lefebvre and Bourgault (1998) found that R&D collaboration with external partners is related with export performance. Rodriguez and Rodriguez (2005) analysed the relationship between the firm's technological capacity and its export behaviour, and conclude that the technological capacity of the firm is a key factor in its international competitiveness. Sterlacchini (1999) found that investments in product design activities and pre-production development efforts lead to export success.

Other studies have focused on the effect of the introduction of product and/or process innovations on exports, which may create or sustain on enterprises a competitive advantage in foreign markets (e.g. Becker and Egger, 2007; Cassiman and Martinez-Ros, 2007; Rodriguez and Rodriguez, 2005; Roper and Love, 2002; Wakelin, 1997, 1998). Some authors (Becker and Egger, 2007; Cassiman and Martinez-Ros, 2007) conclude that product innovation is more important than process innovation for firms' propensity to engage in export activities. Product innovations seem to be more important for foreign market entry instead process innovation seems to contribute to sustain export positions in the established foreign markets (Belderbos, Duvivier and Wynen, 2009). Overall, the existing literature indicates that innovation has become a major underlying force of exporting.

According to Roper and Love (2002) and Wakelin (1998) there are two main theoretical perspectives on the relationship between innovation and trade. The first is related to the 'neo-endowment' models based on the specialisation on factor endowments of materials, labour capital and more recently human capital and knowledge; and, the second is linked with the technology models, such as the technology-gap theory of trade (Posner, 1961) and the life-cycle approach to trade (Vernon, 1966). But, we can add to these ones the Neoschumpeterian perspective (for example, Fagerberg 1988, Fagerberg, Srholec and Knell, 2007; Meliciani, 2002), and the resource based view (e.g. Penrose, 1959; Barney, 1991, Rodriguez and Rodriguez, 2005).

The empirical literature supports the significant relationship between technological innovation and trade (Amable and Verspagen, 1995; Amendola, Dosi and Papagni, 1993; Fagerberg, 1988, 2007; Greenhalg, 1990; Gross and Helpman, 1991; Laursen, 1999; Laursen and Meliciani, 2000; Meliciani, 2002; Montobbio, 2003; Montobbio and Rampa, 2005; Wang and Guan, 2009). And many empirical research studies find evidence in the relation between innovation and trade (e.g Roper and Love, 2002; Wakelin, 1998; Anderton,1999; Ioannidis and Schreyer, 1997; Kumar and Siddharthan, 1994; Lefebvre, Lefebvre and Bourgault, 1998). In most empirical studies, R&D is used as a technology proxy (Bloom, Draca and Van Reenen, 2011; Dosi and Soete, 1988, Dosi and Soete, 1990).

In the past two decades, the globalization of technology has increased both international trade and innovative activities in some sectors related to electronics, physics, and pharmaceutical at a world level (Montobbio and Rampa, 2005). Thus, consistent cross-country and cross-sector evidence is available for the OECD economic area. Fewer studies are available that focus exclusively on the European Union member states. So, with this in mind, the present research is studying four European countries and analysing annuals rates of growth for export shares and for R&D intensity in production by industry. The aim of this study is to identify some stylized evidence and analyse the contribution of technological change, measured by R&D intensity, to export growth for the selected EU member states.

3. Descriptive data analysis and stylized evidence

To explore the relationship between technological change and exports, it is important to take a closer look at how fast all industrial sectors, classified by the United Nations International System of Industrial Classification revision 3 (ISIC Rev.3), have evolved from 2000 to 2007, both in terms of innovation and international trade. One way of looking at the relationship between technological activity and international trade is through an exploratory data analysis. Thus, it is important to bear in mind that the number of results derived from this kind of approach are limited considering the bulk of theoretical and empirical literature reviewed in the previous section. All data is valued at current prices and from OECD Structural Analysis STAN Databases. Cross-correlation coefficients are calculated to compare data of two tables from OECD Structural Analysis STAN Databases. They are measured using the Pearson product moment correlation coefficient, obtained by dividing the covariance of the two variables by the product of their standard deviations. The descriptive data analysis will reveal stylized evidence by comparing the export structure and innovation structure in four European countries, namely in Belgium, France, Germany and Italy. The country choice has been primarily dictated by data availability. These countries are also important countries of the European Union manufacture and export market.

