Go West? The Influence of Eastern Countries on the Export Volume of the German Federal State Saxony: An Econometrical Analysis of Saxon Foreign Trade

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Abstract: The present paper considers the foreign trade of the German state Saxony with 38 countries combine over 10 years to explain the export volume in these countries using a generalized gravity approach. As one of Germany's "new federal states", Saxony had been part of the Eastern Bloc until it became part of the European Union by the reunification of Germany in 1990. The purpose of this paper is to analyze the effects of the accession to the European Union on Saxony's trade structure. By analyzing Saxony's trade relations with the Central and Eastern European countries, which became part of the European Union between 2004 and 2007, it can be shown that the Saxon exports to these countries were higher than average during the observed time. The results indicate that there are positive effects for China and Russia as well.

Keywords: International Trade, Empirical Analysis, Panel Data

INTRODUCTION

Western countries' political and economic relations have significantly affected their wealth. This interdependence is substantial, as the financial and economic crisis that began in 2008 has shown. In the beginning of the 1990s, the German reunification and the collapse of the Soviet Union caused the former East Germany's economic activities to expand westwards.

Since that time, these new federal states of Germany have profited through their economic and political relations with capitalistic western countries. However, their trade relations with the formerly socialist Eastern Bloc countries (these include the Central and Eastern European (CEE) countries and Russia) have remained steadily high.

It actually seems that the formerly socialist Eastern Bloc countries are still less important for trade with the old (West German) federal states than they are for the new (East German) federal states.

Saxony is one of the most successful economies of these new German federal states. After the reunification, its economic relations with the western foreign countries have steadily expanded. However, Saxony's relationship with the eastern countries has been also very strong. Actually, this alignment is stronger than that of the former West German states with the eastern countries 20 years after the fall of the Berlin Wall.[1]

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[1] Source: Statistisches Landesamt Sachsen (2011).

COMMON GROUND

The aims of this paper are twofold: to discover the most important factors on the Saxon export volume to 38 trade partners and the significance of the, especially historically determined, foreign trade relations between the federal state of Saxony and the CEE countries, Russia and China.

The Saxon economy grew enormously before the financial and economic crisis began. Since 1998, Saxony has documented a positive foreign trade balance (without consideration of merchandise flowing to other parts of Germany). The automobile industry is the sector with the highest export volume. It had an average growth rate of 16.6% between 1995 and 2002 (Votteler 2003).[2] However, automotive industry lost importance between 2001 and 2007 (see Figure 1). Other important export sectors include the production of electrical components[3] and engine building for the paper and printing industry,[4] as well as the chemical sector.[5] The most important sectors are also shown in Figure 1.
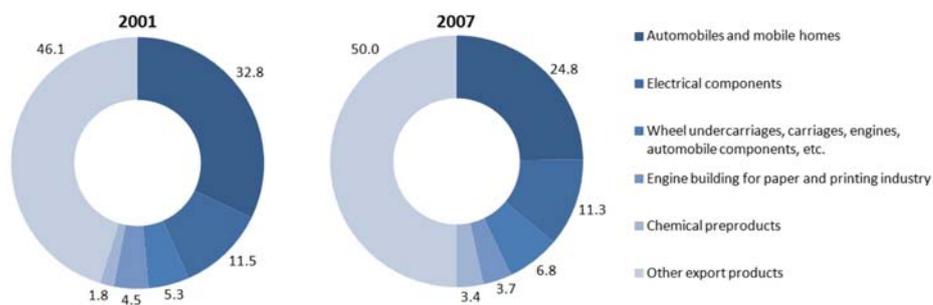

Figure 1: Percentage of the Most Important Export Products in 2001 and 2007 (Source: Ronge 2010)

Three of the most significant export partners are Russia, the USA and China. Russia (as well as the most of the CEE countries) was closely connected to Saxony in the past due to COMECON[6] and Russia's high export demand during the 90s (see Figures 2 and 3).

