The Impact of the Global Recession in Europe - The Role of International Trade[1]

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Abstract:

We assess empirically the marginal impact of export orientation for the severity of the growth downturn in 2009 while controlling for a host of country characteristics such as structural features, macroeconomic imbalances, previous growth record, and the like. We employ an iterative robust regression technique using a sample of 38 mostly European countries to quantify the direct contribution of trade to the crisis response with a special focus on Eastern European economies. We find that greater export orientation is related to a stronger growth downturn in our sample. This effect is only revealed when we allow for an interaction term between export orientation and domestic GDP structure. Moreover, we find strong evidence that the domestic structure of value added (in particular a high share of industry in GDP) has compounded a country's vulnerability during the recent crisis. We further find support for the effects of overheating: previous high growth rates are systematically linked to a stronger growth downturn in all specifications. Finally, a negative influence from previously high debt ratios on the output response during the crisis is confirmed.

JEL-codes: F14, F15, O52

Keywords: trade collapse; industrial structure; Central, Eastern and Southeastern Europe

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1. Introduction

Since the unfolding of the recent financial crisis, world exports and imports dropped dramatically. While global GDP is forecast has shrunk by xx% (according to the IMF World Economic Outlook 04/2010), world trade volume has fallen by xx% in 2009. The figures are similar for all major industrialized regions in the world and some emerging markets. Hence, trade has certainly been one of the most severely hit economic activities. The question arises to what extent this strong and immediate trade response has propagated the crisis throughout the globe in 2009 and to what extent trade openness has reinforced the impact of the crisis for individual countries.

In other words, the remarkably large drop in trade is central in the discussion on how a local financial crisis could turn into a global economic crisis. The academic discussion seems to agree that only the combination of a number of distinct shocks could have led to the sudden spread of the crisis and cause a global recession of this magnitude (see for example Escaith, 2009; McKibbin and Stoeckl, 2009; Rose and Spiegel, 2009, to name just a few). Starting from the bursting of the housing bubble in the US in mid 2007, households in the US experienced a sharp reduction in wealth which, coupled with changing perceptions of risk by households and businesses, implied a demand shock in the US. All else equal, this would have triggered two offsetting effects on the global economy: a shortfall in external demand for countries which are heavily dependent on the US market on the negative side and rising investment opportunities in response to low returns on investment in the US on the positive side (McKibbin and Stoeckel, 2009).

In the recent crisis the latter effect did not materialize, because the reappraisal of risks was just as global in scope as was the shortfall in demand. In particular, emerging markets which in theory could have profited from worsening investment conditions in the US (and other highly developed countries) were negatively affected by changing investor risk perceptions. Hence in the current crisis, the two effects reinforced instead of offsetting each other. In that way, international trade acted as a compounding factor not only transmitting but also magnifying the effects of the US crisis. All this has led to a worsening in investment climate, deteriorating credit conditions and falling domestic demand in particular for durable and investment goods.

But how important in quantitative terms was trade in the global transmission of the crisis? In this paper, we try to quantify this effect and argue that the direct contribution of trade to deepening the economic downturn should not be overstated. Only the combination of structural characteristics and highly open markets have implied a strong output response in the countries which are most heavily exposed to the sectors contracting most strongly during the crisis. We start by summarizing the dramatic developments in world trade in 2009 in Section 2. Section 3 reviews the existing related literature and discusses the mechanisms of crisis transmission through trade. We identify basically three factors of theoretical importance in shaping the outcome of the crisis. Two demand-side explanations are related to the rising importance of global supply chains and structural differences between the domestic and external sector of the economy. A supply-side explanation relates to problems in trade financing. Section 4 uses an econometric model to estimate the importance of trade, structural characteristics and financial uncertainties for the incidence of the crisis in a cross-section of 38 predominantly European countries. Section 5 concludes.

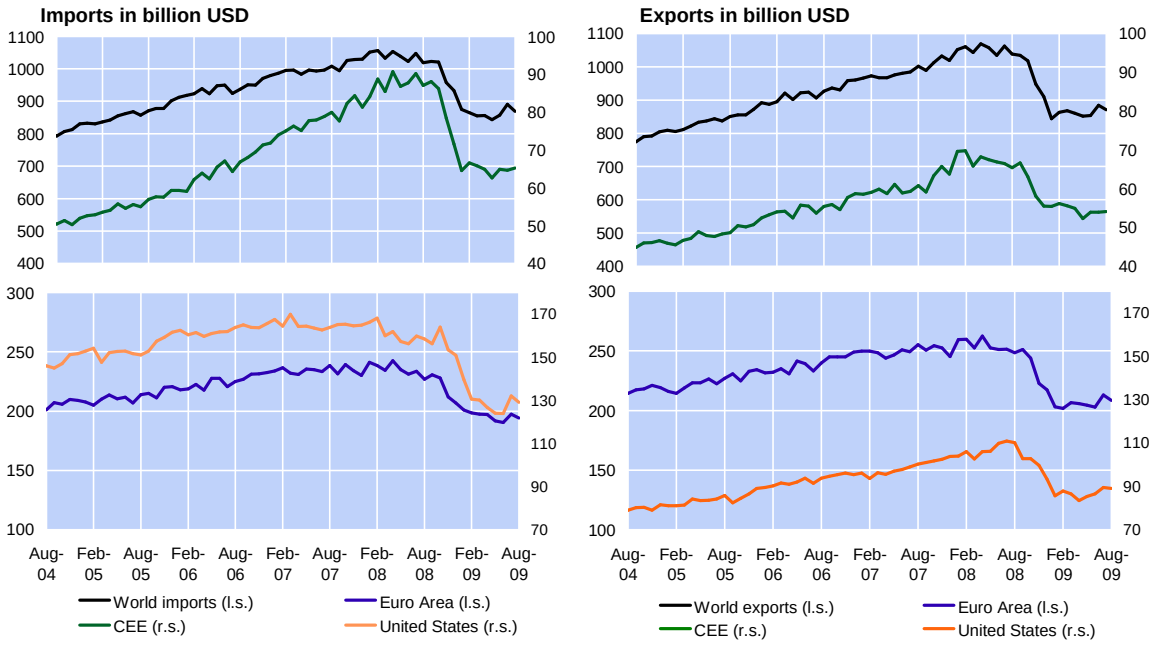
2. Recent Developments in World Trade

The drop in international trade flows observed in early 2009 was unprecedented and largely unexpected. Figure 1 shows real growth of exports and imports for the world, the Euro Area, the United States, and for Central and Eastern Europe from August 2004 to August 2009. The decline in trade volumes started in May 2008 and lasted for roughly one year. By May 2009, global trade volume has dropped by almost 20% annually in real terms.

A similar picture emerges when looking at different world regions. US imports were down by 21%, Euro Area imports by 18%. Exports of both regions contracted by 20% and 19% respectively. For Central and Eastern Europe, the contraction in trade has been particularly strong. Exports from Central and Eastern European countries fell by 23%, while the region's imports contracted by as much as 28%.

