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Evidence Based on Estimating an Export Model over 1997-2016

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Abstract

This paper analyses Austria's export market performance by exploring four channels that can impact on exports: a) cost competitiveness, b) ties to trading partners through their demand for import goods, c) global investment demand, and d) offshoring of goods production. By using cointegration analysis and error corrections, we estimate an export model based on quarterly data over the time period 1997-2016. The main results underscore that it is not only price competitiveness that influences Austria's export performance, as global export demand and trading partners' demand for capital goods are shown to have a significant long-run impact on Austrian goods exports. Cost competitiveness does play a role in determining export market performance, but over the last twenty years the relative contributions of changes in the real effective exchange rate based on unit labour costs to export growth are shown to be relatively small. While Austria's international competitiveness has only recorded small variations since the financial crisis, this paper provides evidence that lower export growth and the falling global export market share of goods since 2007 largely reflect relatively weak economic activity of many of Austria's important trading partners including Eastern Europe.

Keywords: competitiveness, export performance, exports, trade, Austria, Europe

JEL classification: B5, F6, F45

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1 Introduction

Over recent years, the debate about the determinants of the export market performance of European countries has been a major focus of academic and policy debates. Controversies have arisen about price competitiveness issues, with prominent discussions on how changes in unit labour costs in various European countries have impacted on competitiveness and exports (e.g. Trichet, 2009; Vogel, 2012; Flassbeck and Lapavitsas, 2015; Storm, 2016). Several studies have emphasized that non-price competitiveness issues related to the importance of technological capabilities, product quality and labour productivity for international competitiveness are crucial for understanding the export performance of advanced countries (e.g. Dosi *et al.*, 2015; Storm and Naastepad, 2015a; Peneder, 2017). This paper contributes to the literature by analyzing relevant channels that have an impact on export performance. In particular, we estimate an export model for Austria – a European 'core country' whose export industry is strongly integrated into European manufacturing structures (Stöllinger, 2016) and whose macroeconomic performance since the financial crisis has been more favourable than in most EU countries (e.g. Gräbner *et al.*, 2017, 2018).

However, as can be seen from table 1, Austrian goods exports (excluding services) have grown much slower in the post-crisis period than before the crisis: while world exports had grown by 13.4% over the 5-year period 2001-2005, they only grew by 0.6% over the post-crisis period 2011-2015. Export growth to Eastern Europe (CESEE region),[1] which was also hit hard by the crisis (e.g. Gardo and Reiner, 2010; Astrov *et al.*, 2010), declined to an especially notable extent, falling from 17.6% over 2001-2005 to 9.6% over 2006-2010 and 1.2% over 2011-2015. As can be seen from Table 1, Austria even recorded negative average annual growth rates over 2011-2015 to the euro area. Furthermore, the decline of Austria's global market share in goods exports since the financial crisis in 2007/2008 has also attracted attention (e.g. Stehrer and Stöllinger, 2013). Figure 1 shows the evolution of the quarterly global export market share for Austria, Germany and a group of (European and non-European) advanced economies in comparison. It can be seen that advanced economies (-5.4%), Germany (-11.0%) and Austria (-18.1%) have all lost a substantial part of their global export market share since 2007, the year before the start of the crisis. The lines of Germany and Austria have largely moved together, although

[1] The CESEE country group includes: Albania, Bulgaria, Bosnia and Herzegovina, Croatia, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Macedonia, Moldova, Montenegro, Poland, Romania, Russia, Serbia, Slovakia, Slovenia, Turkey and Ukraine. Due to data limitations, we excluded Kosovo and Kazakhstan.

Germany's export market share has bounced back more strongly in the post-crisis period from 2009 onwards. Against the background of how exports have evolved over the last 20 years, and by adapting the methodology proposed in a study on Germany (Danninger and Joutz, 2008), this paper will use econometric export model estimates to assess a number of important channels that impact on Austria's export performance.