Saxony's export volume to the USA increased enormously between the years 2000 and 2002. As a result, over the next eight years the USA became Saxon's most important trade partner, despite the fact that the USA's export demand had been steadily decreasing since 2003. The export volume to China, in contrast, has been increasing continuously. China's demand has also been increasing by over 700% from 1997 to 2006. Figure 3 shows the export shares of selected Saxon export partners from 1993 to 2009. Figure 4 presents the export demand growth from 2000 to 2009.

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[2] For example, VW in Zwickau, Chemnitz and Dresden, BMW and Porsche in Leipzig.

[3] For example, AMD and Infineon in Dresden.

[4] For example, Sachsendruck Plauen.

[5] For example, Wacker Chemie AG in Nünchritz.

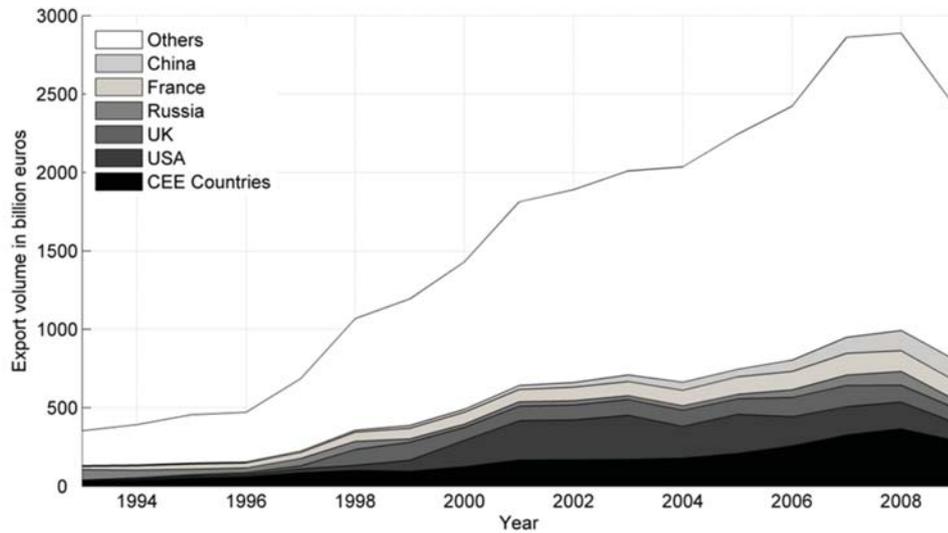[6] Council for Mutual Economic Assistance.

Figure 2: Export Volume (in Billion Euros) to some Selected Trade Partners (Source: Statistisches Landesamt Sachsen 2011)

Saxon companies are smaller than companies of the western part of Germany. They are typically fragmented into small sections with a small share of processing trade. This could be a competitive disadvantage in international markets (Zeddies 2010; Fuchs and Wohlrabe 2006).

