EMPIRICAL ANALYSIS OF DEMAND FOR ROOF TILES: EXAMPLE OF TONDACH COMPANY

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Abstract

In a very dynamic and volatile business environment, multinational companies view the intra-company exchange as a factor of developing the enterprise's capacities and total revenue growth. The paper is aimed at performing econometric evidence of the total revenues of "Tondach" company, based on the collected economic indicators of "Tondach" company development in nine countries. For each individual country, variables on total revenue, total company's investment in the country, the number of employees and the value of intra-company exchange were used. Besides these variables, the model will use two additional ones: population and rating for each individual country. It was established that the intra-company exchange has a positive and significant effect on the total revenue of companies in the Tondach Group in the observed countries and the observed period of time. With respect to rating, as the second independent variable of special interest, we observe a positive and strong effect on total revenue. This result also proves our claim that countries in the region, with a higher risk factor, which are not members of the integration, have a lower rating, which in turn has a direct impact on lower revenues.

Keywords: multinational company, intra-company exchange, integration, intra-firm trade, foreign direct investment.

INTRODUCTION

The modern world is characterized by change. One of the key changes in the modern world is that businesses are having to become more responsive (Dalia and Verdier 2003; Wickham 2008). Further, during the last three decades the growth in multinational production has become a central part of economic globalization (Bernard et al. 2006; Sangcheol 2013). In particular, regional economic integration has substantially increased the opportunities for product and/or process specializations by multinational companies and, as a consequence, inter-affiliate trade. Inter alia this is shown by the very

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considerable growth in all forms of intra-firm trade, both between foreign affiliates and parent companies, and between affiliates within developed countries – especially in such integrated regions as the European Union and North America (Dunning and Sariana 2008). Regional economic integration has also had a significant influence on the trading patterns of a number of countries, such as in the case of Slovakia and Luxemburg within the European Union. According to the United Nations Conference on Trade and Development (UNCTAD 1996) with the growing importance of market-seeking and efficiency-seeking foreign direct investment by multinational companies pursuing global and regional strategies, intra-firm trade between parent firms and their affiliates and the affiliates, has increased.

Intra-firm trade is the mechanism whereby vertical and horizontal production networks are linked across borders. Although intra-firm trade is widespread in all developed countries, there are differences between countries in the extent and form of their reliance on intra-firm trade (Fisch and Zschoche 2012). Horizontal foreign direct investment is usually considered market seeking, since it is generally motivated by the desire to expand sales – although, for some upstream companies, horizontal foreign direct investment can involve the acquisition of resources and/or domination of competitors. Since multinational companies cannot anticipate exactly how the future will unfold in a changing business environment, it is crucial for them to be able to change established strategies without incurring significant costs (Lee and Makhija 2009). In times of uncertainty, multinational companies benefit from the ability to adjust their value-chain, which include production and sales among affiliated firms located in different countries (Sangcheol 2015). Vertical foreign direct investment, on the other hand, is considered more efficiency seeking; since its purpose is to help a company control its value chain more effectively (Sitkin and Bowen 2013). In this work we build on horizontal model of foreign direct investment.

Some general overview of intra company exchange can be found in literature focusing on multinational company (Dunning 2008; Sitkin and Bowen 2013). A multinational company is `an enterprise that controls and manages production establishments located in at least two countries (in case of Tondach Group, nine countries). It is simply one subspecies of multiplant firm' (Caves 1996). Therefore, there are studies concentrating on intra-firm trade. One group brings basis measures and statistical data of intra-firm trade in selected OECD countries (e.g. Zeil 1997; Anderson and Zeile 2006, OECD 2007). Other studies scrutinize determinants of intra-firm trade also via econometric models. Unfortunately, official statistics on intra-firm trade continue to be available for only handful countries. Additional evidence, albeit fragmentary, is available from specially conducted field studies (e.g. Braunerhjelm 1998; Bernard et al. 2005). Nevertheless, intra-company exchange is an issue, which has not been being often scrutinized.