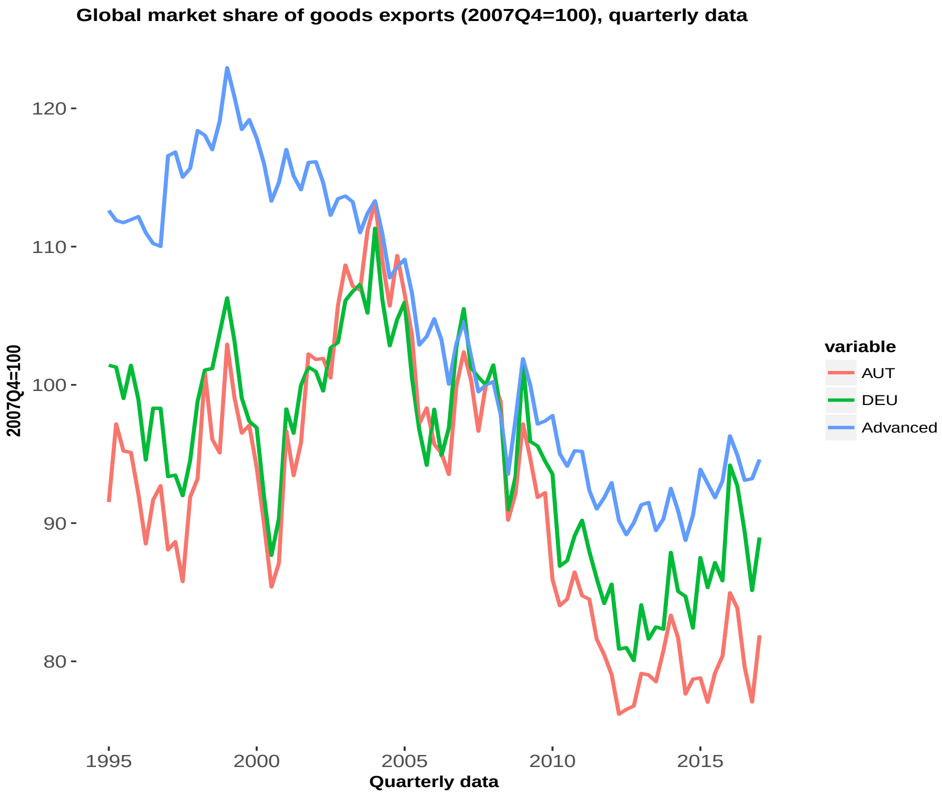
The rest of the paper is structured as follows. Section 2 presents pre-considerations and explanations on the variables and data included in the export model. Section 3 introduces the econometric strategy and the estimation results, based on using cointegration analysis and error corrections, which allow us to come up with long-run parameter estimates on the endogenous variables of interest. Additionally, we assess the relative contribution of the different factors to export growth in pre-crisis years (1997–2006) and in the crisis and post-crisis period (2007–2016). Section 4 concludes and discusses policy implications.

Table 1: Austria: selected growth rates of goods exports at current prices

Exports to region	2001-2005	2006-2010	2011-2015
World	13.4	5.3	0.6
Euro area	12.4	4.8	-0.3
CESEE	17.6	9.6	1.2

Data: IMF (Direction of Trade); own calculations. The CESEE country group includes: Albania, Bulgaria, Bosnia and Herzegovina, Croatia, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Macedonia, Moldova, Montenegro, Poland, Romania, Russia, Serbia, Slovakia, Slovenia, Turkey and Ukraine. Due to data limitations, we excluded Kosovo and Kazakhstan.

Figure 1: global market share of goods exports (2007Q1=100)