On the one hand, the Eastern Germany export economy could stand to profit from CEE countries' entrance into the EU (Herz and Wagner 2008; Rose and van Wincoop 2001; Fuchs and Wohlrabe 2006; Eichengreen and Irwin 1997). Indeed, Saxony's historical relations and the similarity of its institutions with those of the CEE countries could positively affect trade. On the other hand, the CEE countries have potentially lower average wage costs and similar industry structures. They could be strong competitors for Saxon export companies. As a consequence, Saxon companies could be forced to increase their size and decrease average costs (see Zeddies 2010).
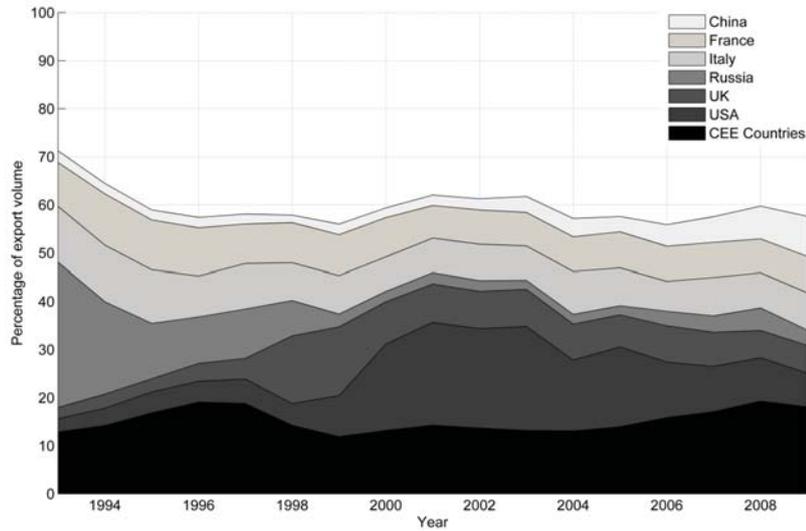
Figure 3: Percentage of Export Volumes to some Selected Trade Partners. (Source: Statistisches Landesamt Sachsen 2011)
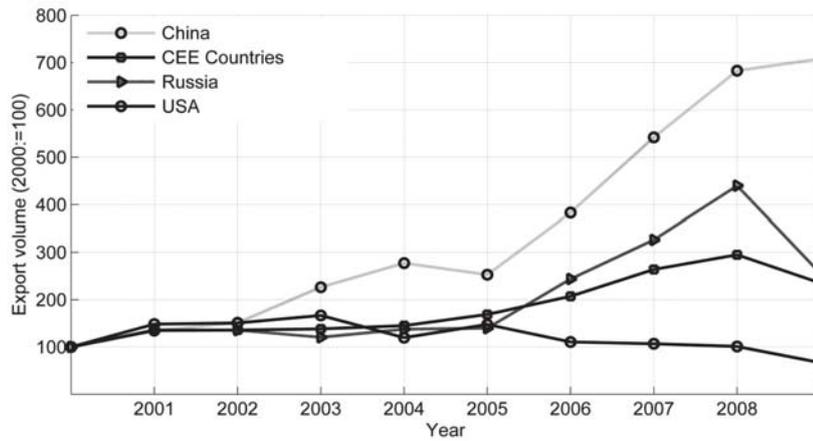

Figure 4: Export Demand Growth of the CEE Countries, China, Russia and the USA Since 2000. (Source: Statistisches Landesamt Sachsen 2011)

Approach

In this section, we introduce our approach for analyzing export volume. This study is based on a dataset covering 38 Saxon foreign trade partners from 1997 to 2006. The sources of data are listed in Table 2 in the appendix.

Our model is based on the general gravity equation. This is a standard model used to explain trade flows (Anderson 1979; Tinbergen 1962; Bergstrand 1985; etc.) and is consistent with foreign trade theories (Deardorff 1998; Davis 1995; Helpman 1987; Bergstrand 1989; etc.). It

explains the export volume of bilateral trade through the production potential of the export country (e.g. the export country's GDP) and demand potential of the import country (e.g. the import country's GDP). Usually both variables positively influence the trade flows. In this study, we do not focus on bilateral trade, but only on the trade flow from Saxony to its foreign trade partners. Since Saxony is not an autonomous country, but a federal state within the Federal Republic of Germany, we do not consider trade between partners in every possible combination. For this reason, we only consider the GDP of the Saxon trade partners (*gdp*) in our model, which is to be interpreted as the demand potential.[7]

Furthermore, we need to consider trading costs (*trading costs*) between two countries. These affect trade flows negatively. Trading costs comprise both the geographic distance between two countries, and the institutional, cultural and political distances between them. Thus, these costs are generally associated with uncertainties, risks, transaction fees, transportation costs, etc. (see McCallum 1995; Anderson and van Wincoop 2004; Feenstra 2004; Redding and Venables 2002; Rose and van Wincoop 2001). In this research, we divided the trading costs into several influencing variables. One of these variables is the geographic distance between the capital of Saxony (Dresden) and the capital or economic centre of the trade partners.[8] Further trading costs could be caused by exchange rate risks or reduced by free-trade agreements, for example, current unions (Rose and van Wincoop 2001; Feenstra 2004; Fuchs and Wohlrabe 2008) or general common political institutions and mergers (North 1991; Knack and Keefer 1995; Hall and Jones 1999; Rodrik, Subramanian and Trebbi 2004; etc.), as well as liberalization (Fuchs and Wohlrabe 2008; Cheptea 2007).