Table 1 reports the aggregate growth rate in terms of export share of production by industry. The export share of production is an indicator which highlights the export effort and it is calculated in terms of exports as a percentage of production. The export share of production shows the importance of the foreign market for a given industry in a country. This indicator may change over time as supply and demand conditions change in foreign and domestic markets. In some cases, exports can exceed production. This can occur in three cases. First, when exports include re-exports and this particularly concerns Belgium where there is a significant amount of transit trade. Second, the production data is usually based on Industrial Surveys which record establishment's primary activities and for this reason activities that are mainly secondary may be understated in terms of production by not being allocated to the relevant ISIC code while exports of the related commodities are allocated to that ISIC code. Third, exports can exceed production when bias is introduced by the conversion from product-based trade statistics to activity-based industry statistics for certain sectors for certain countries.

Table 2 reports the annual growth rates for R&D intensity using production. The variable which deals with innovation is R&D intensity using production, and it is calculated in terms of R&D expenditures as a percentage of production. The indicator is not always available for recent years due to the difference in coverage between R&D and production data by country. The data for France is therefore used only for the year 2006.

Table 1. Annual rate of growth for export share in production by industry (2000-2007)

ISIC Rev. 3	*Industry*		*Belgium*	*France*	*Germany*	*Italy*
	Total manufacturing		2.5	0.8	2.3	1.3
15-16	Food products, beverages and tobacco	Low-tech	1.8	0.4	3.7	3.0
15	Food products and beverages	Low-tech	1.6	0.4	3.5	3.0
16	Tobacco products	Low-tech	6.4	3.4	8.7	8.6
17-19	Textiles, textile products, leather and footwear	Low-tech	4.7	4.1	3.4	0.9
17-18	Textiles and textile products	Low-tech	4.0	3.5	3.1	1.4
17	Textiles	Low-tech	2.5	1.9	1.6	1.1
18	Wearing apparel, dressing and dyeing of fur	Low-tech	6.9	5.5	5.5	2.1
19	Leather, leather products and footwear	Low-tech	6.5	5.2	4.6	-0.3
20	Wood and products of wood and cork	Low-tech	-1.8	0.1	5.2	-0.2
21-22	Pulp, paper, paper products, printing, publishing	Low-tech	1.2	0.3	3.7	0.6
21	Pulp, paper and paper products	Low-tech	2.0	0.7	1.5	1.9
22	Printing and publishing	Low-tech	-0.3	-0.2	6.2	-1.9
23-25	Chemical, rubber, plastics and fuel products	Medium- low-tech	3.5	1.4	3.4	3.6
23	Coke, refined petroleum products, nuclear fuel	Medium- low-tech	-2.5	3.8	5.6	8.2
24	Chemicals and chemical products	Medium- low-tech	5.8	1.3	3.4	3.5
244	Pharmaceuticals	High-tech	8.6	2.8	4.6	3.9
25	Rubber and plastics products	Medium- low-tech	1.8	1.2	3.2	3.1
26	Other non-metallic mineral products	Medium- low-tech	2.0	-2.7	4.1	-2.3
27-28	Basic metals and fabricated metal products	Medium- low-tech	1.9	2.5	2.5	4.5
27	Basic metals	Medium- low-tech	1.9	2.5	0.9	7.1
28	Fabricated metal products, except machinery equipment	Medium- low-tech	0.3	1.0	3.1	1.0
29-33	Machinery and equipment	Medium- low-tech	3.6	1.2	1.6	1.0
29	Machinery and equipment	Medium- low-tech	1.8	2.1	2.2	1.9
30-33	Electrical and optical equipment	Medium- low-tech	4.9	0.8	1.1	-0.8
30	Office, accounting and computing machinery	High-tech	-8.0	4.7	0.7	-8.3
31	Electrical machinery and apparatus	Medium- high-tech	5.5	1.8	3.5	2.5
32	Radio, television and communication equipment	High-tech	5.4	-0.5	-3.6	-2.4
33	Medical, precision and optical instruments	High-tech	3.8	4.7	2.8	0.1
34-35	Transport equipment	Medium- high-tech	2.9	0.1	0.7	0.9
34	Motor vehicles, trailers and semi-trailers	Medium- high-tech	2.7	0.9	1.2	2.4
35	Other transport equipment	High-tech	5.8	-1.7	-2.1	-2.0
353	Aircraft and spacecraft	High-tech	0.4	-1.5	-2.9	-6.0
	Standard deviation		3,1	2,1	2,5	3,4