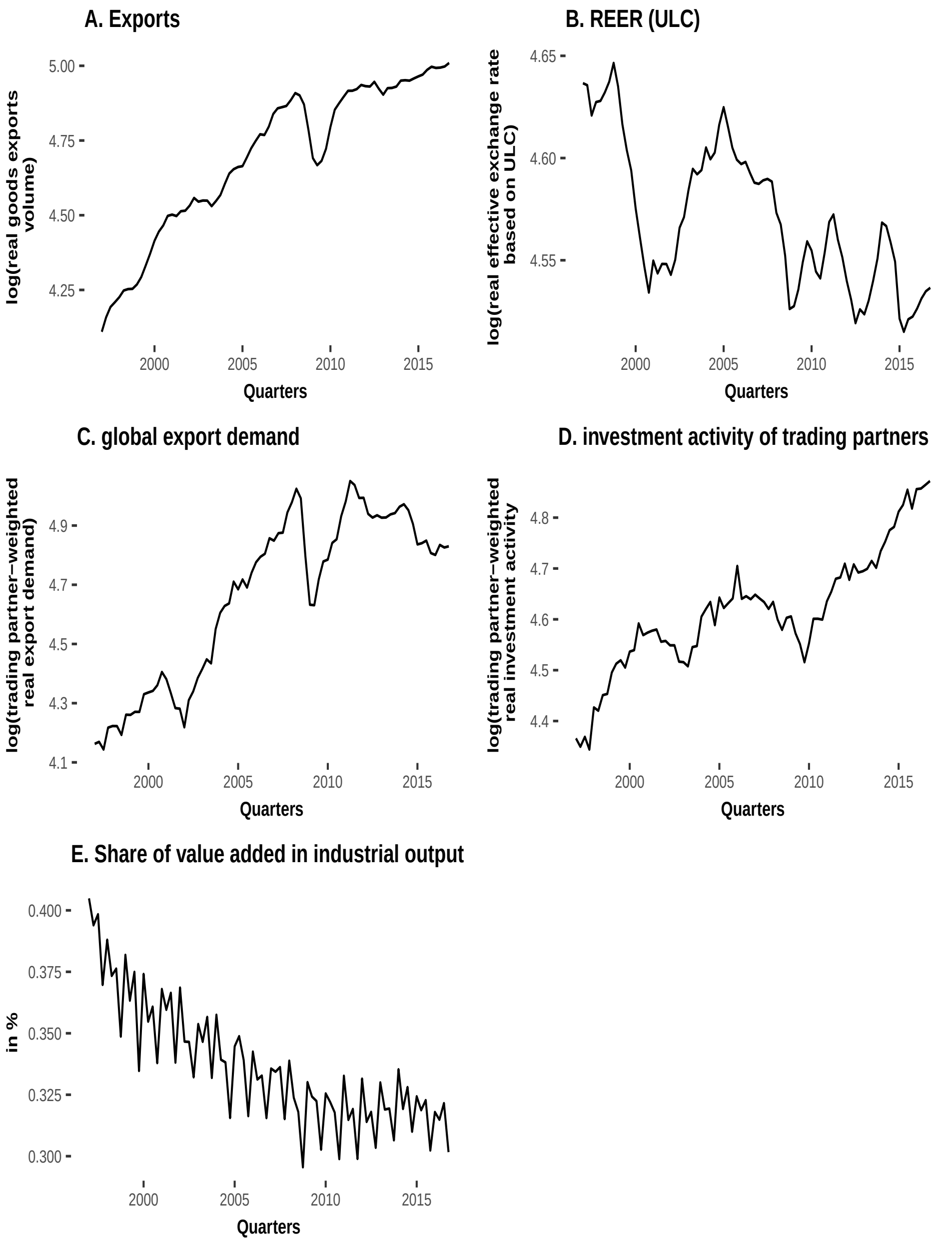


Notes. Data: IMF (Direction of Trade Statistics); own calculations. The advanced country group follows the definition used by the IMF and includes: Australia, Belgium, Canada, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hong Kong, Iceland, Israel, Italy, Japan, Latvia, Lithuania, Luxembourg, Malta, Netherlands, New Zealand, Norway, Portugal, Puerto Rico, San Marino, Singapore, Slovakia, Slovenia, South Korea, Spain, Sweden, Switzerland, Taiwan, United Kingdom, United States (Austria was excluded for reasons of comparability with the Austrian export market share).

2 Which channels have an impact on export performance? Theoretical pre-considerations and data

What explains Austria's export performance? In order to answer this question, we apply the methodology proposed by Danninger and Joutz (2008), who investigated Germany's export performance with a focus on the early 2000s. We explore four channels that can have an impact on exports: (i) cost competitiveness, (ii) global export demand, (iii) global trading partner demand for capital goods, and (iv) changes in the production structure of the export sector (through offshoring of goods production). Notably, these four channels are not necessarily competing; all of them can contribute (to a different extent) to Austria's export market performance. Identifying their impact on exports remains an empirical question.

Figure 2: Time series plots of main variables (log levels except for outsource)



Notes. Data: World Bank, IMF, Eurostat; own calculations.

In what follows, we operationalize all four channels, evaluate their cointegrating relationships in an export model and use error correction to estimate their long-run parameters. The first channel, cost competitiveness, is captured by the real effective exchange rate based on relative unit labour costs in manufacturing (REERu). An increase in the real effective exchange rate (i.e. an appreciation) signals a deterioration in cost competitiveness – and vice versa (e.g. Storm and Naastepad, 2015b). Unit Labour Costs (ULC) are the most established measure of cost competitiveness in the literature; they can be defined as "the average cost of labour per unit of output and are calculated as the ratio of total labour costs to real output."(OECD, 2018) As can be seen from panel B) in Figure 2, the real effective exchange rate has fluctuated over time; in 2016, however, it stood at a very similar level compared to the early 2000s, suggesting that there were neither big gains nor big increases in price competitiveness over this time period.[2] The second channel, global export demand, is operationalized by a variable for export-share weighted real import volumes of Austrian trading partners (exdem). The main reason for including this variable lies in the hypothesis that Austria's ability to penetrate growing export markets matters. Intuitively, slower growth in trading-partner weighted export demand is expected to be an obstacle when it comes to expanding the export market share. Panel C) of Figure 2 shows that global export demand grew relatively fast before the financial crisis, declined during the recession and did not fully recover towards its pre-crisis level until late 2016. The third channel is represented by the variable tpinv, which denotes export-share weighted investment activity of trading partners. This variable is a proxy for the demand for capital goods; it is included since a structural shift in goods demanded could be an explanation for changes in export performance. As the Austrian industry has a tradition in exporting capital goods, changes in trading partners' investment activity might have a pronounced impact on export activities. Panel D in Figure 2 suggests that the tpinv variable fluctuated more than global export demand during the pre-crisis years; since the crisis, however, it has shown more of a recovery than global export demand. Finally, we include a variable representing value added in total industrial production, which can be seen as an indicator for changes in the production structure in the export sector. In particular, the regionalization hypothesis stipulates that if an increasing share of industrial production is placed abroad, this will affect trade volumes, as activities between Austrian exporters and their subsidiaries abroad increase. The outsource variable in panel E of Figure 2 indicates an increase in the regionalization of production processes over time; however, this variable will only be included for the purpose of extending the baseline export model (see section 3.4). In the data appendix, the construction of all the variables introduced above and the data sources used are explained in more detail. Note that all variables except for outsource are used in log levels. Summary statistics are shown in table 2.

[2]On this point, see also Köhler-Töglhofer *et al.* (2017).

Table 2: Quarterly data over the time period 1997-2016: Summary statistics

Statistic	N	Mean	St. Dev.	Min	Max
xgr	80	4.696	0.253	4.110	5.010
REERu	80	4.571	0.036	4.515	4.647
exdem	80	4.659	0.283	4.143	5.050
tpinv	80	4.616	0.120	4.344	4.872
outsource	80	0.337	0.025	0.296	0.405

Note: All variables in log levels except for outsource. Construction and data sources of the respective variable are explained in the data appendix.
xgr... goods exports; REERu... real effective exchange rate based on relative ULC; exdem... global export demand of Austria's trading partners; tpinv... global investment activity of Austria's trading partners; outsource... domestic value added in industry.