We considered exchange rate risks and were able to obtain the appropriate data from OECD STAT. We observed exchange rate volatilities,[9] membership in the European Monetary Union (EMU) and the effects of long-term exchange rate levels. The latter bears a significant effect on the export volume in the model. In addition, we received the Index of Economic Freedom from the Heritage Foundation.[10] Other observed variables include the percentages of GDP sectors (agricultural, industry and service sector) by the trade partners. We obtained the appropriate indices from the World Development Indicators (WDI) 2008.

Moreover, we want to explain how significant the effects of CEE countries, Russia, China, and also the EU are. Therefore, country effects are modeled by dummy variables. One of these dummies (*cee*) considers the CEE countries that became part of the EU in 2004 or 2007. These include the Czech Republic, Poland, Slovakia, Slovenia, Estonia and Hungary in our data. Since we hypothesized that Russia and China play a decisive role in the foreign trade of Saxony, we define a common dummy variable for these countries (*chru*). In order to distinguish the effects of Russia and China separately, we introduce two additional dummies, *ru* and *ch*, respectively. Furthermore, the dummy *eu* distinguishes between EU and non-EU countries. Since it turned out that the EU dummy alone is not significant, we complement it with another dummy (eu^{old}) specifying those countries that had been EU members prior to 2004.

The time effects can be controlled by time dummies (*td*) and country effects by country dummies (*cd*) with the parameters γ and δ. The general gravity model for the endogenous variable export volume *X* can be defined as follows:

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[7] The GDP of Saxony as the production potential is a country invariant variable and is dropped in the econometrical model.

[8] Source: Centre d'Études Prospectives et d'Informations Internationales (CEPII).

[9] The exchange rate volatilities are measured by the standard deviation of monthly exchange rates.

[10] We created a standard index before we found the logarithm of the variable:

$$standard\ index_{it} = 1 + \frac{index_{it} - mean\ of\ index}{100}$$

if 100 is the maximum value. As a result, the indices are comparable.

$$\ln(X_{it}) = \beta_0 + \beta_1 \ln(gdp_{it})$$
$$+ \sum_{k=2}^{K} \beta_k \ln (trading\ costs)_{itk} + \sum_{l=K+1}^{L} \beta_l \ln (trading\ costs)_{il} + \gamma_t\ td_t + \delta_i cd_i$$
$$+ \varepsilon_{it}$$

The country index i with $i = 1, \dots N$, the time index t with $t = 1, \dots T$, the number k of time-variant explanatory variables with $k = 1, \dots K$ and the number l of time-invariant explanatory variables with $l = 1, \dots L$ are defined. The Fixed Effects approach is appropriate to estimate unbiased parameters.[11] Heteroskedasticity and serial correlation are avoided by creating robust standard errors by Arellano (2003). Multicollinearity could not be found in this model.[12] Country-specific effects like distance $dist_i$, old EU countries eu_i^{old}, CEE countries cee_i, China and Russian $chru_i$, etc. cannot be separately measured using the Fixed Effects approach. For this reason, we use the decomposition approach by Plümper and Troeger (2007) following Fixed Effects estimation.

