



Horyzonty Polityki
2017, Vol. 8, N° 25



TOMASZ SERWACH

University of Lodz
Faculty of Economics and Sociology
Department of International Exchange
serwachtomasz@gmail.com

PIOTR GABRIELCZAK

University of Lodz
Faculty of Economics and Sociology
Department of Macroeconomics
piotr.gabrielczak@gmail.com

DOI: 10.17399/HP.2017.082507

Countries' Position in the International Trade Network According to Self-Sufficiency of Their Export Production and the Width of Their Trade Contacts – Implications for the EU¹

Abstract

RESEARCH OBJECTIVE: The first objective of this paper is to evaluate countries' position in the international trade network with regard to their two dimensions: their self-sufficiency and extent of their trade contacts. The second objective is to test the implications of the utilized criteria for the European Union member states

THE RESEARCH PROBLEM AND METHODS: It was decided to classify countries using the data on foreign value added in trade and network characteristics (mainly – vertex centrality). Different categories of countries were identified and labelled according to that criteria. Later, correlation analysis was used to determine if the utilised criteria had any effect on countries' welfare and shock resistance.

1 The research project was financed by means of the National Science Centre of Poland (Narodowe Centrum Nauki) granted upon decision number DEC-2014/13/N/HS4/02977 (contract number: UMO-2014/13/N/HS4.02977). The article was prepared by both researchers with equal percentage contribution.

Suggested citation: Serwach, T. & Gabrielczak, P. (2017). Countries' Position in the International Trade Network According to Self-Sufficiency of Their Export Production and the Width of Their Trade Contacts – Implications for the EU. *Horizons of Politics*, 8(25), 111-123. DOI: 10.17399/HP.2017.082507.

THE PROCESS OF ARGUMENTATION: In our opinion, countries that play an important role in international trade network should be important partners for numerous other countries. However, that criterion is not enough, as many less developed countries serve simply as assembly lines for value created elsewhere. Therefore we focused also on the share of imported value added to the total value of exported goods. We then tested if our notions translate to national welfare and export's resistance to external shocks, such as the Great Trade Collapse of 2008/2009.

RESEARCH RESULTS: The classification concept was applied to a sample of EU member states displaying differences between Old and New member states. The analysis proved differences in welfare and stability of export performance during the Great Trade Collapse among countries with different levels of export and import contacts and intensity of relying on imported inputs for their own export production.

CONCLUSIONS, INNOVATIONS AND RECOMMENDATIONS: It is vital to diversify export and import contacts due to possible impact of those characteristics on welfare level and stability of trade flows. At the same time, the effects of engagement in international production networks creates a trade-off: higher dependence on foreign inputs may stabilize trade dynamics at the expense of lowering GDP level.

KEYWORDS:

trade, network, value added, European Union

INTRODUCTION

The debate over advantages of engagement in international exchange has been alive among economists and politicians for many years. Numerous details about the trade flows, such as the intensity, geographical and product diversification, technological advancement and complexity of exported or imported goods, etc., may affect what are the consequences of trade. Despite this knowledge, analyses of country's position in the trade network are often surprisingly simplified and focus on very basic aspects, such as trade openness or sectoral composition of export or import. Every too often researchers concentrate on one-factor models or multi-factor approaches that are in fact just a sequence of one-factor analyses – interaction between different aspects of trade position is often neglected.

In the presented article we try to evaluate selected EU member states' position in the international trade network controlling for

two key phenomena: dependence of export production on foreign supplies and the number of established trade links. Theoretical development of the concept allowed us to define eight types of trade network participants. Then we applied our classification to sample of EU member states in order to evaluate how different types of countries contribute to the development of European international trade relations and how they correspond with other economic characteristics of the European countries, such as their income level or performance during crisis.

THE CONCEPT OF POSITIONING CRITERIA

Country's position in the international trade network could be determined by two key factors: the self-sufficiency of its export production and the range of contacts it has.

The first dimension shows the dependency of the country's output on its suppliers. This dimension is important, because in contemporary world economy goods are no longer produced and exported within bilateral relations, but global value chains have become a new standard of production organisation.² Numerous countries participate in the production process and it is believed that those countries, that contribute the most value to production process tend to have the best effects for their welfare (Mudambi, 2008). This process has become so intense, that nowadays some countries, like China, Russia, Germany or the USA, are even believed to specialize in creating input value for other countries' exports (Amador & Cabral, 2016).