Figure 1

Real Merchandise World Trade, Aug. 2004 - Aug. 2009



Source: CPB Trade Monitor.

At the sectoral level, mineral fuels, crude materials, manufactured goods and machinery and transport equipment experienced the most severe drops in trade. Figure 2 displays three-month moving averages of import growth for different sectors in OECD countries. OECD imports in these categories recorded dramatic declines between 11% and 15% month-on-month at the height of the trade collapse (from December 2008 to January 2009). In May 2009, when global trade volumes reached the trough, these categories were between 49% (mineral fuels) and 34% (machinery and transport equipment) below their previous levels in annual terms. However, these were also the categories which showed the strongest signs of recovery in mid-2009.

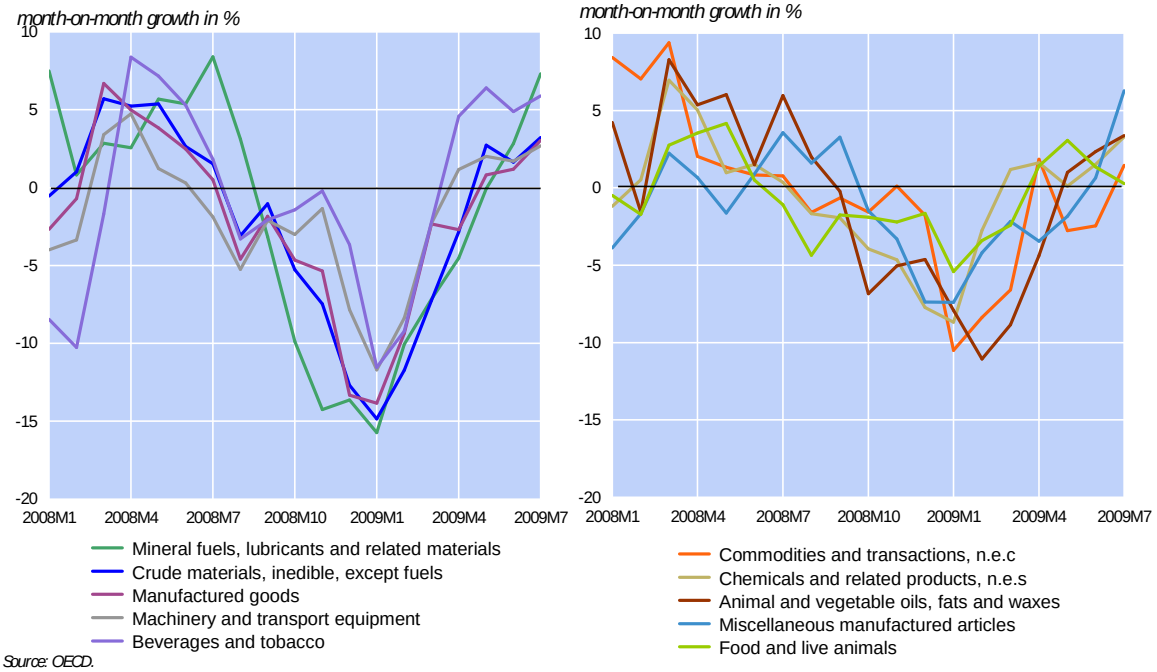
As mentioned above, trade started to decline in May 2008 and turned negative first in October 2008 when the collapse of Lehman and the consequent re-assessment of risks has added a second, decisive shock to the global economy in addition to the US-demand shock. The trough in trade growth was reached already in January 2009, positive import growth, however, was only reached again in July 2009.

Much of the nominal trade collapse depicted in Figure 2 is of course due to price effects, which becomes visible in the steep decline in OECD fuel imports shown in the second panel of figure 2. The weakness in US demand for mineral fuel may also have a supply-chain component since petroleum

and natural gas are major inputs into chemicals and plastics, which are in turn intermediate inputs for many other industrial sectors (Ferrentino and Larsen 2009).

Figure 2

OECD Import growth by product categories, based on 3-month moving averages



Source: OECD.

The casual inspection of the data suggests that trade may have the potential to act as an important transmission channel in particular for countries heavily exposed to those manufactured exports experiencing the sharpest declines. For example, the Central, Eastern and Southeast European countries (CESEE) are strongly specialized in exports of machinery and transport equipment. Recent trade data for the CESEE EU member states reveal that indeed their exports of automobiles and related parts declined strongly already in the fourth quarter of 2008 and thus before most of these countries showed a GDP-reaction to the financial crisis. The initial drop was particularly strong in exports of automobiles and related parts, followed by a substantial reduction in capital goods exports in early 2009 (see Figure 3).

Figure 3

Absolute Change In Exports By End-Use Categories for CESEE EU Member States

change to previous year in ppts of GDP

Source: Eurostat.

By all standards, the trade developments in 2009 represented a dramatic shock for all export oriented countries throughout the world. In the next section, we will separate conceptually different mechanisms through which this external demand shock could be transmitted to domestic output shocks in individual countries.

3. The role of trade in crisis transmission

The discussion in the literature on openness and vulnerability to shocks is not new, the findings may often seem, however, to be contradictory at first sight. For example, Cavallo and Frankel (2008) find robust evidence that – even when controlling for endogeneity between trade and growth – openness to trade reduces the vulnerability to crises. Edwards (2004) shows that trade integration can lead to fewer sudden stops in capital inflows. Martin and Rey (2006) find that emerging markets showing increased financial integration without increased trade openness are at higher risk to financial crises - since profits and dividends relate to output volatility.

The contrasting view, namely that trade propagates shocks, is presented inter alia very recently by Fidrmuc and Korhonen (2009) who point towards greater synchronisation of shocks in the presence of stronger trade ties. Their analysis is based on East Asian business cycles over the period 1990-2008. Haile and Pozo (2008) confirm this view with respect to currency crises. Both studies conclude that openness is one factor which renders a country prone to sudden stops of capital inflows. To summarize, countries that are more integrated are also more at risk to be affected by external shocks.

The apparent puzzle between the conflicting findings presented above is easily resolved when disentangling differences in the definition of a "crisis" as being of either domestic or external origin. On the one hand, greater openness will have a positive impact when the crisis is of domestic origin. There is even evidence that openness can help to avoid domestic crises, for it spurs financial (Aizenman, 2008) and general regulatory, economic and legal reform (Cavallo and Frankel, 2008). On the other hand, greater openness by definition helps to propagate external shocks across countries

which are highly integrated. This is also often considered to be an explanation why most crises remain regional in scope (Caramazza, Ricci and Salgado, 2000).