The complexity of multinational companies regarding multiple geographical markets, diverse activities and very dynamic and volatile business environment, multinational companies view the intra-company exchange as a factor of developing the enterprise's capacities and total revenue growth. In this paper, intra-company exchange refers to the sales and purchase of roof tiles among affiliated firms within the same multinational companies network; it also indicates how closely the firms are operationally linked via cross-border product shifts (Rangan 1998). Thus, due to the limited capacities of plants in each individual country—except in Bosnia and

Herzegovina, where Tondach has no plants[2]—the aim of the analysis is to test the hypothesis that the Company's total revenue, as a dependent variable, when it reaches its maximum in the host country in order to meet the demand for roofing materials, depends on the investment and the level of intra-company exchange, and to estimate the importance of individual variables' impact on total revenue. The correlation between the dependent variable and the described ones was tested on a representative sample.

We believe that this study contributes to the literature, which is being studied in greater depth by researchers generally in international business field, and particularly could be new initial trigger to researchers working on intra-company exchange and foreign direct investment. In the research process, we focus on the testable prediction from the existing theoretical literature, paying special attention of the impact of intra-company exchange on the company revenue development. The analysis of economic indicators of the company's development in nine countries takes advantages of a unique new dataset. These data are derived from the business owners, senior managers and Tondach annual reports, for every observe countries, that accompany every intra-firm trade flows. For each import or export shipment we are able to observe identity of exporting or importing firm. This study is expected to provide comprehensive framework for understanding how multinational companies and their foreign subsidiaries take advantage of their international network.

1. EXPLANATION OF THE MEANING OF VARIABLES AND DESCRIPTIVE STATISTICS

The total revenue of daughter companies for each of the nine countries equals the product of the sales price and quantity. The average value of total revenue amounts to EUR 22.6 million, whereby the lowest value was recorded in Romania, where it amounts to EUR 2.54 million, while the highest value of total revenue was registered in the Czech Republic, where it amounts to EUR 72.8 million (Osmankovic and Hoso 2010). After the logarithm transformation, variable *Inprihod* has the average value of 9.69, with the minimum value of 7.83 and the maximum value of 11.19.

Total investment show the value of investment expressed in EUR million, for each individual country. Thus, for example, the average investment value amounts to EUR 4.53 million. The minimum investment value was registered in Bosnia and Herzegovina, and the maximum in Hungary, where it amounts to EUR 38.38 million. After the logarithm transformation, variable *Ininvest* has the average value of 7.37. The increased pressure on the side of demand for Tondach products in certain markets, particularly in the EU member-states, is resolved through intra-company exchange, which directly affects the increase in the enterprise's total revenue.

The average number of employees in the nine analyzed countries is 302 employees, whereby the number of employees is the smallest in Bosnia and Herzegovina and the largest in Hungary. The variable 'population size' is important from the aspect of observing the market size and future expectations. Depending on the country, the population size ranges from 2.05 million in Slovenia to 22.2 million in Romania.

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[2] According to the OECD (2011) multinational companies operate not only production networks, but also distribution networks and that distribution firms source and distribute goods through wholesale trade affiliates. See also Zeile (1997 and 2003) for the importance of wholesale trade affiliates in US intra-firm trade.

Table 1. Results of descriptive analysis for Tondach companies 2004–2008

Variable	Number of observations	Mean	Standard deviation	Minimum	Maximum
revenue	45	22628.18	18239.12	2540	72787
lnrevenue	45	9.695402	.8549074	7.83992	11.19529
investment	45	4531.956	7311.44	21	38387
lninvest	45	7.378432	1.758891	3.044523	10.55547
inter	36	1908.8	2055.613	0	7912
lninter	36	6.53948	2.518477	0	8.976136
employ	45	302.7778	243.6558	10	736
population	45	7.524445	6.012053	2.05	22.2
rating	45	.8766667	.1183216	.65	.99

An important variable in the analysis above includes rating for each of the observed countries, as it controls the risk factor between individual countries and the effect on total revenue. Rating was determined depending on the risk estimate for each observed country. Risk determinants taken into consideration include: whether the country is a member of integration, whether the country is a member of Euro zone, currency stability and exposure to currency risks, market stability, political stability (Feinberg and Gupta 2009; Alesina 2003; Sangcheol 2015). It is an index with a value from 0.00 to 1.0. A lower value of this variable signifies a greater exposure to risks for the company. In Table 1 we can observe that the average value of this variable is 0.87, whereby the estimated rating is lowest for Bosnia and Herzegovina while Slovakia and Slovenia are the best rated countries.