Source: own calculations using data from OECD Structural Analysis STAN Databases.

Notes: industrial sectors are classified following the OECD technological classification in low-tech, medium-tech and low-tech, and high-tech industries. Numbers are expressed as a percentage.

In particular, stylized evidence displayed in Table 1 and Table 2, suggests that the annual aggregate growth rate in terms of R&D intensity in production in the technology intensive sectors is higher than the annual growth rate of all manufacturing sectors in all four countries. Thus, there are sectors where this is not the case: radio, television and communication in Germany; other transport equipment in France and Germany; pharmaceuticals in Germany and Italy. It can also be seen from the tables that the annual growth rates in terms of exports is much higher in the technology intensive sectors when compared to the total annual manufacturing growth rate. There are exceptions, however: the sectors of office, accounting and computing machinery in Belgium and Italy; radio, television and communication equipment in France, Germany and Italy; aircraft and spacecraft in France and Germany; and other transport equipment in all countries except Belgium. It can also be seen from the tables below that growth rates in terms of trade and technology are related to each other. When sectors grow faster than the average of the total in technology, sectors also seem to grow faster in terms of exports. There are some exceptions, namely in low-tech sectors, such as textiles, footwear and leather, wearing apparel, dressing and dyeing of fur, pulp, paper and paper products; basic metals, and machinery equipment.

Table 2. Annual rate of growth for R&D intensity in production by industry (2000-2007)

ISIC Rev. 3	*Industry*		*Belgium*	*France*	*Germany*	*Italy*
	Total manufacturing		-1.0	1.7	-1.2	2.0
15-16	Food products, beverages and tobacco	Low-tech	0.0	3.6	0.1	0.1
15	Food products and beverages	Low-tech	0.1	0.1	0.1	0.1
16	Tobacco products	Low-tech	9.5	7.1	5.7	0.1
17-19	Textiles, textile products, leather and footwear	Low-tech	-2.0	6.1	0.1	14.3
17-18	Textiles and textile products	Low-tech	-4.8	6.1	0.1	14.3
17	Textiles	Low-tech	-2.0	8.3	0.1	9.5
18	Wearing apparel, dressing and dyeing of fur	Low-tech	-23.8	0.1	0.1	14.3
19	Leather, leather products and footwear	Low-tech	5.0	0.1	0.1	14.3
20	Wood and products of wood and cork	Low-tech	-7.1	0.1	0.1	0.1
21-22	Pulp, paper, paper products, printing, publishing	Low-tech	-7.1	0.1	7.1	14.3
21	Pulp, paper and paper products	Low-tech	4.8	0.1	-7.1	7.1
22	Printing and publishing	Low-tech	-42.9	0.1	14.3	14.3
23-25	Chemical, rubber, plastics and fuel products	Medium- low-tech	-1.2	0.5	-2.7	-4.8
23	Coke, refined petroleum products and nuclear fuel	Medium- low-tech	-14.3	-7.1	7.1	0.1
24	Chemicals and chemical products	Medium- low-tech	1.3	1.2	-2.8	-4.3
244	Pharmaceuticals	High-tech	3.6	0.5	-2.4	-7.1
25	Rubber and plastics products	Medium- low-tech	4.3	2.6	1.1	7.1
26	Other non-metallic mineral products	Medium- low-tech	-6.1	-1.3	-7.1	7.1
27-28	Basic metals and fabricated metal products	Medium- low-tech	-5.7	0.1	-7.1	7.1
27	Basic metals	Medium- low-tech	-7.1	-2.0	-3.6	7.1
28	Fabricated metal products, except machinery and equipment	Medium- low-tech	-7.1	0.1	-2.9	7.1
29-33	Machinery and equipment	Medium- low-tech	0.9	2.3	-1.0	-1.2
29	Machinery and equipment	Medium- low-tech	1.7	1.4	-1.4	5.4
30-33	Electrical and optical equipment	Medium- low-tech	2.5	3.6	-0.7	-4.5
30	Office, accounting and computing machinery	High-tech	6.6	8.3	3.2	1.2
31	Electrical machinery and apparatus	Medium- high-tech	5.7	4.1	2.0	-2.9
32	Radio, television and communication equipment	High-tech	3.1	5.5	-7.5	-5.7
33	Medical, precision and optical instruments	High-tech	7.2	1.4	2.0	3.8
34-35	Transport equipment	Medium- high-tech	1.6	3.0	-3.5	1.5
34	Motor vehicles, trailers and semi-trailers	Medium- high-tech	0.1	4.9	-2.7	0.1
35	Other transport equipment	High-tech	6.2	-0.3	-8.8	2.1
353	Aircraft and spacecraft	High-tech	8.1	-1.1	-7.0	3.1
	Standard deviation		10,1	3,2	4,8	6,5