Assigning the centre of the current crisis to the housing bubble in the US, all other countries have been confronted with an external shock during 2007/2008. It is still unclear, to which extent this US-based crisis has then been transmitted by the financial channel as opposed to a real (i.e. trade) channel. Looking at currency crises, Caramazza et al. (2000) identify weak output growth and to a lesser extent external imbalances as important factors for the vulnerability of emerging and developing countries. Trade and financial linkages play a role only when coupled with weak current account balances. Also for industrial countries they find that fundamentals play an important role, however, their importance differs with unemployment playing a greater role here. Haile and Pozo (2008) also confirm these findings and stress the importance of fundamentals and highlight the possibility of contagion through the trade channel, when fundamentals are weak.

Basically, three rather distinct channels emerge, which could explain the fast propagation of the crisis across the globe. Two of these offer a demand-side explanation, while the third one works through supply shortages. All three channels imply also an indirect role for international trade in crisis transmission:

1. Rising importance of global value-chains
2. Structural differences between domestic and external sector
3. Problems in (trade) financing

The first two channels imply that the demand contraction in the US is transmitted across trading partners with different intensity depending on structural characteristics of these countries. The third channel is qualitatively different and describes a supply shock, i.e. production outside the US is impeded due to deteriorating credit conditions.

3.1. Rising importance of global value-chains

The interconnectedness of modern production chains provides for the first channel. The US demand shock is transmitted via international trade, often within a firm but nevertheless across countries, through strongly integrated global supply chains, also referred to as “fragmentation of production”, outsourcing or offshoring. The elasticity of trade to changes in GDP has been explored by many empirical studies. While the literature provides different estimates depending on the model being used, there is a clear consensus that the elasticity of trade to GDP seems to have increased over recent years in response to the higher degree of vertical specialisation we see today. Irwin (2002) estimates the elasticity of real world trade to real world income to have increased from around 2 in the 1960s and 1970s to 3.4 in 1990. In a rather simple empirical framework, Freund (2009) finds this elasticity to be around 3.5 today. Yi (2008) and Tanaka (2009) also attribute the significant increase in the elasticity of trade to income to greater fragmentation of production. The high degree of vertical integration we see today would however imply that the countries which are similarly integrated in global value chains are hit to the same extent. However, this is not what we observed in practise.

Escaith (2009) attributes also a prominent role in the spreading of the 2008/09 crisis to trade effects. He argues that global production networks aggravated the downturn in the real sector because global supply chains involve a high degree of stock-building and hence financing. The drop in final demand and the drying up of credit markets consequently resulted in the aggravation of the initial effect in each link in the chain and thereby exacerbated the economic downturn. By the same logic, economic recovery should also work its way back the supply chain in a similar way.

However, increased vertical specialization and supply chains might be only part of the explanation for the strong trade reaction. As several authors point out (Francois and Woerz, 2009; Freund, 2009), a

part of the unproportionally strong drop in trade is due to simple accounting reasons. Since GDP is a value added measure but trade data are measured on a gross value basis, any decline in GDP necessarily triggers a relatively higher decline in trade. Double counting over countries adds to this.

Hence, the contribution to crisis-transmission by trade potentially remains considerably smaller than the observed volatility in trade flows. A large decline in trade could reflect a much smaller decline in global value added if production is done across countries at the margin and - as demand falls - international production chains break down. For example, Porsche in April announced that it is reducing production in Finland, but upholding German production (New York Times, 4 April 2009). Firms may tend to source relatively more from home country suppliers during times of crisis.[2]

3.2. Structural differences between domestic and external sector

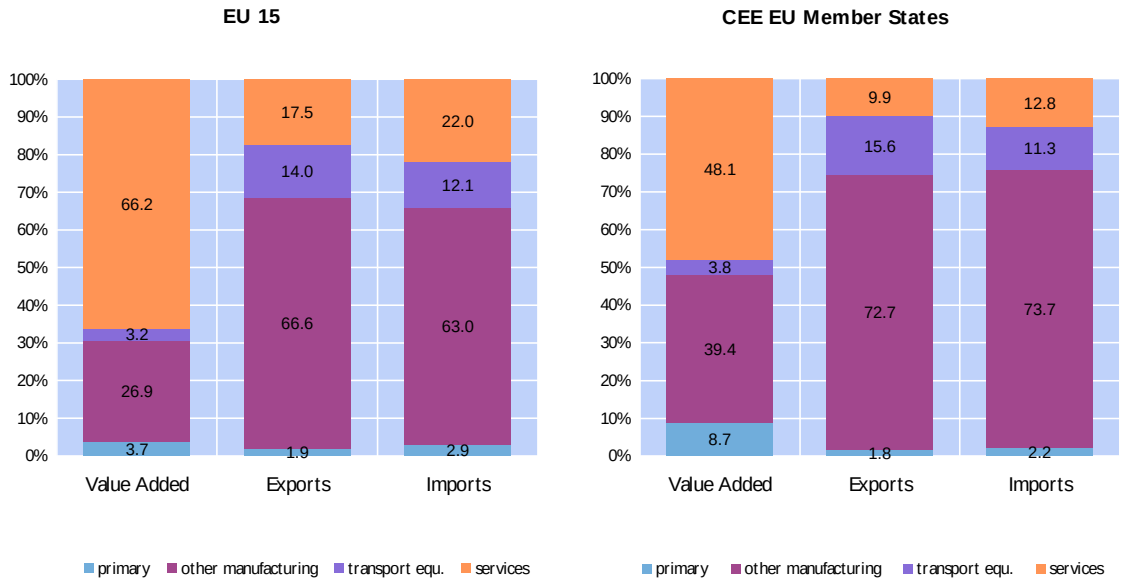
A second demand-side transmission channel via trade is to be found in structural differences between the domestic sector and the external sector of an economy. For developed countries, about 80% of trade is manufactures, while they constitute only 20% of domestic GDP. This structural argument offers an explanation for a different crisis-impact on countries depending on their specific trade and GDP structure. Thus, not only openness as such matters for a country's vulnerability to a severe external demand shock, but it is important whether the country is particularly exposed to those sectors which suffer the strongest decline in demand.

A casual inspection of available data underlines this argument. Figure 3 contrasts the differences in GDP versus trade structure for the EU25 (as of 2004). The left panel of figure 3 shows a weighted average for all EU members which acceded prior to 2004 (EU15), while the right hand side panel gives the same data for the Central and Eastern European countries which acceded in 2004 (CEE EU member states). The differences are striking. First of all, we see a clear distinction between the industrial structure of the external sector (exports and imports) and domestic value added in each region. The EU15 exhibit a typical structure for highly industrialized countries with 66% of domestic income generated by the service sector in 2005. The manufacturing sector accounted for 30% in domestic value added but as much as 80% of trade. The respective figures for the CEE EU member states' manufacturing sector were 43% and 89% respectively in 2005, the share of services in domestic value added was at 48%. Thus, the importance of manufacturing in trade is much greater than in domestic GDP for both regions, hence explaining the steep drop in trade during the peak of the crisis.