To measure it we analysed the so called TiVA (Trade in Value Added) – the share of foreign value added in the total value of country's export. Such measure also displays the strength of a country's engagement in international production chains³ – the greater the analysed share, the higher dependency on imported intermediate goods. As a result, countries with extremely high shares of imported

2 More information on the reasons why global value chains have so strongly emerged in the recent decades may be found in Baldwin, 2013.

3 For further analysis of such chains and networks see, among others, Elms & Low, 2013; Kaplinsky, 2013; Jha, Amerasinghe, & Calverley, 2015.

value in their export production could be viewed as tightly linked to their co-operatives. On the other hand, countries with low TiVA should be viewed as value creators rather than only processors of imported value. Their export is based on domestic inputs, which makes it self-sufficient. In reality, fully autonomous export production is practically impossible (there are no countries with zero TiVA measure). Companies expand internationally by transferring part of their operations within their own organisation (offshoring) or based on agreements with subcontractors (international outsourcing). That is why self-sufficiency of export production can only be relative – in reference to other countries' TiVA values.

Considering the above remarks about TiVA values, we decided to introduce two categories of national economies:

- leveraged – with relatively high TiVA;
- unleveraged – with relatively low TiVA.

Suggested terms are inspired by the essence of the so called financial leverage, which usually means the relation between total held assets or liabilities and the value of company's own equity (and complementary – towards borrowed capital as well). Thus, we consider using foreign inputs to produce own export output as a form of trade leverage.

The second dimension of our analysis is the width of trade contacts. Some countries have geographically diversified international exchange structure, while others focus only on particular markets. The general idea that diversification of international trade promotes economic growth is widely supported by contemporary economic research both in theory (Hesse, 2008) and in empirics (Al-Marhubi, 2000; Agosin, 2008).

We used two basic oriented network (graph) vertex parameters to categorise countries.⁴ The first parameter is indegree, which is the number of oriented graph edges entering the vertex. Here it means import flows of a particular country. The second parameter is out-degree, which is the number of oriented graph edges originating in the vertex. Here it refers to export flows from a particular economy.

⁴ For information about network analysis read e.g. Jackson, 2008 or Newman, 2010.

Cross-reference of these network measures allowed us to define four categories of countries:

- hourglasses – countries with numerous import and export links;
- horns – countries with rare incoming flows, but a wide range of outflows;
- funnels – countries with many inflows, but much less export partners;
- straws – countries with few links on both ends of international exchange.

Figure 1 demonstrates the idea of the classification of countries according to the width of their trade contacts, at the same time graphically justifying the suggested names for each category.

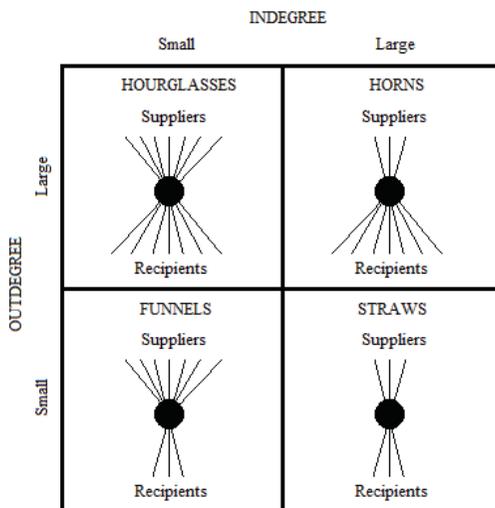


Figure 1. Country classification in reference to the number of import and export links.

Source: own elaboration.

High indegree means diversified import, while high outdegree means diversified export. There are incentives to believe, that possibility to diversify supplies allows hourglasses and funnels to be less susceptible to exogenous supply shocks. Similarly, hourglasses and horns should be more capable of absorbing external demand shocks.

Joining both analysed aspects of country positioning, we can distinguish eight types of countries in the international trade network:

- leveraged hourglasses;
- unleveraged hourglasses;
- leveraged horns;
- unleveraged horns;
- leveraged funnels;
- unleveraged funnels;
- leveraged straws;
- unleveraged straws.

Having prepared the concept of classification, we then tried to apply it to European countries.