Source: own calculations using data from OECD Structural Analysis STAN Databases.

Notes: industrial sectors are classified following the OECD technological classification in low-tech, medium-tech and low-tech, and high-tech industries. Numbers are expressed as a percentage.

The cross-correlation coefficient varies from 0,3 to 0,6 for low-tech industries in Belgium, France and Germany, respectively, but it is negative in the case of Italy. In medium and low-tech sectors the coefficients range from -0,34, 0,03, 0,4 and 0,8 for France, Italy, Germany and Belgium respectively. In the high-tech industries cross-correlation coefficients are positive for France and Germany with 0,47 and 0,72 respectively, and show negative figures of -0,51 and -0,53 for the remaining countries in Italy and Belgium respectively. So, the relation between technological innovation on the exports are more evident in the low-tech and high-tech industries for the Germany case; while Belgium have a strong relationship between medium and low-tech sectors and exports. Italy and Belgium have a negative relation between high-tech industries with technological innovation. The results also display that the annual growth rates in relation to the mean, measured by the standard deviation, are more dispersed across sectors in technological activity than for the annual growth rates in trade across sectors.

4. Conclusions

The present exploratory and preliminary analysis is applied to the four EU countries with the purpose to evaluate the relationship between innovation technology, measured by annual growth rates of R&D in production, and foreign trade with the annual growth rates of exports in production for several industrial manufacturing sectors. Further conclusions are derived by applying the OECD technological classification of to provide stylized evidence on the link between technological innovation and foreign trade.

At this stage, we can infer, as far as it goes, that there is a connection between technological innovation and exports, as indicated by the calculated correlation coefficients. The descriptive analysis sheds some light on the type of technological improvements that may be related to export performance at the country level. Export performance may depend upon a diffused relative technological improvement in every sector, upon the type of technological specialization (high versus low technological opportunities), or finally, upon the ability to adapt, upgrade, and enter innovative sectors. Furthermore, the results cannot be generalized and it is important to keep in mind that the methodology followed here is of a preliminary and exploratory nature. Future research should therefore use more advanced research tools, such as econometric models, to study the connection between technological innovation and international trade.

References

Amable B., Verspagen B., (1995), “The role of technology in market share dynamics”. *Applied Economics*, Vol.27, pp. 197–204.