A first look at the time series plots of the variables in Figure 2 already suggests that the series are integrated of order one. This presumption was formally confirmed by running Augmented Dickey Fuller (ADF) tests, which suggest that all time series are indeed I(1).[3]

3 Econometric strategy

In what follows, we develop an econometric model of Austrian goods exports by including data on the following variables introduced above: real goods exports volume (xgr); real effective exchange rate based on unit labour costs (REERu); global export demand (exdem); and trading partner investment activity (tpinv). The analysis builds on estimating cointegration relationships and error corrections, which allow us to disentangle the long-run relationship and short-term corrections between these endogenous variables (e.g. Lütkepohl, 2005). We interpret the parameter estimates obtained from the econometric analysis and discuss whether they are consistent with theoretical considerations. We also present a number of extensions and robustness tests related to the stability of the estimated models.

[3]The results of the Dickey Fuller tests are not reported here but they are available on request.

3.1 Export model selection

The first step of our analysis of the long-run relationship between the variables of interest is to estimate a simple unrestricted export VAR model (e.g. Pfaff, 2008; Lütkepohl, 2009), specified as:

$$\begin{bmatrix} xgr_t \\ REERu_t \\ exdem_t \\ tpinv_t \end{bmatrix} = \Pi(L) \begin{bmatrix} xgr_{t-1} \\ REERu_{t-1} \\ exdem_{t-1} \\ tpinv_{t-1} \end{bmatrix} + B\begin{bmatrix} Constant \end{bmatrix} + \begin{bmatrix} \epsilon_{1,t} \\ \epsilon_{2,t} \\ \epsilon_{3,t} \\ \epsilon_{4,t} \end{bmatrix} \tag{1}$$

where $\Pi(L) = \Pi_1 L + \Pi_2 L^2 + \Pi_3 L^3 + ... + \Pi_p L^p$ and $\epsilon_t = MWN(0, \Omega)$.

L denotes the lag polynomial operator; the indivial Π_i terms represent a matrix of coefficients at the ith lag; the error terms are assumed to be white noise, and they can be contemporaneously correlated.

We determine the proper lag structure of this unrestricted model by running lag reduction tests. Comparing information criteria at different lag lengths suggests that the appropriate lag length is five, since both the Akaike information criterion (AIC) and the Akaike final prediction criterion (FPE) indicate that 5 lags should be included in the baseline VAR model (see Table 3).

Table 3: Testing for the proper lag structure

	1lag	2lags	3lags	4lags	5lags
AIC(n)	-30.8	-31.4	-31.4	-31.3	-31.6
FPE(n)	$4.1*10^{-14}$	$2.3*10^{-14}$	$2.4*10^{-14}$	$2.6*10^{-14}$	$2.0*10^{-14}$

Note: A smaller AIC and FPE indicate a preferable model, respectively.

As we are not yet interested in interpreting the results from the unrestricted VAR model (which we will do later on after introducing error corrections), we do not present the results for the baseline model with 5 lags in detail.[4] Here, we focus on running diagnostic checks in order

[4]Detailed results on the baseline VAR model with 5 lags are available upon request.

to establish whether the underlying assumption of white noise residuals is appropriate. Table 4 shows the results from the multivariate Portmanteau test for serially correlated errors.

Table 4: Portmanteau Test (asymptotic)

Chi-squared	p-value
178.89	0.43

Data: Residuals of VAR model

The p-value is 0.43; hence, we are unable to reject the null hypothesis of no autocorrelation in the residuals. Additionally, by applying the Jarque-Bera test to the residuals of the VAR, we do not find evidence for non-normality of the residuals.[5] When we run the Lagrange Multiplier test, which fits a linear regression model for the squared residuals, we cannot reject the null hypothesis that the squared residuals are a sequence of white noise, as is indicated by the results in Table 5.

Table 5: ARCH-LM test (multivariate)

Chi-squared	p-value
521.34	0.25

Data: Residuals of VAR model

All in all, these tests on the unrestricted VAR model suggest that there is no evidence for a significant departure from the assumption of white noise residuals, which confirms that – given the data discussed in section 2 – the chosen econometric strategy seems to be sound.

3.2 Cointegration test

After establishing the proper lag structure and running diagnostic checks on the unrestricted VAR model, we turn to the analysis of cointegrating relationships between the endogenous variables in our baseline model. Formally, if some time series are individually integrated but a linear combination of them has a lower order of integration, the series can be said to be

[5] Results are not reported here but are available upon request.