2. SIMPLE CORRELATION BETWEEN VARIABLES OF INTEREST

The term correlation means connection or mutual dependence of the observed variables. Correlation can be positive or negative. The positive correlation exists when an increase in the value of one variable is followed by an increase in the value of the other observed variable, i.e. when a decrease in one is followed by a decrease in the other variable. The negative correlation exists when an increase in one variable is followed by a decrease in the other variable and vice versa. The value of the linear correlation coefficient ranges between -1 and 1. Values of -1 and 1 denote the perfect negative and positive correlation, respectively. A higher coefficient value indicates the existence of greater linear correlation between variables X and Y. It should be noted that a lower value of this coefficient does not necessarily point to lower correlation, since it may be a case of inappropriate use of the linear correlation coefficient for measuring connectedness with a phenomena that are not in a linear relationship (Somun 2014).

From the analyzed data, we observe that the obtained results related to the impact of intra-company exchange on total revenue have the expected sign. The linear correlation coefficient of the two variables is positive and is fairly close to 1, which means that there is a great correlation between the intra-company exchange and total revenue.

Table 2. Results of linear correlation between variables

	lnrevenue	lninvest	lninter	employ	population	rating
lnrevenue	1.0000					
lninvest	0.4324	1.0000				
lninter	0.8610	0.4368	1.0000			
employ	0.6803	0.4682	0.4913	1.0000		
population	-0.1678	0.1929	-0.3950	0.3019	1.0000	
rating	0.1993	0.3932	0.1958	-0.1901	0.1765	1.0000

Table 2 shows that there is a significant correlation between the number of employees and the dependent variable. The linear correlation coefficient is 0.68, which leads to the conclusion about the existence of positive correlation between the two variables. The mutual dependence between investment and total revenue is indicated by the positive correlation coefficient of 0.43. Although there is a positive linear correlation between rating and total revenue, it is not prominent to a great degree, since the linear correlation coefficient is closer to zero, which means that the correlation between the two variables is weak.

3. EMPIRICAL MODEL FOR TONDACH COMPANIES

As aforementioned, there are a few variables of interest in our model that we want to track and that we could collect for our analysis needs. Although we have already presented the variables in a way, we will repeat the meaning of individual variables. The reason for this is that in our final analysis we had to use some of the variables in a transformed form.

The variables are as follows:
- *Inrevenue* – total company's revenue in EUR mil., logarithm transformation
- *Ininvest* – total investment in EUR million, logarithm transformation
- *Ininter* – inter-company exchange in EUR mil., logarithm transformation
- *employ* – the number of employees
- *population* – population size in millions
- *rating* – risk factor in individual countries

The variable that we particularly want to observe and explain in the model, and that is also our dependent variable in the regression is the total revenue of Tondach company in the nine observed countries (Inrevenue). All the other variables that we presented and that were available to us are used as independent variables. Although our research used indicators that cannot be obtained through official statistical channels, which we consider as our contribution to the research, we still have to point out that the specification in this model is limited to the available data.

It is certainly one of the model's limitations, although we attempted to obtain as much information as possible for our study through this model. The other independent variables were explained in the discussion above; however, it should be noted that two independent variables were used in the logarithm transformation (Ininvest and Ininter), in order to yield a satisfactory functional form and diagnostics of the model. The other variables remained unchanged compared to the initial explanation.

Table 3. Results of empirical OLS model for Tondach companies 2004-2008

Variable	Coefficients	Standard error	t Stat	P-value
Constant	6.57	0.79	8.31	0.000
Ininvest	- 0.09	0.04	- 2.06	0.048
Ininter	0.14	0.03	4.35	0.000
employ	0.01	0.01	5.87	0.000
population	- 0.03	0.01	- 2.08	0.046
rating	6.57	0.79	8.31	0.000
Model diagnostics				
Number of observations	36			
Test for joint variable significance (F-test)	$F_{(5, 30)} = 60.09$ $P = 0.000$			
R-squared	0.88			

Table 3. (*continued*)