Table 1: Parameter Values and Standard Deviations (Beneath and Italic) for 7 different Model Variations. The Models Differ in the Selection of Explanatory Variables. All of them Contain Systematic Country-specific Effects. For this Reason the Parameters are Estimated Using a Fixed-effects Estimator

	Model 1		Model 2		Model 3		Model 4		Model 5		Model 6		Model 7	
Intercept	7.948	**	11.609	**	6.463	***	8.698	**	-2.757		8.541	**	1.157	
	3.775		3.775		0.055		3.871		3.366		3.820		9.512	
GDP *gdp*	0.329		0.329		0.988	***	0.282		0.996	***	0.293		0.285	
	0.282		0.282		0.002		0.287		0.270		0.283		0.266	
Distance *dist*	-0.355	***	-0.355	***	-1.206	***	-0.376	***	-1.071	***	-0.386	***	-0.269	***
	0.009		0.009		0.001		0.006		0.002		0.006		0.010	
Exchange Rate *exr*	-1.397	***	-1.397	***			-1.500	***			-1.483	***	-1.380	***
	0.249		0.249				0.276				0.277		0.257	
Financial Freedom Index *finf*	0.573		0.573										0.643	*
	0.360		0.360										0.367	
CEE countries *cee*	0.343	***	0.354	***			0.192	***	0.639	***	0.198	***	0.367	***
	0.007		0.007				0.016		0.006		0.015		0.028	
China/Russia *chru*	1.310	***					1.175	***			1.163	***	1.583	***
	0.033						0.012				0.011		0.033	

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[11] A Breuch-Pagan Lagrange multiplier test can refuse the homogeneity of country-idiosyncratic variance.
[12] The variance inflation factor (VIF) is less than 4.

	Model 1		Model 2		Model 3		Model 4		Model 5		Model 6		Model 7	
China *ch*			1.112	***										
			0.032											
Russia *ru*			1.503	***										
			0.035											
EU-Members (until 2004) eu^{old}					1.754	***	-0.282	***	1.846	***	-0.311	***		
					0.002		*0.015*		*0.053*		*0.040*			
European Monetary Union *emu*									0.343	*	0.088		0.110	
									0.174		*0.129*		*0.127*	
Agricultural sector													0.039	
													0.319	
Industry sector													0.379	
													1.000	
Service sector													1.459	
													1.647	
(corr.) R^2	0.988		0.988		0.982		0.988		0.981		0.988		0.989	
AIC	322.568		322.568		509.695		322.568		502.988		330.296		310.993	
BIC	519.577		519.577		698.823		519.577		516.513		696.057		515.762	
Significance level ***1%, **5%, *10%														

Results

The estimated variables for seven different model specifications can be found in Table 1. With the exception of Model 3 and 5, the GDP does not have a significant effect (p-value = 0.244). In contrast, the distance parameter is negative and strongly significant as expected.[13] The exchange rate level (*exr*) is a trading barrier, too, and it is reflected in a negative, strongly significant, as well as very robust, parameter. In addition, the exchange rate volatility should have a negative effect on export, but the data cannot support this hypothesis. Therefore, we tried to introduce a dummy (*emu*) to measure the effect of the European Monetary Union, but there is also no significant evidence for a positive influence. The effect is very small or rather immeasurable (compare Model 5, 6 and 7 in Table 1). In contrast, the exchange rate level is strongly negative and shows that Euro appreciation and the currency depreciation of a trading partner,

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[13] For interpretation of the distance parameter: If a trade partner is 1% farther away, the export volume in that country is, on average, reduced by 0.36% (see Model 1 and 2 respectively).

respectively, increases the price as well as decreases the demand for Saxon products. That could explain the export stagnation to the USA observed since 2003.[14]

The indices of the Heritage Foundation for liberalization evaluation of trade partners are not significant. Indeed, the index of financial freedom (*finf*) has the excepted algebraic sign, but the standard deviation is too high (p-value = 0.112). Otherwise it could be evidence that a liberal financial system of the trade partner affects the export demand positively, due to more competition between banks as well as a likely decrease in interest rates.

The effect of the sectors (percentage of GDP) also turned out to be insignificant (see Model 7). Unfortunately, the eu_i^{old} dummy is not robust in terms of direction action, and is consequently not interpretable (compare Model 5 and 6 in Table 1).