[2] As a word of caution, there is the danger that protectionist policies kick in when global GDP drops sharply and this sharp drop is exacerbated through a decline in trade. However the same protectionist policies, while arriving too late to shield a country from the downturn may also impede the country to profit from the global upswing again. The Great Depression of the 1930s illustrated very impressively this policy mistake which has led to a prolonged period of recession. (see Almunia et al. 2009)

Figure 4

Structure of Value Added and Trade in 2005



Source: EUKLEMS database (Timmer et al. 2007).

These figure further illustrates a second important difference between the two regions: The catching-up economies of Central and Eastern Europe show a higher share of manufacturing not only in trade but also in domestic value added. A tenth of this is transport equipment, almost 4% of GDP and more than 15% of exports for the region as a whole. This share is however higher for the three largest economies in the region. According to recent Eurostat figures, exports of automobiles and related parts accounted for 22% in the Czech Republic, 21% in Hungary and almost 23% in Poland in 2008. Countries with high trade shares in industries and sectors that were hit especially hard in the crisis were strongly affected by the crisis as well. During the 2008/09 downturn, the manufacturing industries have been among the ones that have been hit the hardest. For Central and Eastern Europe, the automobile sector along with increased risk perceptions by international investors was particularly relevant for the deep impact of the crisis in 2009.

3.3. Problems in (trade) financing

Finally, financial crises may affect different sectors not only on the demand side but also through different financing needs. Iacovona and Zavacka (2009) show that sectors which are highly dependent on external financing needs suffer more from a banking crisis than other sectors. Auboin (2009) assigns an important role to problems with financing in general and hence also with trade finance concerning the trade collapse in the recent crisis. He stresses that credit for trade – while holding up well compared to other forms of credit until autumn 2008 - was subject to a tremendous reassessment of risk and scarce liquidity in late 2008 as shown by the increase in spreads for credit for emerging and developing countries. This is in line with Chauffour and Farole (2009) who underline the role of trade finance in the recent trade collapse and give a number of reasons why trade finance declines particularly strongly during times of financial crises: First, markets may encounter difficulties in (re)assessing the associated risks, second, market participants face asymmetric information and increased risks of default, third, financial intermediaries have to respond to scarce liquidity and needs of recapitalization and finally, political factors might play a role as well. Furthermore, it might be more difficult to assert one's claims across borders during times of crisis. Alun (2009) emphasizes that trade is usually financed via short-term credit lines which are more easily cut back in times of crises. He shows that the simultaneous halt of capital inflows and banking crises significantly lowers imports in emerging economies.

4. Quantifying the importance of trade for the economic downturn

In this section we try to quantify the direct contribution of trade to the crisis response with a special focus on Eastern European economies. We use regression analysis to assess empirically the marginal impact of export orientation on the severity of the growth downturn in 2009 while controlling for a host of country characteristics such as structural features, macroeconomic imbalances, previous growth record, etc. In particular, this allows us to shed some light on the relative importance of the two demand-side explanations given earlier and to assess empirically to which extent openness as such has implied an increased economic weakness during the crisis.

Our econometric model identifies how the vulnerability of individual countries to common shocks is determined by national characteristics of each country. Our approach is similar to Rose and Spiegel (2009) in two ways: First, as in Rose and Spiegel (2009) we undertake a cross-section analysis (determined by the uniqueness of the event) using iterative robust regression. Secondly, we also do not attempt to determine the timing or causes of the crisis, but the different impact of the crisis across countries. However, we depart in two important ways from the analysis by Rose and Spiegel (2009): First of all, while they incorporate changes in real GDP, the stock market, country credit ratings and exchange rates into a single measure of crisis incidence, we do not construct a latent variable. In contrast, we consider some of the components which they incorporate into their "crisis measure" as determinants for the crisis response. We focus here on the output response to the crisis, thus our measure of the severity of the crisis is the downturn in real GDP growth between the realized growth rate in 2007 and the projected growth rate in 2009. Second, we also apply a different timing for the causes and crisis-response than in Rose and Spiegel (2009). Although many countries already exhibited negative growth in the final quarter of 2008, most countries continued to grow throughout 2008. However, the majority of countries is expected to show a real GDP decline in 2009. Further, in particular emerging countries and the countries in Central and Eastern Europe, which are of particular interest to us, entered into recession with a roughly 1 quarter delay compared to major industrial countries. Forecasts for 2010 are again somewhat brighter, even if the recovery may turn out to be unassertive. Hence, 2009 appears to be a good choice for the trough of the crisis. By the same reasoning, we calculate the full impact of the crisis as the absolute change in real growth between 2007, the last year before the crisis struck, and the real growth forecast for 2009 rather than the growth difference 2007-2008 as in Rose and Spiegel (2009).

4.1 Data description

In our model we relate the decline in output growth between 2007 and 2009 to a set of country specific characteristics relating to potential transmission channels and a range of other control variables. The dependent variable – the absolute decline in real GDP growth - is calculated as the absolute change in real GDP growth between the average real GDP growth over 2007-2008 and recent forecasts for the 2009 growth rate (and 2010 for robustness checks). The latter are taken from IMF and Consensus Forecasts and date from November 2009. Thus, the growth downturn is measured in percentage points with high values indicating a strongly negative crisis response.

We identify a range of macroeconomic preconditions arising from the literature review in Section 3 and which may have played a role in determining the severity of the crisis across countries. The direct impact of openness or trade is captured by various trade ratios (exports to GDP ratio, intermediate or consumption goods as a share of total exports, exports to the EU as a share of total exports) whereby we concentrate on total exports to GDP in most specifications. Structural aspects are captured by the share of industry in total value added. We further control for a certain lack of investor confidence already prior to the crisis rather crudely through the change in nominal exchange rates or alternatively the change in CDS spreads between 2006 and 2008. This can also be

interpreted as an indication of economic weakness (or perceptions thereof) before the full impact of the crisis stroke. Apart from these prime variables of interest, we also control for a range of alternative factors. Previous growth is included to control for effects from overheating. We further control for weak fundamentals by including external debt stocks in relation to GDP. Finally, we also include regional integration dummies. A detailed description of the variables used is given in appendix table A1.