Variable	Coefficients	Standard error	t Stat	P-value
Test for functional form (Ramsey RESET test)			F (3, 27) = 2.39	P = 0.09
Test for multicollinearity (VIF analysis)			Median = 3.34	Min = 1.87 Max = 4.50

We estimated the model using the Ordinary Least Square regression and cross-section methodology (Zikmund et al. 2012) with the following functional form:

$$\ln \text{revenue}_i = \hat{a}_0 + \hat{a}_1 * \ln \text{invest}_i + \hat{a}_2 * \ln \text{inter}_i + \hat{a}_3 * \text{employ} + \hat{a}_4 * \text{population} + \hat{a}_5 * \text{rating} + \hat{\varepsilon}_i \qquad (1)$$

i	Denotes Tondach companies in the nine observed countries
ln	Abbreviation for the logarithm of the observed variable
$\hat{\alpha}_0$	Constant in the model
$\hat{\alpha}_1, \hat{\alpha}_2, \hat{\alpha}_3, \hat{\alpha}_4, \hat{\alpha}_5$	The estimated coefficients
$\hat{\varepsilon}_i$	Standard error in the model

Index "i" denotes Tondach companies in the nine observed countries, which were aggregated into a single sample since they are the same companies of the Tondach Group, which produce same products, with signs in the interval i = 1, 2, 3, …, 36. '*ln*' is the abbreviation for the logarithm of the observed variable, $\hat{\alpha}_0$ is a constant in the model; $\hat{\alpha}_1, \hat{\alpha}_2, \hat{\alpha}_3, \hat{\alpha}_4, \hat{\alpha}_5$ are the estimated coefficients, and $\hat{\varepsilon}_i$ is a standard error in the model.

The model was estimated with 36 observations since all the data we observe were not available for a few companies, although we had 45 observations in the initial sample. In any case, it should be noted that our model covered 100 percent of Tondach companies in the observed sample in nine countries and in the time period 2004–2008, and can therefore be considered more than representative for estimates (see Osmankovic and Hoso 2010). The results obtained are presented in Table 3.

Statistical diagnostics of the model that we obtained is satisfactory. The model has no problems with the functional form used at the 1% and 5% level of significance (p-value equals 0.09), nor with the data multicollinearity (see VIF factors, where the maximum value is lower than 10.0 and the mean value lower than 4.0). This result is consistent with the patterns described in Waters (2011). The model had problems with heteroscedasticity, i.e. great variations in data among companies, and we therefore used the estimate that recognizes and controls this statistical problem; actually, the robust standard errors were estimated, which took care of the problem (Curwin and Slater 2013).

In the model, we can reject the null hypothesis that independent variables taken together are equal to zero at the highest level of statistical significance (F-test has the p-value of 0.000), which means that the set of variables we control together is crucial in explaining our dependent variable (Bahovec and Erjavec 2009). Finally, the model explains an unexpectedly high percentage of the variation of dependent variable. The coefficient of determination (R^2) has the value of 0.88, which means that in our linear model the observed independent variables account for 88% variation in the total revenue of Tondach Company. In simple terms, our model manages to explain 88% variation in total revenues of Tondach companies in the nine observed countries in the time period from 2004 to 2008, which is an extremely good result for such a model and limitation of the data we are faced with.

All the used variables are statistically significant at the 5% conventional significance level; in other words, they are essential in explaining the variation of total revenue of

individual Tondach companies in the nine observed countries. Variable signs oscillate between positive and negative; we will clarify the obtained results below. In our model, we are particularly interested in two independent variables, i.e. *Ininter* – the variable that explains the intra-company exchange, and *rating* – the variable that controls the risk factor between individual countries and the effect on the total revenue of Tondach companies in different countries. These are variables that we will clarify in more detail, while the other variables are used more as the control variables and will not be explained in detail.

As we can see from the results obtained, variable *Ininter* had a positive and significant effect on the total revenue of companies in Tondach Group in the observed countries and in the observed period. The effect is relatively strong having in mind the fact that the increase in intra-company exchange (*Ininter*) by 1% results in the increase in total revenue of 0.14%. In the context of our research, such a result confirms the hypothesis that if the countries are members of a given integration bloc, in this case of the EU, the level of intra-company exchange will be more significant for the company. The reason for this is meeting the demand for Tondach products in particular markets that is not possible with the available capacities in the host country.