In contrast, the effects of CEE countries, Russia and China are definitely positive and strongly significant. However, the joint parameter of Russia and China is higher than the parameter of CEE countries. This observation could be evidence of a strong relation between Saxony and Russia, perhaps because of their common history and the growing economic force of China. The dummy variables need to be interpreted as exponents, because of the logarithm in the Equation. The export volume to the CEE countries is $e^{0.343}$ = 1.41 = 41% above average in comparison with the export volume to the other trade partners. Actually the positive effect is stronger for Russia and China. The export volume in these countries amounts to $e^{1.309}$ = 3.70-times above average (see Model 1).

It is interesting to study the effects of Russia and China separately in Model 2. Both countries strongly influence the export volume. Over the observation period, the effect of Russia (e^{ru} = $e^{1.50}$ = 4.50) is stronger than the effect of China (e^{ch} = $e^{1.11}$ = 3.04).

Further country dummies are unembodied, but contained in the models. The separate models hardly vary the model's validity. The highest model quality has model 7 (see the lowest values of AIC and BIC).

The country's specific effects (for example the distance and the separate country dummies) are contained in every fixed-effects estimated model and could be separated using the decomposition model of Plümper and Troeger (2007).

Conclusion

Even though political and economic relations are mostly aligned towards western countries, Saxon companies profit enormously from the trade with partners in the East during the observation time. Especially due to a common history, fallen economic barriers, and similar institutions explain these above average country-specific effects. Although Russia's demand for Saxon export products has not grown as strong as China's (see Figure 4), a stronger positive country-specific effect was measured during the observed time. On the one hand, the European Monetary Union shows a low positive effect, but on the other, a strong negative price effect dominates the results through the exchange rate level. We could not show the significance of the agricultural, industrial or service sectors.

The results show the significance of the eastern countries for the Saxon economy. It could be also the strength of the Saxon economy, despite possible structural disadvantages. Therefore, further scientific studies will be necessary, especially to explain the effects of these eastern countries on Saxony during the financial and economic crisis. A comparison between the former West German states and the East German states could be also very interesting.

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[14] The dollar was devalued between 2002 and 2008 (by about 50% between 2002 and 2004).

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Appendix

Table 2: Data Sources

Data	Source
Export, import volume	Statistisches Landesamt Sachsen, accessed January 25, 2011.
GDP	WDI 2011, World Bank, accessed February 9, 2012. http://databank.worldbank.org/ddp/home.do
Distance	CEPII, accessed February 9, 2012. http://cepii.fr
Exchange rate	OECD STAT, accessed February 9, 2012. http://stats.oecd.org
Exchange rate volatility	OECD STAT, accessed February 9, 2012. http://stats.oecd.org
Index of Finance Freedom	Indices of Economic Freedom by the Heritage Foundation, accessed February 9, 2012. http://heritage.org
Shares of sectors per GDP	WDI 2011, World Bank, accessed February 9, 2012. http://databank.worldbank.org/ddp/home.do

Table 3: Description of Variables

Variable	Description
gdp_{it}	GDP of trade partner i to time t
$dist_i$	Geographic distance from Dresden to the capital (or rather trade centre) of trade partner i
exr_{it}	Growth factor of the indirect exchange rate of trade partner i to time t
$finf_{it}$	Standard Index of Finance Freedom of trade partner i to time t
emu_i	= 1, if trade partner i is a member of EMU during the observation time, otherwise 0
eu_i^{old}	= 1, if trade partner i was a member of EU before 2004, otherwise 0
cee_i	= 1, if trade partner i is a part of CEE countries, otherwise 0
$chru_i$	= 1, if trade partner i is China or Russia, otherwise 0
ch_i	= 1, if trade partner i is China, otherwise 0
ru_i	= 1, if trade partner i is Russia, otherwise 0
cd_i	= 1, if the country is i, otherwise 0
td_t	= 1, if the year is t, otherwise 0

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