cointegrated, suggesting that they move together in the long-run (e.g. Maddala and Kim, 2010). In section 2, we have already established that all our variables have a stochastic trend and are integrated of order (1). Against this background, we use the Johansen test procedure to test for the presence of cointegration, which allows for more than one cointegrating relationship (Johansen, 1988). We linearly transform the unrestricted VAR model in levels into a VAR model in first differences, specified as:

$$\begin{bmatrix} \Delta xgr_t \\ \Delta REERu_t \\ \Delta exdem_t \\ \Delta tpinv_t \end{bmatrix} = \Pi(L) \begin{bmatrix} xgr_{t-1} \\ REERu_{t-1} \\ exdem_{t-1} \\ tpinv_{t-1} \end{bmatrix} + \Gamma(L) \begin{bmatrix} \Delta xgr_{t-1} \\ \Delta REERu_{t-1} \\ \Delta exdem_{t-1} \\ \Delta tpinv_{t-1} \end{bmatrix} + B \begin{bmatrix} Constant \end{bmatrix} + \begin{bmatrix} \epsilon_{1,t} \\ \epsilon_{2,t} \\ \epsilon_{3,t} \\ \epsilon_{4,t} \end{bmatrix} \quad (2)$$

where $\Gamma_i = -(\Pi_{i+1} + \Pi_{i+2} + ... + \Pi_{p-1} L^{p-1}$,
$\Pi = \Pi_1 + \Pi_1 + ... + \Pi_p - I$.

With this linear transformation of the VAR model in levels into a VAR model in first differences, the results from the cointegration test are shown in Table 6. An inspection of the test statistics in the table of the Johansen test output provides evidence for a single cointegrating relation between our endogenous variables. To further analyze the long-run relationships between the variables in our export model, we therefore use parameter estimates from error corrections under the assumption of a single cointegrating relationship.

Table 6: Johansen-Procedure

	Test type is the maximal eigenvalue statistic				
Eigenvalues (lambda)	0.41	0.17	0.09	0.03	$-9.3*10^{-16}$
	Values of teststatistic and critical values of test				
	test	10pct	5pct	1pct	
r <= 3	2.09	7.52	9.24	12.97	
r <= 2	7.34	13.75	15.67	20.20	
r <= 1	14.17	19.77	22.00	26.81	
r = 0	39.26	25.56	28.14	33.24	

Note: r=0 is the hypothesis of no cointegration relationships between the endogenous variables in the model; we are able to reject r=0. In sum, according to the Johansen test statistics there is evidence for a single cointegrating relationship.

3.3 Estimating the vector error correction model

The vector error correction (VEC) model that we use for the purpose of estimating the long-run relationship is a restricted VAR that has cointegration restrictions (in our case: the assumption of one cointegrating relation) built into the specification; it is designed for use with nonstationary time series that are cointegrated, which we have already established by using the Johansen procedure. The VEC specification restricts the long-run behavior of the endogenous variables to converge to their cointegrating relationships, while allowing a wide range of short-run dynamics. The cointegration term is known as the error correction term (ect); the deviation from long-run equilibrium will push the system back towards the long-run equilibrium position through a series of partial short-run adjustments (e.g. Engle and Granger, 1987).

The results obtained by running the VEC model are shown below. ect1 represents the estimated error correction terms (α coefficients) of the respective equation. The β coefficients are the long-run parameters.

Table 7: Results from estimating the VEC model

	Coefficients			
ect1	-0.1645208	0.6888133	0.1181760	-0.1443549
xgr.dl1	0.8990363	0.9107328	-0.0291618	0.3141083
exdem.dl1	-0.0182990	0.3038142	0.0304247	-0.1174737
REERu.dl1	0.3023738	0.4972423	0.3596649	0.3620215
tpinv.dl1	-0.0841903	0.6866113	0.1054172	-0.2598393
xgr.dl2	-0.2680450	-0.6389973	-0.0314484	-0.0573657
exdem.dl2	-0.0697391	-0.1249728	-0.0603351	-0.0218412
REERu.dl2	0.4076441	-0.3741004	0.0317714	0.0938670
tpinv.dl2	0.0481098	0.5266068	0.1136606	-0.0400381
xgr.dl3	0.4371629	0.2159792	0.0216934	0.1975812
exdem.dl3	-0.0863272	-0.1382411	0.0034211	0.1227199
REERu.dl3	0.1139175	0.6108985	0.0002482	-0.0083779
tpinv.dl3	0.0475444	0.7025111	0.0788958	-0.1007758
xgr.dl4	-0.2727936	-0.5426608	-0.0590286	0.0666892
exdem.dl4	-0.0345698	0.2153796	0.0089944	-0.1371205
REERu.dl4	0.2017632	-1.7800409	-0.3764939	0.9729600
tpinv.dl4	-0.0310812	-0.0475103	-0.0213492	0.2774512
	β coefficients			
xgr.l1	1.0000000			
exdem.l1	-0.5497782			
REERu.l1	0.9954791			
tpinv.l1	-0.7182249			
constant	-3.3876232			

Note: .d denotes the first difference of the respective variable. l1... l5 means lag1 to lag 5. ect is the error correction term.

xgr... goods exports; REERu... real effective exchange rate based on relative ULC; exdem... global export demand of Austria's trading partners; tpinv... global investment activity of Austria's trading partners. Details on the variable construction are available in the appendix.