CLASSIFICATION OF EUROPEAN COUNTRIES

Network analyses gain more and more popularity in recent years, however, they are still limited by the availability of reliable data. This limitation has also affected our research. We utilised CEPII Network Trade (CEPII) to gain information about indegree and outdegree⁵ and OECD data about TiVA (OECD). The intersection of both sets of data covered 16 countries, all of which were EU member states at the moment of conducting the research. Indegree and outdegree data was available for period 2007-2010, while TiVA was measured in a 2008-2011 horizon. For each country we calculated average values for these periods and henceforth, whenever empirical measures of any country's indegree, outdegree or TiVA are mentioned, they refer to such averages.

Indegree values of analysed countries varied within the range 76% – 100% with a mean value of about 92% and standard deviation of 6 percentage points. Outdegree values were situated within the scope 81% – 100% with mean value of 96% and standard deviation of about 5 percentage points. Indegree and outdegree distributions

5 CEPII presents this data in relative terms, which means that actual indegree or outdegree in absolute terms, as defined before, is related to total number of all possible edges that could be flowing in or out of the vertex if the network was complete.

in our sample group do not match because CEPII database included other countries as well, which lead to occurrence of flows that either were only originated or completed in the sample group. TiVA values came from the range 19% – 48% with the mean value of about 31% and standard deviation of 8 percentage points. With generally high indegrees and outdegrees and a third part of own export value on average being created abroad, we argue that EU member state are significantly interdependent on each other in terms of international trade and form a rather dense network of strong connections.

Similarly to the proposed concept of countries' position in network, our empirical sample can be divided into countries with values above and below mean values with respect to any of the three considered measures. Cross-reference of such divisions results in classification of analysed EU member states, which is presented in Table 1.

Table 1

Classification of European countries in reference to self-sufficiency of their export production and the range of their trade contacts

Trade network characteristics		Number of import flows (indegree)	
Relatively high		Relatively low	
Number of export flows (outdegree)	Relatively high	<p>HOURGLASSES</p> <ul style="list-style-type: none"> • Austria • Denmark • France • Greece • Ireland • Portugal • Spain • Sweden • United Kingdom 	<p>HORNS</p> <ul style="list-style-type: none"> • Finland
	Relatively low	<p>FUNNELS</p> <ul style="list-style-type: none"> • Czech Republic • Poland 	<p>STRAWS</p> <ul style="list-style-type: none"> • Estonia • Hungary • Slovakia • Slovenia

Italics – countries with high network leverage.

Source: own elaboration.

The majority of analysed EU countries are hourglasses, also straws are widely represented. This proves that in most cases indegree and outdegree follow the same pattern and if one measure is high or low, so is the other. There were only 3 mixed cases (horns or funnels). What

is more, all countries with relatively low indegree turned out to be leveraged exporters> At the same time countries with wide import contacts did not manifest an unequivocal pattern, however, most of them were characterised by rather low values of TiVA. Trade leverage had similar properties in reference to export contacts – leveraged exporters usually had a relatively narrow group of recipients.

Our sample included 10 countries of the so called Old Union (member states that had joined EU before 2004) and 6 countries that were included in UE in 2004 (analogically we can name them New Union countries). Excluding Finland, the only horn in the sample, we can say that Old Union countries are hourglasses – they have diversified international trade contacts on both ends of the exchange process. What is more, 6 out of 10 countries of the Old Union were relatively unleveraged. As for the New Union, 5 out of 6 countries were classified as leveraged⁶ and all of them had relatively few export partners. As a matter of fact, most of them were straws, so it seems justified to claim that New Union member states are typically leveraged exporters with narrow international contacts. One very important observation is that Old Union member states demonstrate a mixed pattern of utilising trade leverage, but New Union representatives clearly tend to use high levels of leverage, which means that their exported output is largely dependent on value created abroad. This supports the commonly stated idea that New Union countries, often abundant in cheaper labour force, serve as assembly halls for the Old Union. In terms of long-term economic development, this tendency should be considered as a negative one, contributing rather to an increase of wealth gap between both groups of EU member states than to its closing.

Despite the efforts taken by the New Union member states, Old Union countries seem to have a clear advantage in international trade. They are more independent from particular international production chains, as they have established contacts with numerous partners. Their export value is also more self-sufficient, not as largely based on imported inputs as in case of New Union countries. Moreover,

6 As a matter of fact, Poland, which was the only unleveraged country of the New Union, had TiVA value of 30.5% with 31% being the border value. Thus, Poland was in fact very close to being a leveraged exporter.

greater diversification of export and import helps them to better disperse external shocks, both demand and supply side.