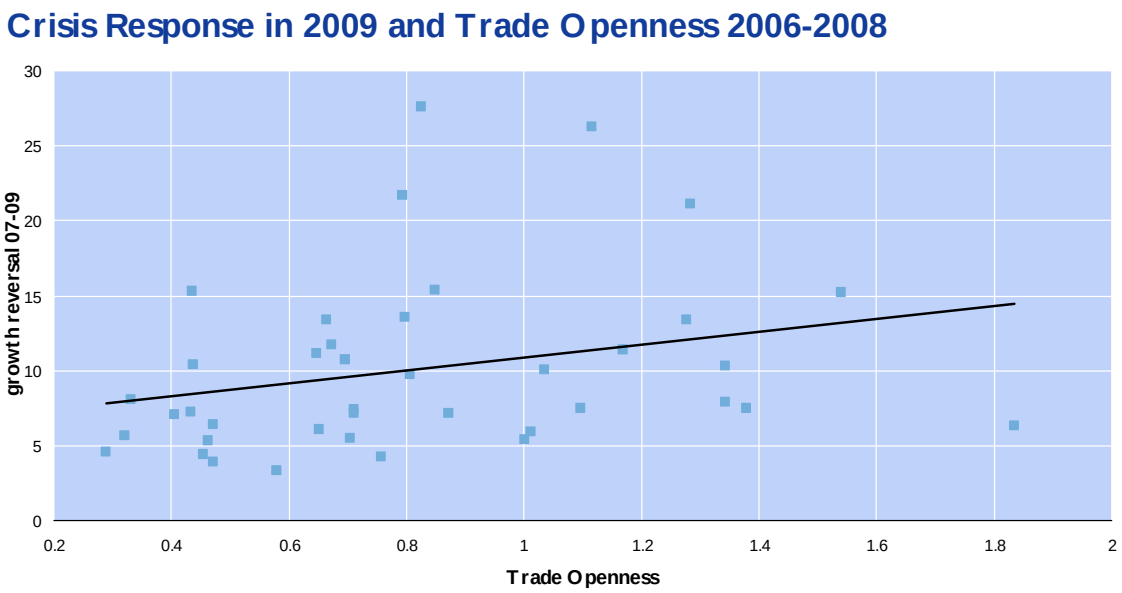
In order to minimize the number of missing observations and to even out short-term fluctuations on some variables, we calculate a three-year average for all explanatory variables over the period 2006-2008. This approach also avoids endogeneity problems, since all explanatory variables are lagged compared to the short-term reaction of GDP on changes in the external environment.[3] For the exchange rate and CDS spreads, we use the percentage change over the period 2006-2008 instead of average levels, since we want to capture strong revaluations and thus already existing vulnerabilities in these variables prior to the crisis, rather than relative standing of countries as reflecting a potential initial weaknesses.[4]

We base our analysis on a sample consisting of 38 OECD and European countries (see appendix table A2). Our data comes from various sources. We combine data from the IMF International Financial Statistics and the World Bank's World Development Indicators with data from Eurostat, national sources and Datastream in order to obtain detailed information on trade structure and changes in risk perception. A first inspection of the data shows an apparent but rather weak positive relationship between the share of exports in GDP and the output response to the crisis. As mentioned before, our dependent variable is defined such that a large positive value implies a strong decline in GDP growth, hence in the figure below a positive correlation is interpreted as a reinforcing effect of trade openness on the crisis response.

[3] We also run two robustness checks replacing our dependent variable by the decline between 2008 and 2009 as well as 2007-2010. The results are presented in the appendix.

[4] It lies outside the framework of our empirical model to capture transmission channels, and in particular the financial channel, during the unfolding of the crisis, due to the simultaneity of events. The time period between the large and sudden re-assessments of risks in late 2008, leading to sharp increases in credit costs, and the outbreak of the crisis in individual countries is too short to be captured by the macro-economic data which we are using in our model.

Figure 5



Sources: Authors' Calculations based on Eurostat, UN, IMF, Consensus Economics.

4.2. The econometric model

Our econometric model is rather simple and the basic specification is summarized in equation 1.

$$y_i = \alpha + \beta_1 xratio_i + \beta_2 vad\_ind_i + \beta_3 er_i + \beta_4 avgrowth_i + \beta_5 debt_i + \varepsilon_i$$

In earlier versions of the model, we included a range of additional control variables. Since they all turned out to be insignificant and were without impact on the remaining variables in the model, we dropped them in view of severe degree of freedom constraints in the small sample. The following variables were additionally used in earlier specifications: Macroeconomic imbalances were captured by the current account (and trade) balance as a ratio of GDP. The magnitude of domestic demand, which may influence the effect of external demand as transmitted through trade, was proxied for by country size in terms of GDP and population. We also constructed a measure of domestic demand as domestic consumption plus imports minus exports. From the growth accounting framework we used gross fixed capital formation as a share of GDP. According to the convergence hypothesis, poorer countries experience faster growth. Hence, we also included per capita GDP at purchasing power parities in an initial specification. Finally, given the importance of global production chains and the lack of suitable data to capture outsourcing, we included the inward FDI stock as a ratio of GDP as well. [5] As mentioned, all these factors were without influence on the growth downturn and on the remaining variables and were dropped in the final specification.

We use iteratively re-weighted least squares to eliminate the influence of outliers and to deal with the violation of fundamental assumptions in the empirical model related to our small sample size[6].

[5] We would like to emphasize that, although our original model might at first sight resemble a neoclassical growth model, we are not trying to explain long-run determinants of economic growth here. Rather we want to identify stylized facts of the short-run output reaction to the crisis. Put differently, we identify the characteristics shared by countries prior to the outbreak of the crisis and which implied a particularly strong decline in output.

[6] This form of estimation is implemented in Stata through the command "rreg".

This uses a Maximum-Likelihood estimator, whereby in a preliminary step, possible influential outliers are detected and assessed based on Cook's (1977) distance statistic. Two types of iterations are performed subsequently whereby observations are weighted such that influential outliers obtain lower weights. First, Huber (1981) iterations are performed, attaching non-zero weights to all observations. In the next step, up to 1000 bi-weight iterations are applied, whereby all cases with residuals are down weighted and cases with large residuals obtain zero weight. In most cases, convergence occurred relatively fast after about 20 iterations in total. This sequencing ensures fast convergence (from the Huber iterations) while also minimizing problems with extreme outliers (due to the bi-weight iterations). (Yaffee 2002)

4.3. A Weak Case for Strong Trade Effects

Table 1 shows the results of our regression and compares the importance of the three main variables of interest: trade openness (to proxy for the importance of increased integration of production) as measured by the export to GDP ratio (*xratio*), differences in domestic structure of value added measured by the share of industry in total value added (*vad_ind*), and potential macro economic weaknesses prior to the crisis as captured by strong devaluations of the currency (*er*). We find no evidence for a significant direct effect of increased export orientation on the GDP downturn in the short run. However, we find rather strong evidence for the structural-difference hypothesis in terms of both, statistical and economic significance. Those countries with a higher share of industry in domestic value added are hit considerably stronger by the crisis. The growth downturn for countries with a 1% greater share of industry in domestic GDP is predicted to be increased by roughly 0.4 pps. This would imply for example that the Slovak Republic, with 40% of total value added generated in the industrial sector, would have seen a drop in real GDP by 6.8 pps beyond the drop recorded in the UK, where industry accounts for only 23% of GDP. These 6.8 pps difference, which is explained solely by structural differences between the two economies, is in fact rather close to the observed difference of 8 pps (-15 pps in the Slovak Republic versus -7 pps growth downturn in the UK). Finally, we also find no significant direct effect from strong exchange rate fluctuations of the currency - reflecting less stable macroeconomic conditions - prior to the crisis on the severity of the growth downturn. Along the same line, we also do not see a significant effect in either direction from participating in a fixed currency arrangement (a point which we turn to in section 4.4).