The cointegration vector with the short-run (α) and long-run (β) coefficients from the VEC model output are shown in more condensed form in table 9. When we normalize the first standardized eigenvector (β vector) on Austrian real goods exports volume (xgr), we get the long-run relationship written in Table 8.[6]

Table 8: Long-run relationship based on model estimation

long-run relationship:	xgr	=	0.550 exdem	−	0.995 REERu	+	0.718 tpinv
standard errors:			(0.02***)		(0.15***)		(0.06***)
speed of adjustment:	α	=	-0.165				
			(0.09***)				

*** denotes statistical significance at the 1% level.

xgr... goods exports; REERu... real effective exchange rate based on relative ULC; exdem... global export demand of Austria's trading partners; tpinv... global investment activity of Austria's trading partners. Details on the variable construction are available in the appendix.

The β coefficients for global export demand (exdem), the real effective exchange rate (REERu) and global investment demand (tpinv) are 0.550, -0.995 and 0.718, respectively (which can be interpreted as elasticities, since all variables are expressed in log levels). The standard errors (reported in brackets) suggest that the impact of the respective variable on exports is statistically highly significant. The long-run estimates suggest that all variables have the theoretically expected impact: an increase in global export demand increases exports; a deterioration in cost competitiveness lowers exports; and an increase in the global demand for capital goods raises exports. Furthermore, the error correction term α is negative and also statistically significant. This suggests that the specified cointegrating relationship is appropriate, since the model fairly rapidly adjusts to short-run deviations.

[6] Note that the signs reported in this equation are reported opposite to the presentation in the standard export model equation; see table 9. Standard errors are reported in brackets.

Table 9: Cointegrating vector and loading parameters

Vector	xgr	exdem	REERu	tpinv	trend
$\beta^\top$	1.000	-0.550	0.995	-0.718	-3.387
$\alpha^\top$	-0.165	0.689	0.118	-0.144	

Note: Own calculations, based on the model described above. Construction and data sources of the respective variable are explained in the data appendix.
xgr... goods exports; REERu... real effective exchange rate based on relative ULC; exdem... global export demand of Austria's trading partners; tpinv... global investment activity of Austria's trading partners.

3.4 Accounting for the regionalization hypothesis

In a next step, we account for the regionalization hypothesis, which states that if an increasing share of industrial production is placed abroad, export volumes will be affected. We do so by additionally including the outsource variable (capturing the share of value added in industry production; see Figure 2) into the export model.[7] When we impose weak exogeneity for global export demand, the cointegrating relationship can be written as in Table 10.

Table 10: Long-run relationship with regionalization hypothesis

lr relationship:	xgr	=	0.474 exdem	−	0.636 REERu	+	0.704 tpinv	−	1.093 outsource
standard errors:			(0.05***)		(0.21**)		(0.06***)		(0.77)
speed of adjustment:	α	=	-0.254						
			(0.078***)						

, * denotes statistical significance at the 5% and 1% level, respectively; lr... long-run
xgr... goods exports; REERu... real effective exchange rate based on relative ULC; exdem... global export demand of Austria's trading partners; tpinv... global investment activity of Austria's trading partners; outsource... value added in industry. Details on the variable construction are available in the appendix.

It can be seen that the long-run parameter estimates again conform to the basic expectations regarding their signs. The elasticity of REERu is a bit lower (in absolute terms) than in the baseline model (-0.636 compared to -0.995), while the exdem and the tpinv coefficient

[7] Note that we include seasonal dummies as the outsource data are not seasonally adjusted.

do not change markedly; all three variables retain their high statistical significance. The speed of adjustment (α) coefficient is significant and suggests that short-run deviations are corrected fairly rapidly. The outsource variable also has the expected sign: in the long run, increased outsourcing is negatively linked to exports volumes. However, the standard error of the outsource variable does not allow for rejecting the null hypothesis, i.e. the coefficient lacks statistical significance. Furthermore, running the Johansen procedure to test for the presence of cointegration yields results that do not allow us to rule out that there is more than one cointegrating relation. For those two reasons – the possibility of more than one cointegrating relation and a lack of statistical significance of the outsource variable –, we decide to stick to our baseline model as the preferred model choice.

3.5 Restricting the time period to 2007-2016

In a next step, we are interested in analyzing whether the long-run relationship changes when we restrict the time period to the yeas 2007-2016, which implies that we leave out the pre-crisis years 1997-2006. By again using an error correction model, we can see from Table 11 that the real effective exchange rate based on unit labour costs no longer seems to have a long-term impact on exports.

Table 11: Long-run relationship for time period 2007–2016

long-run relationship:	xgr	=	0.31 exdem	+	0.08 REERu	+	0.73 tpinv
standard errors:			(0.08***)		(0.21)		(0.06***)
speed of adjustment:	α	=	-0.47				
			(0.12***)				

*** denotes statistical significance at the 1% level.

xgr... goods exports; REERu... real effective exchange rate based on relative ULC; exdem... global export demand of Austria's trading partners; tpinv... global investment activity of Austria's trading partners. Details on the variable construction are available in the appendix.

The REERu standard error is so large that we cannot reject the null hypothesis at the 10% level. This result suggests that the impact of the real effective exchange rate on Austrian exports might have been muted during the crisis and post-crisis period of 2007-2016. Global export demand (exdem) and trading partner investment activity (tpinv), on the other hand, retain their expected sign and statistical significance. Notably, the speed of adjustment parameter again has the correct sign and is statistically significant. It should, however, be noted that interpretations should only be conducted very carefully, since the number of observations has gone down after excluding the pre-crisis data.