With respect to the other independent variable of special interest, *rating* – the variable that controls the risk factor between countries – we again observe a positive and strong effect on total revenue. Let us be reminded that a higher value of this variable means lesser risk, where the risk is already expressed in percentages (since it is an index with values ranging from 0.0 to 1.0). Such a result also confirms our arguments that countries in the region with a higher risk factor, which are not members of the regional economic integration, such for example European Union, have a lower rating, which in turn directly affects lower revenues (Allen and Panzalis 1996). According to Peng (2014) and Hoso (2010) countries and their companies, which remain beyond the integration, are discriminated against. It is particularly prominent for West Balkan countries, although in this case a certain differentiation in risks should also be made. Thus, Bosnia and Herzegovina, which has a stable currency but a fairly uncertain business environment due to political turmoil has the lowest rating, and is followed by Macedonia and Serbia (Faeth 2009). With respect to the latter, the problem of exchange rate stability (Goldberg and Kolstadt 1995) which has been a significant problem for the Tondach Company since its entry to the Serbian market, remains one of the greatest challenges in the future as well.

Although the other independent variables are not of a great interest to us, we will briefly say that a greater number of employees in Tondach companies (*employ*) positively correlate with a higher total revenue, which is an expected result. However, it should be noted that Tondach in Bosnia and Herzegovina, with ten employees and EUR 9.8 million in 2008. achieved a greater turnover than, for example, Tondach in Macedonia, which has 158 employees or Tondach Romania, which has 238 employees and EUR 9,6 million turnover (Osmankovic and Hoso 2010).

A greater population size in some of the nine countries (*population*) correlates with a lower revenue, which may seem an unexpected result. Still, one should keep in mind that, in our sample, a bigger country such as Romania with the population of 22.2 million registered the poorest performance in 2008., while Slovenia, with the population of 2.05 million had the total revenue of EUR 24.06 million. The reason may be the fact that Romanian market is clearly differentiated and traditionally oriented toward roofing

materials made of sheet metal. Although it is a EU member-state, the level of its citizens' income significantly affects the level of demand for Tondach products in this country.

Finally, a result that might be unexpected in the model at the first glance is that greater investment correlates with a slight decrease in total revenue. In our sample, greater investment in the context of Tondach companies means the introduction of new technologies though not an unconditional increase in production capacities. Capacities are increased through "green field" investment or upon the initial takeover of outdated plants with smaller capacities and their reconstruction. The increase in capacity from 12.0 million pieces to 20.0 million pieces of roof tiles, as is the case in Macedonia, will significantly affect the total revenue until the maximum of production and sales is achieved. After this point, investment has a negligible effect on increase in revenues, i.e. a slight increase in production can be expected only if the production processes are optimized. Clausing (2000) finds that multinational activity and trade are complementary activities, particularly multinational activity and intra-company trade. The global economic and financial crisis (Lee and Makhija 2009) that started in late 2008 and that has not yet been fully overcome despite the EUR 79.4 million investment in 2008 and increase in capacities at two sites, in the Czech Republic and Hungary, by additional 50 million pieces of roof tiles had an unfavorable effect on the total revenue of Tondach company in these countries.

CONCLUSION

If we control individual countries in the model, the results obtained for the two variables of interest are of consistent quality, the variables are still statistically significant with a favorable effect, while the estimated coefficients vary slightly. If, on the other hand, we control the years of estimates, the results are again very consistent with the preferred model, which we find the simplest for estimation and clarification. In other words, our key variables of interest are still significant, and have the same sign while the coefficient level again slightly varies, somewhat more for variable *rating*. In the attempt to control both years and the observed countries in the model in the same time, the model diagnostics is not satisfactory and we will therefore not interpret the results.

Finally, the model limitations include a relatively small sample we work with due to limited data, impossibility to control some other, potentially important variables in our regression, and use of OLS methodology rather than a static or dynamic panel model. The reason that was already mentioned is that in our sample we have companies that are part of the same group, that operate by the same principles, with the same technology, and according to same or similar development strategies.

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