Amendola G., Dosi G., Papagni, E. (1993), “The dynamics of international competitiveness. *Weltwirtshaftliches Archiv*, Vol.129, pp.451–471.

Anderton B., (1999), “UK trade performance and the role of product quality, innovation and hysteresis: some preliminary results”, *Scottish journal of political economy*, Vol.46 (5), pp.570-595.

Aw B.Y., Roberts M. J., Winston T. (2007), “Export Market Participation, Investments in R&D and Worker Training, and the Evolution of Firm Productivity,” *The World Economy*, 14(1), pp. 83-104.

Aw, B.Y.,. Roberts M.J., Xu D. (2008), "R&D Investments, Exporting, and the Evolution of Firm Productivity," *American Economic Review*, Papers and Proceedings,Vol.98, No.2 (May), pp. 451-456.

Becker S., Egger P. (2007), “*Endogenous Product Versus Process Innovation and a Firm’s Propensity to Export*”. CESIFO Working Paper No. 1906.

Belderbos R., Duvivier F., Wynen J. (2009), “*Innovation and Export Competitiveness: Evidence from Flemish Firms*”, Working Paper Steunpunt Ondernemen en Internationaal Ondernemen (STOIO), Katholieke Universiteit Leuven.

Belderbos, R., Sleuwaegen, L., (1998), “Tariff jumping DFI and export substitution: Japanese electronics firms in Europe”, *International Journal of Industrial Organization*. 14 (5): 601 -638.

Bloom N.; Draca M. Van Reenen, J. (2011). "Trade Induced Technical Change? The Impact of Chinese Imports on Innovation, IT and Productivity," *NBER Working Papers* 16717, National Bureau of Economic Research, Inc.

Buxton, T., Mayes, D., Murfin, A. (1991). UK Trade Performance and R&D. *Economics of Innovation and New Technology* 1,pp. 243–256.

Cassiman B., Martínez-Ros E., (2007), “Product innovation and exports: Evidence from Spanish Manufacturing”, *IESE working paper*, mimeo.

Crepon B., Duguet E., Mairesse J. (1998), “Research, innovation, and productivity: An econometric analysis at the firm level”, *Economics of Innovation and New Technology,* 7, pp. 115-156.

Damijan J. P., Kostevc C., Polanec S. (2008), "From Innovation to Exporting or Vice Versa? Causal Link between Innovation Activity and Exporting in Slovenian Microdata". Licos Discussion Paper Series.

Dosi, G. Soete L. (1988), Chapter19. *Technical change and international trade* **in** *Technical Change and Economic Theory*. Edited by G. Dosi, C. Freeman, R. Nelson, G. Silverberg, L. Soete. Pinter Publisher, London and New York, pp 401-431.

G. Dosi, K. Pavitt, L. Soete. *The Economics of Technical Change and International Trade* . New York University Press. Washington Square, New York. (1990).

Fagerberg, J. (1988) International Competitiveness, *Economic Journal*, 98, pp. 355-374.

Fagerberg, J., Srholec M., Knell, M.. (2007), “The Competitiveness of Nations: Why Some Countries Prosper While Others Fall Behind”. *World Development*, 35, pp. 1595-1620.

Greenhalg C. (1990), “ Innovation and trade performance in the United Kingdom”, *The Economic Journal*, Vol. 100, pp.105–118.

Griffith R., Huergo E., Mairesse J., Peters, B. (2006), “Innovation and productivity in four European countries”, *Oxford Review of Economic Policy* 22, pp. 483-498.

Hall B.H., Lotti F., Mairesse J. (2011), Evidence on the impact of R&D and ICT investment on innovation and productivity in Italian firms, revised version of paper presented at the Concord 2010 Conference, Seville, Spain, March 2010.

Hall B.H., Mairesse J., Mohnen P. (2010), *Measuring the Returns to R&D,* in B.H. Hall and N. Rosenberg, Handbook of the Economics of Innovation, Elsevier, Amsterdam and New York.