3.6 Decomposing contributions to export growth since the financial crisis

Finally, we quantify the contributions of the various channels in our model to export growth in our preferred model. In particular, we use our model estimates to assess which channels are relevant for explaining export growth by following Danninger and Joutz (2008). We start by assessing the model fit. As shown in Table 12, actual average annualized export growth over the time period 2007-2016 was 1.71%, while the model developed in section 3.3 predicted a slightly higher growth rate of 2.03%; the model fit, however, can be assessed to be good, since the residual is only about -0.33%-points; hence, about 81% of actual export growth over the time period 2007-2016 can be explained by our model. Table 12 also includes the contributions of the individual variables to model-predicted export growth. The large majority of export growth over 2007-2016 is explained by global investment demand (tpinv:1.7%), while the real effective exchange rate has also contributed to a smaller extent (REERu: 0.5%); global export demand even recorded a slightly negative contribution (exdem: -0.15%). We can also ask whether the contributions of the various factors to Austrian export growth differ for the pre-crisis years 1997-2006. We find that the annualized export growth rate was markedly higher (7.3%) than during the crisis and post-crisis period. Furthermore, Table 12 indicates that growing export demand contributed about 3.8% to the growth in real pre-crisis exports. While global investment demand recorded a contribution of 2.0%, the contribution of the real effective exchange rate based on unit labour costs was comparatively much smaller (0.5%), but also had a positive impact. In short, these findings provide evidence that Austria's exporters benefited from widespread economic growth in pre-crisis years. When the financial crisis hit and major trading partners entered a (prolonged) slump, however, the contributions deriving from increasing economic activity of trading partners declined markedly, leading to substantially lower export growth rates. The role of cost competitiveness is found to have played a role as well, but in terms of size and relevance it is comparatively small.

We may also be interested in finding an answer to why Germany's global export market share has bounced back more than the Austrian export market share since 2009 (see Figure 1). Comparing Austria and Germany, a major part of the answer is that important trading partners of Germany were less affected by the repercussions of the crisis than Austria's trading partners. We can derive this conclusion from our data, since the average growth rate of (trading partner-weighted) global export demand in Germany was about 2.1 percentage points higher than the model-based tpinv growth rate in Austria, while the growth of (trading-partner weighted) global investment demand (exdem) in Germany was 1.0 percentage points higher than in Austria. An important part of Germany's growth story over the last 20 years is that German firms have managed to diversify their export markets, recording strong export growth in fast-growing regions outside of Europe (Gräbner *et al.*, 2017). A potential way forward for the Austrian export industry could therefore be to further diversify its export basket to reach fast-growing parts of the global economy and to push for further improvements in non-price competitiveness – a point which we will elaborate on in the concluding section.

Table 12: Comparing actual export growth with model export growth: average annual export growth over 2007-2016 and model contributions to export growth

	Export growth			*Contributions to export growth*		
	Actual	model	Residual	exdem	REERu	tpinv
2007–2016	1.71%	2.03%	-0.33pp.	-0.15%	0.51%	1.67%
1997–2006	7.29%	6.27%	1.02pp.	3.82%	0.48%	1.96%
Long-run parameters	-	-	-	0.55	-1.00	0.72

Note: Model export growth is defined as predicted export growth of real exports between 2007 and 2016 (and 1999-2006, respectively) from the cointegrating relationship of the preferred export model.
REERu... real effective exchange rate based on relative ULC; exdem... global export demand of Austria's trading partners; tpinv... global investment activity of Austria's trading partners. Details on the variable construction are available in the appendix.

4 Conclusions

This paper has analyzed Austria's export market performance (in terms of real goods exports) over the time period 2007-2016. We included information on four non-competing channels that can impact on exports: (i) cost competitiveness, (ii) global export demand, (iii) global trading partner investment demand, and (iv) the regionalization of production structures. By using cointegration analysis and error corrections, we have gathered evidence according to which price competitiveness, global export demand and global investment demand all have a significant long-run impact on exports. However, against the background that there were "only small variations in Austria's international competitiveness since 2008" (Köhler-Töglhofer *et al.*, 2017, p. 73), we find that price competitiveness has only played a relatively small role in terms of its contributions to export growth, especially over the crisis and post-crisis period of 2007-2016. Lower export growth since 2007 is to a significant extent driven by ties to slower growing trading partners and reduced trading partner demand for capital goods, which largely reflects the relatively weak macroeconomic performance of many of Austria's important trading partners since the financial crisis. A decomposition of the contributions of the various factors to export growth has shown that during 1997-2006 (i.e. in pre-crisis years), Austria's exporters had substantially benefited from economic growth in trading partner countries. However, after the financial crisis hit and large parts of Austria's trading partners recorded lower economic activity, the contributions deriving from trading partner growth declined sharply and pushed Austrian export growth downwards. Cost competitiveness did play a role – and remains a significant long-run determinant of export performance –, but the results reported in this paper suggest that over the last twenty years the relative contribution of changes in the real effective exchange rate based on unit labour costs to export growth were comparatively small.