Table 1: Determinants of the Growth Downturn in 2009.

Variable	(1)	(2)	(3)	(4)	(5)
xratio	-0.003	0.019			0.216 **
	0.89	*0.47*			*0.03*
vad_ind	0.427 ***		0.354 ***		0.705 ***
	0.00		*0.00*		*0.00*
er	0.074			-0.034	0.107
	0.20			*0.62*	*0.34*
avgrowth	0.511 ***	0.830 ***	0.487 ***	0.872 ***	0.652 ***
	0.01	*0.00*	*0.01*	*0.00*	*0.00*
debt	0.002 ***	0.001	0.002 ***	0.001	0.002 ***
	0.00	*0.56*	*0.01*	*0.48*	*0.01*
xratio*vad_ind					-0.009 **
					0.02
xratio*er					-0.004 *
					0.09
constant	-5.721 ***	4.953 ***	-3.644 *	5.510 ***	-13.000 ***
	0.01	0.00	0.08	0.00	0.01
N	38	38	38	38	38
R^2	0.69	0.32	0.60	0.37	0.71
F	14.0 ***	5.4 ***	17.3 ***	6.7 ***	10.7 ***
Prob > F	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*

Note: The dependent variable is the percentage point change in real GDP growth between 2007 and the projected growth rate for 2009; p-values are reported below each coefficient; *(**)[***] indicate significance at the 10% (5%) [1%] level or below.

Columns 2-4 in table 1 show that our main variables of interest are robust to in- or exclusion of the remaining two variables. Nevertheless, we further tested for possible multiplicative relationships between export orientation and the remaining two main variables of interest. Controlling for interactions between the export ratio and the weight of industry in GDP in column (5) brings out more clearly the importance of either factor in aggravating the growth downturn, while at the same time the two factors jointly seemed to have ameliorated the situation. Put differently, greater export orientation has helped to soften the adverse effects arising from the dominance of the industrial sector which was hit particularly strongly in during the crisis. However, this dampening effect is very limited in scope, given the statistically significant (at the 2% level), but economically rather small coefficient on the first interaction term. The second interaction between the export ratio and exchange rate developments also shows a similar, economically small and statistically only weakly significant, dampening impact on the growth downturn.[7]

Let us now turn to the remaining control variables in our model. There is clear evidence for the overheating-hypothesis: countries with a previous fast growth performance (*avgrowth*) showed a significantly greater contraction in GDP during the crisis. This effect is highly significant and robust across different specifications. The coefficient of 0.6 implies that countries which on average grew by 1 pp more over the period 2006-2008 experienced a decline in GDP growth of 0.6 pps beyond the average in the period 2007-2009. Finally, also the debt to GDP ratio (*debt*) emerges as a robust and significant determinant of the growth reaction to the crisis in the sense that starting from a higher debt ratio has clearly added to a country's vulnerability in 2009.

The results are more or less robust to using an alternative timing for the calculation of the growth downturn (see appendix table A3). In particular our results are not sensitive to measuring the growth downturn by the change in GDP growth rates between 2008-2009 rather than 2007-2009. The same

[7] We also included in a different specification the interaction term between the exchange rate and the industry share in GDP, which turned out to be insignificant and without impact on the results.

factors emerge as being relevant, apart from the debt to GDP ratio, which looses its significance in the very short term. On the other hand, strong currency depreciation just prior to the outbreak of the crisis seemed to have intensified the growth downturn in the short run. The coefficient of roughly 0.2 in the appendix table implies that a 1% greater depreciation over the 2006-2008 period translates into a 0.2 pp further decrease in real GDP on average in the very short-run (2008-2009). This may reflect less investor confidence in countries with rather volatile exchange rate developments already before the crisis as well as the fact that strong devaluations before the crisis may have limited the scope for further devaluation during the crisis, which have improved nominal competitiveness in the short run.

In this context, it is interesting to see some qualitative differences arising when looking at the medium-term growth response. The last column of appendix table A3 uses the change in real GDP growth between 2007 and the forecast for 2010 as the dependent variable. Neither the export ratio, nor the share of industry in GDP or any of the interaction terms between the two show a significant effect here. In contrast, now strong currency devaluation seems to have smoothed the GDP contraction. This implies that in the medium term, depreciation and hence improvements in nominal competitiveness have helped to bolster the impact of the crisis on GDP. However, one should bear in mind that the dependent variable in this last specification in the appendix is subject to considerable uncertainty, since the 2010 forecasts rely on information up until September 2009 plus on certain external assumptions. Therefore, we decided to focus on the more short term output response using forecasts for 2009 only which are already based on data for the first three quarters of 2009.

Table 2: Controlling for Different Regions

Variable	EU-27	EU-10	BAL	CEE
xratio	0.198 **	0.204 **	0.218 **	0.206 **
	0.05	*0.04*	*0.02*	*0.04*
vad_ind	0.680 ***	0.690 ***	0.727 ***	0.691 ***
	0.00	*0.00*	*0.00*	*0.00*
er	0.123	0.083	0.099	0.104
	0.28	*0.45*	*0.32*	*0.34*
avgrowth	0.674 ***	0.723 ***	0.744 ***	0.600 ***
	0.00	*0.00*	*0.00*	*0.01*
debt	0.002 ***	0.006 **	0.006 **	0.006 **
	0.01	*0.05*	*0.03*	*0.04*
xratio*vad_ind	-0.008 **	-0.009 **	-0.009 ***	-0.009 **
	0.03	*0.02*	*0.01*	*0.02*
xratio*er	-0.004	-0.004	-0.005 **	-0.004 *
	0.11	*0.15*	*0.05*	*0.09*
EU	0.591			
	0.51			
EU10		0.845		
		0.39		
BAL			14.441 ***	
			0.00	
CEE				1.188
				0.27
constant	-13.000 ***	-13.000 ***	-14.000 ***	-13.000 ***
	0.01	*0.00*	*0.00*	*0.00*
N	38	37	37	37
R^2	0.72	0.74	0.90	0.74
F	9.1 ***	9.9 ***	30.6 ***	9.9 ***
Prob > F	*0.00*	*0.00*	*0.00*	*0.00*

Note: The dependent variable is the percentage point change in real GDP growth between 2007 and the projected growth rate for 2009; p-values are reported below each coefficient; *(**)[***] indicate significance at the 10% (5%) [1%] level or below; see appendix table A1 for explanation of regional dummies.