IMPLICATIONS

Suggested classification criteria are associated with more general characteristics of national economies. To start with, presented classification reflects the level of income. The results are presented in table 2.

Table 2

Pearson correlation coefficients between classification criteria and GDP per capita

Variables	Indegree	Outdegree	TiVA
GDP per capita (average for 2007-2011)	0.642***	0.540***	-0.389***

*** statistical significance at 0.01.

Source: own elaboration.

Both indegree and outdegree turned out to be positively correlated with GDP per capita.⁷ More affluent societies are characterized by more sophisticated and complex demand, which means they tend to manifest love-for-variety type of preferences,⁸ which supports creation of new import connections. Diversification of supplies might also mean better choice of intermediate goods and higher elasticity of production, which results in higher productivity and increase in welfare. More export connections may result in larger demand for domestic output, thus increase in GDP and GDP per capita. At the other hand, countries with larger GDP per capita are often more advanced (as they have higher resources that might be used to obtain technological development), which means that their export offer might be become attractive to more potential consignees. Thus,

7 To match the indegree/outdegree and TiVA data, for each country we analyzed average GDP per capita from period 2007-2011. Data was obtained from World Bank database.

8 In this consumer preference model, consumers are more satisfied when they get the chance to consumer a wider range of variants of a heterogeneous good. Such idea was first suggested by Chamberlain (1950) and later formalized by Dixit & Stiglitz (1977).

positive correlation between indegree or outdegree and GDP per capita might be considered intuitive.

Negative coefficient between TiVA and GDP per capita also has a simple explanation. Less advanced countries, with lower GDP per capita, are usually engaged in processes that create less value. These processes are usually associated with final steps of production, such as assembly, which means that they are based on value created on earlier stages. Research, product design or marketing – all stages that create the majority of value added – are often conducted in more developed countries, with more qualified labour and capital.

Allowing for the above considerations we concluded, that unleveraged hourglasses should be viewed as the most developed countries, while leveraged straws should be placed on the opposite end of the continuum. This only supports the previous conclusion, that Old and New Union member states play different roles in the international trade network. Furthermore, they even seem to generally be on different levels of development.

We then tried to verify if falling into any of the categories based on our classification might affect the way that countries deal with crises as such. One of the more recognisable features of the recent global crisis was a large and synchronised fall of export in many countries in 2009 – this phenomenon is known as the Great Trade Collapse.⁹ We therefore compiled our data about indegree, outdegree and TiVA with World Bank data about export dynamics in 2009 in reference to 2008. The results are presented in table 3.

Table 3
Pearson correlation coefficients between classification criteria and export dynamics in 2009

Variables	Indegree	Outdegree	TiVA
2009 year-to-year export dynamics	0.472***	0.585***	0.138***

*** statistical significance at 0.01.

Source: own elaboration.

⁹ More details about the Great Trade Collapse, its course, consequences and explanations, can be found in works collated under research and editorial guidance of Baldwin (2009).

We assumed that diversification of export and import should stimulate shock absorption, therefore countries with higher indegree or outdegree should maintain higher dynamics during crisis. These hypotheses are supported by relatively strong positive correlation coefficients of 2009 export dynamics and indegree or outdegree.

Correlation between TiVA and 2009 export dynamics on the other hand is slightly more ambiguous. It may seem that countries with more independent export output should be more immune to external supply shocks and thus should perform better during the crisis. However, the empirically found correlation was positive, which means that countries more dependent on foreign supplies of intermediate goods actually performed better during the Great Trade Collapse. This result may suggest the key role played by international production chains. It would seem that existing chains are stable enough to maintain export even during crisis, but being engaged in such a chain also means more dependency in imported inputs.

The analysis of correlation with 2009 export dynamics suggests, that leveraged hourglasses were the ones to best cope with the crisis, as at the same time they were able to use their wide contacts to diffuse the negative shocks among their partners and could benefit from international production chains as a source of export stabilisation.

CONCLUSIONS

In the article we formulated criteria to classify countries by the width of their trade contacts and self-sufficiency of their export output. We applied those criteria to a sample of EU member states and discovered, that Old Union member states and New Union member states present different patterns of positioning in the international trade network.