Ioannidis E., Schreyer, P., (1997), “Technology and Non-Technology Determinants of Export Share Growth’, *OECD Economic Studies*, Vol. 28, pp. 169-205.

Kumar N., Siddharthan, N S (1994), “Technology, Firm Size and Export Behaviour in Developing Countries”, *Journal of Development Studies*, Vol. 32 (2), pp.288-309.

Laursen K., (1999). "The impact of technological opportunity on the dynamics of trade performance". *Structural Change and Economic Dynamics*, 10(3–4), pp.341–357.

Laursen, K., Meliciani, V., (2000). "The importance of technology based intersectoral linkages for market share dynamics", *Weltwirtshaft Archiv*, 136, pp.702–723.

Lefebvre E., Lefebvre L.A., Bourgault, M.,(1998), " R&D-related capabilities as determinants of export performance", *Small Business Economics*, 10: 365–377.

Mairesse J., Mohnen P. (2010), *Using innovation surveys for econometric analysis,* in B.H. Hall and N. Rosenberg (eds.), Handbook of the Economics of Innovation, Vol II, Elsevier, Amsterdam and New York.

Meliciani, V. (2002), "The impact of technological spcialisation on national performance in a balance-of payments-constrain growth model", *Strutural Change and Economic Dynamics,* 13, pp. 101-118.

Montobbio F., (2003), "Sectoral patterns of technological activity and export market share dynamics", *Cambridge Journal of Economics*, Vol.27, pp.523–545.

Montobbio F., Rampa F. (2005), "The impact of technology and structural change on export performance in nine developing countries, World Development, Vol. 33 Iss: 4, pp.527-547.

Pillania R. K., (2009), "Competitiveness and emerging markets", Business Strategy Series, Vol. 10 Iss: 2, pp.90 - 95

Porter M., (1990), Competitive Advantage of the Nations. – New York, Free Press, 857 p.

Priede J., Skapars R., (2011), Theoretical aspects of measuring countries quality competitiveness of exports// Entrepreneurship and Macroeconomic Management: Reflections on the World in Turmoil: Conference Proceedings/ 5th International Scientific Conference. – Pula: Papirus, – pp. 654. -671.

Priede. J, Skapars R., (2012), "Quality Competitiveness of Latvian´s metal Industry in the Iron and Steel Product Groups", *Economics nad Management*, 17(1), pp. 202 – 208.

Roberts, M., Tybout J. (1997), "The Decision to Export in Colombia", *American Economic Review*, 87, pp.45–65.

Rodriguez J.L., Rodriguez R.M.G. (2005), "Tecnology and Export Behavior: a resorce-based view approach", *International Business Review*, 14(5, October, pp. 539-557.

Roper S., Love J.H., (2002), "Innovation and export performance: evidence from the UK and German manufacturing", *Research Policy* 31, 1087-1102.

Schwab K. (2011), The Global Competitiveness Report 2011-2012. – Geneva, World Economic Forum.

Sterlacchini A., (1999), "Do innovative activities matter to small firms in non-R&D-intensive industries? An application to export performance". *Research Policy* 28: 819–832.

Vaidere I., (2011), "The paradigm of competitiveness and impact of innovations on regional development in the EU", *Human Resources: The Main Factor of Regional Development*; Issue 5, pp.282-291

Vernon, V (1966) 'International Investment and International Trade in the Product Cycle', *Quarterly Journal of Economics*, V. 80, pp. 190-207.

Wakelin, K. (1997) Trade and Innovation: Theory and Evidence. Cheltenham, UK: Edward Elgar.

Wakelin K., (1998), "Innovation and export behaviour at the firm level". *Research Policy*, 26, pp.829-841.

Wang G-B, Guan J-C (2009), "The Impact of Technological innovation on Export Performance: Evidence from a Cross-country analysis", Intelligent Computing and Intelligent Systems, ICIS 2009, IEEE International Conference on 20-22 Nov. 2009, Vol.3 , pp. 393-397.