Controlling for regional integration clubs (table 2) does not alter the results of our baseline model (last column in table 1). Controlling for membership in the EU or the effect of being located in Eastern Europe, brings out the effect of most factors more clearly: the coefficients on domestic economic structure, previous growth and debt ratios all increase marginally. This is particularly true when we include a dummy for the three Baltic states, which showed by far the worst growth performance, or in the framework of our model: the largest crisis response.

4.4. Robustness of the Results

Finally, we performed a series of robustness checks, using alternative measures to capture the effect of financial weakness and trade. We continue to include the dummy for the Baltic states given their extremely bad growth performance in 2009, which seems to be largely unrelated to the explanatory variables in our model.[8] In the first column in table 3 we use the growth in CDS spreads (in percent) to control for early indication of financial trouble instead of changes in the exchange rate. The results suggest that the reappraisal of risks has had a decisive influence for the impact of the crisis, amounting to half a pp of additional loss in GDP growth following a one percent stronger rise in CDS spreads. In columns 2 and 3 we alternatively use a dummy variable for Euro area members and fixed exchange rate regimes instead of exchange rate movements. The results are again robust, however the exchange rate dummies themselves are not statistically significant. Thus, we cannot identify any effect (neither negative nor positive) from being a member of the euro zone or having a fixed exchange rate regime.

In the last three columns of table 3, we add different measures of trade structure to our model. In column 4 we include the share of consumer goods in total exports, while columns 5 and 6 use the share of intermediate goods and goods shipped to the EU instead. The results are again highly robust when controlling for sectoral and regional trade structure in addition openness to trade as in our baseline specification. One new result emerges with respect to the commodity structure of trade: A large share of consumption goods in total exports seemed to have had a cushioning effect during the crisis. Contrary to our expectations, there is no evidence for a significantly negative influence arising from global production chains given that the coefficient on the intermediate goods share fails to be significant. Finally, export orientation to the EU also had no systematic effect for the growth downturn.

To summarize, the sensitivity checks show that our results are rather robust to alternative specifications concerning the financial channel and to refining the trade channel. Domestic output structure appears as one of the strongest and quantitatively speaking most important determinant of a country's vulnerability in the recent crisis. Further, we find string evidence for an aggravating impact (in terms of subsequent output loss) from previous high growth rates (i.e. overheating). Finally, the negative influence from previously high debt ratios on the output response during the crisis is confirmed.

[8] The three Baltic countries show average values of export orientation, export structure and the share of industry in GDP. They all have a fixed exchange rate regime. Their previous growth performance was mixed, only Latvia showed very strong growth, coinciding with rather low debt ratio. The other two countries had elevated debt ratios. All three countries clearly stand out with respect to the increase in CDS spreads between 2006 and 2008.

Table 3: Alternative Financial and Trade Measures

	CDS	EURO	FIX-ER	Exp_int	Exp_cons	Exp_EU27
xratio	0.229 ***	0.059	0.032	0.163 *	0.188 **	0.216 **
	0.01	*0.47*	*0.64*	*0.08*	*0.02*	*0.02*
vad_ind	0.462 ***	0.476 ***	0.403 ***	0.646 ***	0.626 ***	0.697 ***
	0.00	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*
er				0.113	0.033	0.062
				0.27	*0.72*	*0.58*
avgrowth	0.712 ***	0.797 ***	0.871 ***	0.676 ***	0.816 ***	0.774 ***
	0.00	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*
debt	-0.008	0.005 *	0.006 **	0.005 ***	0.007 ***	0.006 ***
	0.13	*0.06*	*0.02*	*0.04*	*0.00*	*0.02*
exports*vad_ind	-0.009 ***	-0.003	-0.002	-0.007 **	-0.008 ***	-0.009 ***
	0.00	*0.36*	*0.50*	*0.04*	*0.01*	*0.01*
exports*financial [1)]	-0.015 ***	-0.044	-0.077	-0.004 *	-0.004 *	-0.004 *
	0.01	*0.55*	*0.18*	*0.08*	*0.04*	*0.07*
BAL	16.55 ***	13.48 ***	14.25 ***	14.367 ***	15.136 ***	14.410 ***
	0.00	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*
cds	0.505 ***					
	0.00					
EURO		1.017				
		0.67				
FIX-ER			1.683			
			0.36			
exp-int				0.054		
				0.17		
exp-cons					-0.066 *	
					0.07	
exp-eu27						-0.019
						0.50
constant	-5.378	-7.333 **	-5.372 *	-14.000 ***	-9.448 ***	-12.000 ***
	0.12	*0.05*	*0.10*	*0.00*	*0.02*	*0.01*
N	36	37	37	37	37	37
R^2	0.93	0.90	0.92	0.90	0.92	0.90
F	42.6 ***	30.5 ***	40.1 ***	26.6 ***	36.1 ***	27.3 ***
Prob > F	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*

Note: The dependent variable is the percentage point change in real GDP growth between 2007 and the projected growth rate for 2009; p-values are reported below each coefficient; *(**)[***] indicate significance at the 10% (5%) [1%] level or below.

[1)] The interactions terms are built with the respective variables for financial factors used in each specification and thus vary across columns.

5. Conclusions

World trade has reacted strongly to the global recession. Several reasons explain the particularly strong response of trade to the decline in GDP. Besides accounting and price effects, increased vertical specialisation and global supply chains boosted the drop of trade figures in the aftermath of the financial crisis. While on the one side the decline in GDP had an impact on imports and exports worldwide, the collapse of trade on the other side may also have aggravated the decline in growth and helped to spread the crisis quickly and profoundly across regions. Due to sudden and severe financing constraints demand dropped steeply in particular for durable consumption and investment goods, thus causing a recession which fell hard on manufacturing and within the manufacturing sector on intermediate goods. This in turn affected the functioning of global supply chains, making a role for international trade as a transmission channel of the crisis. As a consequence, regions with high trade and output share in these sectors are expected to be hit particularly hard during the crisis.

In this paper we present some empirical evidence to verify the above line of argument and to quantitatively assess the importance of different factors for the impact of the crisis within a predominantly European context. We focus on a sample of 38 countries, consisting of EU members, advanced OECD members and a number of Eastern and South-Eastern European countries. We employ robust regression techniques in the cross-section (owing to the uniqueness of the event) to quantify the effect of trade openness on the reversal of GDP growth, thereby controlling for a range of additional determinants such as structural features of the economies, exchange rate developments, previous growth performance and external debt ratios to account for macroeconomic imbalances at large. Thus, we do not attempt to determine the timing or causes of the crisis. Our econometric model rather identifies how the vulnerability of individual countries to the common shock occurring in late 2008 is determined by national characteristics of each country.