Old Union countries are mostly hourglasses, which means that they have diversified import and export flows. There is no clear principle in terms of trade leverage in that group of countries, as some of them tend to use it relatively a lot, while other countries rely more on domestic inputs.

New Union countries are mostly straws or funnels, which means that they have narrow contacts, especially in export. Practically all of them are highly leveraged, which means that foreign inputs largely contribute to the value of their export output.

Then we analysed correlations between GDP per capita, which is a main welfare indicator, and our criteria of trade network position. We have obtained significant coefficients for all three criteria, positive for indegree and outdegree and negative for TiVA. This proves that unleveraged hourglasses are the countries with highest welfare, which in European reality refers to Old Union member states.

We have also analysed the relation between our criteria and the sample countries' performance during the Great Trade Collapse. It turned out that all three criteria were significantly and positively correlated with trade dynamics in 2009, which means that we should expect leveraged hourglasses to cope with the global trade shocks better than other country types.

We are aware that the presented research has been largely limited in its geographical and temporal scope. We believe that further investigation is needed. The limitations of the presented results arise from the limitations of available data. To overcome such circumstances it is advisable to build one's own trade network from primary data in order to calculate measures of contact width and export self-sufficiency rather than to use secondary data. Authors hope that their research will work as an inspiration for more complex network research projects, which would allow more detailed testing and formulating more advanced recommendations.

BIBLIOGRAPHY

- Agosin, M.R. (2008). Export diversification and growth in emerging economies. *UN CEPAL Review*, 97.
- Al-Marhubi, F. (2000). Export diversification and growth: an empirical investigation. *Applied Economics Letters*, 7(9), 559-562.
- Amador, J. & Cabral, S. (2016). *Networks of value-added trade*. VoxEU Article. Retrieved from: <http://voxeu.org/article/networks-value-added-trade> (access: 23.12.2016).

- Baldwin, R. (2013). Global supply chains: why they emerged, why they matter, and where they are going. In: D.K. Elms & P. Low (eds.), *Global value chains in a changing world*. Geneva: WTO Publications, 13-60.
- Baldwin, R. (ed.). (2009). *The Great Trade Collapse: Causes, Consequences, and Prospects*. 1st Edition. London: CEPR.
- CEPII. (2016). *Network Trade*. Retrieved from: http://www.cepii.fr/cepii/en/bdd_modele/presentation.asp?id=27 (access: 18.05.2016).
- Chamberlin, E. (1950). Product Heterogeneity and Public Policy. *American Economic Review Proceedings*, 40, 85-92.
- Dixit, A.K. & Stiglitz, J.E. (1977). Monopolistic competition and Optimum Product Diversity. *American Economic Review*, 67(3), 297-308.
- Elms, D.K. & Low, P. (2013). *Global value chains in a changing world*. Geneva: Fung Global Institute (FGI) – Nanyang Technological University (NTU) – World Trade Organization (WTO).
- Hesse, H. (2008). *Export Diversification and Economic Growth*. Commission on Growth and Development Working Paper No. 21. Washington DC: World Bank.
- Jackson, M. (2008). *Social and Economic Networks*. Princeton NJ: Princeton University Press.
- Jha, M., Amerasinghe, S. & Calverley, J. (2015). *Global supply chains: New directions*. London: Standard Chartered Global Research.
- Kaplinsky, R. (2013). *Global Value Chains, Where They Came From, Where They Are Going And Why This Is Important*. IKD Working Paper No. 68, Milton Keynes.
- Mudambi, R. (2008). Location, control and innovation in knowledge-intensive industries. *Journal of Economic Geography*, 8(5), 699-725.
- Newman, M. (2010). *Networks: An Introduction*. 1st Edition. Oxford: Oxford University Press.
- OECD. (2016). *Trade in Value Added (TiVA) Database*. Retrieved from: <https://stats.oecd.org/index.aspx?queryid=66237> (access: 18.05.2016)
- World Bank. (2016). *World Bank Data*. Retrieved from: <http://databank.worldbank.org/data/home.aspx> (access: 10.09.2016).

Copyright and License



This article is published under the terms of the Creative Commons Attribution – NoDerivs (CC BY- ND 4.0) License <http://creativecommons.org/licenses/by-nd/4.0/>