What are the policy conclusions? First, the results in this paper underscore the importance of striking a fine balance between price competitiveness and consumption demand considerations: while the success of the Austrian export industry partly relies on adequate wage policies to avoid large appreciations in the real effective exchange rate, it is important to stress that aggregate demand dynamics are of central importance for the future of the Austrian economy: in 2016, only about 2.5 out of 10 Euros of total demand in the Austrian economy derived from goods exports,[8] which underscores the relevance of domestic consumption and investment demand. Hence, the question of wage policies should not be reduced to the issue of price competitiveness and export performance. Wages play a dual role, as they are not only the most important cost competitiveness component for most firms, but also represent the incomes of employees, so that wage growth is highly important for sustaining adequate domestic demand (e.g. Badhuri and Marglin, 1990). Against this background, striking a balance between price competitiveness and demand-side considerations in the long run could be achieved by following the so-called Benya formula, according to which wage policies should be a function of inflation and productivity: in particular, yearly wage growth should compensate both for the inflation rate and medium-term productivity growth (e.g. Mesch, 2015). Second, given that this paper has shown that global export demand is an important determinant of export performance, industrial policy should aim at ensuring a diversified economic structure that strengthens the production base for complex products. Existing research has emphasized that technological capabilities are highly relevant for assessing the future developmental trajectories within given political and institutional constraints (Cristelli *et al.*, 2015). Countries that are able to produce and export more complex products typically record a favourable development in terms of increasing incomes (Hidalgo

[8] According to AMECO data provided by the European Commission, for Austria the share of goods exports in total demand was 24.47% in 2016, while the share of exports of goods and services in total demand stood at 35.05%. Source: AMECO (update May 3rd 2018); own calculations.

et al., 2007; Hidalgo and Hausmann, 2009). Since the financial crisis, Austria has been one of only a handful of European countries, which were able to sustain their strong technological position (Gräbner *et al.*, 2017, 2018). As Austria's technological capabilities are highly important for the future of its growth model, targeted policies could foster the technological position by pushing for investments in knowledge policies that support technological, organizational and institutional innovations. Policy-makers could also work to ensure sufficient national supply of a highly-skilled labour force, which requires appropriate education policies (e.g. Hausmann and Rodrik, 2003; Cimoli and Dosi, 2017). Third, given the integration of the Austrian economy into global value chains and its strong linkages with Eastern Europe in particular (Stöllinger, 2016), Austrian policy-makers should support European policy measures that prevent disruptions in trade with important trading partners. A sustainable strategy therefore requires policies that allow for a continuation of the catching-up process in Eastern Europe and an European policy agenda that supports convergence within the Eurozone (e.g. Landesmann and Stöllinger, 2018). Finally, policymakers should think about how to increase exports to regions that could be expected to feature higher growth rates and increasing demand for capital goods in the future. For example, such an orientation of Austrian capital goods exports could be developed in the context of a strategy for future economic relations with India and Africa.

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5 Appendix

This appendix includes additional information on how the variables used throughout the paper were constructed and where the relevant data were obtained from.

The following variables are used in this paper:

- **xgr**: natural logarithm of total goods exports (volume at constant prices transformed into an index: 2004Q1=100), quarterly data (seasonally-adjusted) over the period 1997Q1-2016Q4. Source: Eurostat.

- **REERu**: natural logarithm of the real effective exchange rate based on relative unit labor costs in industry (index: 2004Q1=100). Source: International Financial Statistics (IFS). Quarterly data over the period 1997Q1-2016Q4.

- **exdem** (global export demand): natural logarithm of export share-weighted volume of real aggregate goods import volumes in Austria's trading partners. Source: World Bank, Direction of Trade (IMF); own calculations. Index: 2004Q1=100. Quarterly data over the period 1997Q1-2016Q4.[9]

$$exdem_t = \sum_i exshare_{i,t} m_{i,t} \tag{3}$$

  where $exdem_t$ is the global export demand at time t, $exshare_{i,t}$ is the share of Austria's goods exports to country i at time t in relation to Austria's total goods exports at time t, and $m_{i,t}$ are real goods imports in country i at time t.

- **tpinv** (investment activity of Austrian trading partners): natural logarithm of export share-weighted volume of real investment activity in Austria's trading partners (index: 2004Q1=100). Source: World Bank, Direction of Trade (IMF); own calculations. Quarterly data over the period 1997Q1-2016Q4. [10]

$$tpinv_t = \sum_i exshare_{i,t} inv_{i,t} \tag{4}$$

[9] *Note:* Due to a lack of quarterly data on real aggregate import volumes for a global country sample, we took annual data from the World Bank and used spline interpolation to generate quarterly data.

[10] *Note:* Due to a lack of quarterly data on real investment activity for a global country sample, we took annual data from the World Bank and used spline interpolation to generate quarterly data.

where $tpinv_t$ captures real investment activity of Austrian trading partners at time t, $exshare_{i,t}$ is the share of Austria's goods exports to country i at time t in relation to Austria's total goods exports at time t, and $inv_{i,t}$ represents real gross fixed capital formation in country i at time t.

- **outsource** (domestic value added in industry): Domestic value added in % of total output of the industrial sector. Source: Eurostat, Statistik Austria; own calculations. Quarterly data over the period 1997Q1-2016Q4.

The time series of all variables explained above are plotted in Figure 2.

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