Our analysis suggests that greater export orientation is related to a stronger growth downturn in our sample but the effect is only revealed when allowing for interaction terms between the export ratio and the structure of GDP. In quantitative terms, the marginal effect of export openness is non-negligible but still considerably lower than the impact of domestic economic structure on the growth reversal. In contrast to the conditional findings for openness, we find quite convincing evidence that the domestic structure of value added matters strongly for a country's vulnerability during the recent crisis. Those countries with a higher share of domestic value added in the industrial sector as opposed to more service-based economies were suffering more severe GDP shortfalls. While the predominance of the industrial sector for a country's output response in the crisis is independent of other characteristics of the economy, the trade effect only materializes when interacted with structural characteristics of the economy. Thus, an important finding relates to the observation that the trade shock could only result in adverse growth dynamics when coupled with an appropriate economic structure. Hence, only the combination of different characteristics allow us to explain regional differences in the impact of the crisis.

Another highly robust result gives support to the overheating hypothesis: previous high growth rates are systematically linked to a stronger growth downturn in all specifications. Further, a negative influence from previously high debt ratios on the output response during the crisis is confirmed reflecting increased vulnerability from the fiscal side. Our results support the view that a higher level of indebtedness prior to the crisis implied severe limitations to the room for necessary counter-cyclical measures during the crisis.

Sensitivity checks show that our results for are rather robust and in particular do not depend on the geographical composition of trading partners and only to a limited extent on the sectoral composition of trade. Countries which are specialized in consumption goods suffered relatively weaker declines in output growth, while a specialization on intermediate goods failed to yield a

statistically significant result. However, all these robustness checks suggest that the case for a strong role for trade alone in aggravating the crisis remains limited.

The robust correlation between the importance of industry and manufacturing and the severity of the crisis response raises of course another, highly policy relevant question: Did the crisis reveal a fundamental structural change, or in other words: Are the industries which suffered the strongest declines in the recent crisis going to recover or will they loose importance in the near future? This would of course call for a completely different set of long-term, structural policy responses, rather than short-term interventions in the reaction to the crisis.

Finally, since we find only weak evidence that openness to trade has reinforced the impact of the crisis on the growth performance in the short-run, it remains an open question by how much trade is able to spur growth in the upswing. In the presence of global supply chains, open borders are of course an important pre-requisite to guarantee the functioning of economic activity and to assure a prosperous development in all countries. However, hopes that trade will pull the world out of recession may be unwarranted as long as credit markets are not fully functioning and global demand for goods continues to remain below average.

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Appendix

Appendix Table A1: List of Variables and Data Sources

Variable name	Description	Source
dependent variable		
gdp0709	Absolute difference in real GDP growth 2007 to real GDP growth forecasts for 2009, in pp	Eurostat/ Consensus Economics
gdp0809	Absolute difference in real GDP growth 2008 compared to real GDP growth forecasts for 2009, in pp	
gdp0710	Absolute difference in real GDP growth 2007 compared to real GDP growth forecasts for 2010, in pp	Eurostat/ Consensus Economics
trade factors		
xratio	Exports of goods and services (% of GDP)	World Development Indicators
exp_cons	Export share of consumption goods plus motor spirit and passenger motor cars (in % of total exports)	Eurostat/ IMF
exp_eu27	Export share to EU-27 (in % of total exports)	Eurostat/ IMF
exp_int	Export share of intermediate goods (in % of total exports)	Eurostat/ IMF
structural factors		
vad_ind	Industry, value added (% of GDP)	World Development Indicators
financial factors		
cds[1]	5 year Credit Default Swaps	Datastream
er[2]	Nominal exchange rate versus Euro	Eurostat/ IMF
additional control variables		
avgrowth	Average real GDP growth 2006-2008	Eurostat/ IMF
debt	External debt, incl. intercompany loans (% of GDP)	Eurostat/ IMF
regional dummies		
BAL	Dummy variable for Estonia, Latvia, Lithuania	
CEE	Dummy variable for Albania, Bosnia and Herzegovina, Bulgaria, Belarus, Czech Republic, Estonia, Croatia, Hungary, Lithuania, Latvia, Montenegro, Macedonia, Poland, Romania, Serbia, Russia, Slovenia, Slovakia, Ukraine	
EU	Dummy variable for the EU-27 countries	
EU10	Dummy variable for Poland, Slovakia, Slovenia, Czech Republic, Hungary, Estonia, Latvia, Lithuania, Bulgaria, Romania	
FIX-ER	Dummy variable for countries with fixed exchange rates (Austria, Belgium, Bulgaria, Bosnia and Herzegovina, Cyprus, Germany, Estonia, Spain, Finland, France, Greece, Ireland, Italy, Luxembourg, Lithuania, Latvia, Macedonia, Malta, Montenegro, The Netherlands, Portugal, Slovakia, Slovenia)	
EURO	Dummy variable for Euro Area 16	

Note: All control variables represent averages over the period 2006-2008, except of the exchange rate and CDS, where the growth rate between 2006 and 2008 was used.

[1] Growth of CDS spreads between 2006 and 2008; data on 5y CDS spreads were not available for Albania, Bosnia and Herzegovina, Belarus, Switzerland, Macedonia, Norway, and the United Stated, for these countries, CDS spreads were assumed to equal zero.

[2] Growth of the nominal exchange rate of national currency vis-a-vis the euro between 2006 and 2008, a positive number indicates a depreciation of the national currency vis-a-vis the euro.

Appendix Table A2: List of Countries.

Albania	Greece	Romania
Austria	Hungary	Russia
Belarus	Ireland	Serbia
Belgium	Italy	Slovak Republic
Bosnia and Herzegovina	Japan	Slovenia
Bulgaria	Latvia	Spain
Croatia	Lithuania	Sweden
Czech Republic	Luxembourg	Switzerland
Denmark	Macedonia	Turkey
Estonia	Netherlands	Ukraine
Finland	Norway	United Kingdom
France	Poland	United States
Germany	Portugal	

Appendix Table A3: Sensitivity of results to differences in the timing of measured growth downturn.

Variable	2007-2009	2008-2009	2007-2010
xratio	0.216 **	0.237 **	-0.054
	0.03	*0.02*	*0.34*
vad_ind	0.705 ***	0.524 ***	0.073
	0.00	*0.00*	*0.43*
er	0.107	0.196 *	-0.114 *
	0.34	*0.09*	*0.08*
xratio*vad_ind	*0.65* ***	*0.88* ***	*0.81* ***
	0.00	*0.00*	*0.00*
xratio*er	0.00 ***	0.00	0.01 ***
	0.01	*0.21*	*0.00*
avgrowth	-0.009 **	-0.008 **	0.002
	0.02	*0.03*	*0.42*
debt	-0.004 *	-0.002	0.002
	0.09	*0.39*	*0.19*
constant	-13.000 ***	-11.000 ***	-1.942
	0.01	*0.01*	*0.44*
N	38	37	37
R^2	0.71	0.75	0.83
F	10.7 ***	12.4 ***	20.4 ***
Prob > F	*0.00*	*0.00*	*0.00*

Note: The dependent variable is the percentage point change in real GDP growth; p-values are reported below each coefficient; *(**)[***] indicate significance at the 10% (5%) [1%] level or below.