



The Impact of the Global Financial Crisis on Output Performance Across the European Union: Vulnerability and Resilience

Karin Kondor and Karsten Staehr

Working Paper Series

3/2011

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ISBN 978-9949-404-93-3
Eesti Pank. Working Paper Series, ISSN 1406-7161; 3

The impact of the global financial crisis on output performance across the European Union: vulnerability and resilience

Karin Kondor and Karsten Staehr *

Abstract

This paper uses regression analyses to explain the different output performance in the 27 countries in the EU based on measures of their pre-existing vulnerability and resilience. Rapid financial deepening and high financial leverage, both domestically and externally, were followed by larger output losses during the crisis. The level of financial depth, on the other hand, did not affect output negatively. A large degree of trade openness was associated with weaker output performance, possibly because of falling export demand during the crisis. Finally, government deficits and debt stocks do not seem have impacted negatively on output. The Baltic States stand out as having much explanatory power in the sample due to their large output losses during the crisis.

JEL Code: E32, F4, G01, H12

Keywords: global financial crisis, contagion, business cycles, GDP

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The views expressed are those of the authors and do not necessarily represent the official views of Eesti Pank or the Ministry of Finance of the Republic of Estonia

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Non-technical summary

The bankruptcy of Lehman Brothers in September 2008 led to extreme instability in global financial markets and, therefore, represents an important milestone in the unfolding of the crisis. The shock spread rapidly to the EU and eventually resulted in substantial downturns. It is noticeable, however, that the effect on output differed markedly across the 27 EU countries. The idea of this paper is to examine the extent to which differences in pre-existing economic fundamentals, measures of vulnerability and resilience, can explain the different economic performance across the 27 countries.

A number of papers have examined the importance of various measures of pre-crisis vulnerabilities for output performance after the global financial crisis using different datasets, mostly consisting of emerging economies. This paper set out to assess whether the results of these econometric analyses are also applicable to the 27 countries in the European Union. The EU countries share many institutional characteristics, but exhibit substantial heterogeneity regarding economic development and their economic performance prior to the crisis.

In the light of the limited number of observations, the empirical approach had to be kept simple; GDP growth during the crisis was regressed on explanatory variables individually or jointly. The use of explanatory variables that are dated mainly to the time before the outbreak of the global financial crisis reduced concerns about reverse causality. The main problem facing the empirical analysis is the difficulty in identifying the effects of individual vulnerabilities given substantial multicollinearity and the small sample size. Our estimation procedures and the interpretation of the results seek to take account of the identification problems that emerge from multicollinearity and the small number of data points.

The main finding in this paper is that the results for the EU countries are largely commensurable to those attained using different datasets mainly consisting of emerging economies. The determinants of output performance after the outbreak of the global financial crisis in the EU countries can be summarised as follows:

1. Variables depicting financial leverage and financial deepening, both domestically and externally, appear to have substantial explanatory power. This includes variables such as private loans growth, current account deficits, loans-to-deposits and the net international investment position.
2. Variables depicting the level of financial depth have either little explanatory power or may even have contributed to a better output performance. This may signify that countries with deep financial markets have been better able to take measures counter-acting the effects of the crisis.

3. Variables directly or indirectly capturing the effects on trade also proved to be of importance. Countries with large trade volumes prior to the crisis or with trading partners that suffered from large output contractions have been adversely affected.
4. Government deficits or government debt stocks do not seem to have affected output negatively, signifying that countries with more profligate governments have not been punished in terms of output losses in the early stages of the global financial crisis.
5. Variables proxying the economic stance or the degree of overheating prior to the crisis, i.e. the real effective exchange rate, inflation and the exchange rate system, do not provide consistent results in the estimations. The financial sector variables have more explanatory power, possibly because the pre-crisis economic stance in large part was determined by financial developments.
6. The Baltic States stand out for their very large output contractions during the global financial crisis. Unsurprisingly the inclusion of these countries matters a lot for the results, but this is also the case for other countries which are outliers in some of the regressions presented in this paper.

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“[T]he link between vulnerabilities and performance during crisis periods is neither simple nor straightforward.”

Gardo and Martin (2010, pp. 15–16)

1. Introduction

After more than a year of strain in US financial markets, Lehman Brothers filed for bankruptcy in September 2008, and this came to signal the start of the global financial crisis.¹ In a short time the crisis spread to countries across the world and liquidity in global financial markets came under pressure, resulting in rapid de-leveraging, higher risk premiums and credit contraction (EC, 2009). More difficult financing conditions, declines in stock and real estate markets and falling business and consumer confidence led to contractions in consumption and investment demand in many countries.² Meanwhile export demand fell, as global trade contracted very rapidly. In a short time the problems in the financial sector in the USA had spread to the real economy in countries across the world, often leading to substantial GDP declines.

Europe was among the hardest hit regions in terms of output decline. Figure 1 shows the output performance of the 27 EU countries from the third quarter 2008 to the third quarter 2009. The average output decline was 5.7 percent (unweighted), but there was substantial heterogeneity across the Union and eight of the 27 countries experienced output losses in excess of 5 percent. The countries in Central and Eastern Europe (CEE) exhibited the most diverse performance; the three Baltic States, Latvia, Estonia and Lithuania, stand out for their output declines of between 14 and 19 percent, while Poland was the only EU country to retain positive economic growth during the period.

¹ The events and chronology of the global financial crisis have been discussed in e.g. Brunnermeier (2009), Blanchard (2009), EC (2009), IMF (2009) and Keeley and Love (2010).

² Hall (2010) discusses theories linking financial distress and economic activity; Cecchetti et al. (2009) provide an empirical analysis of the real effects of different forms of financial crisis.

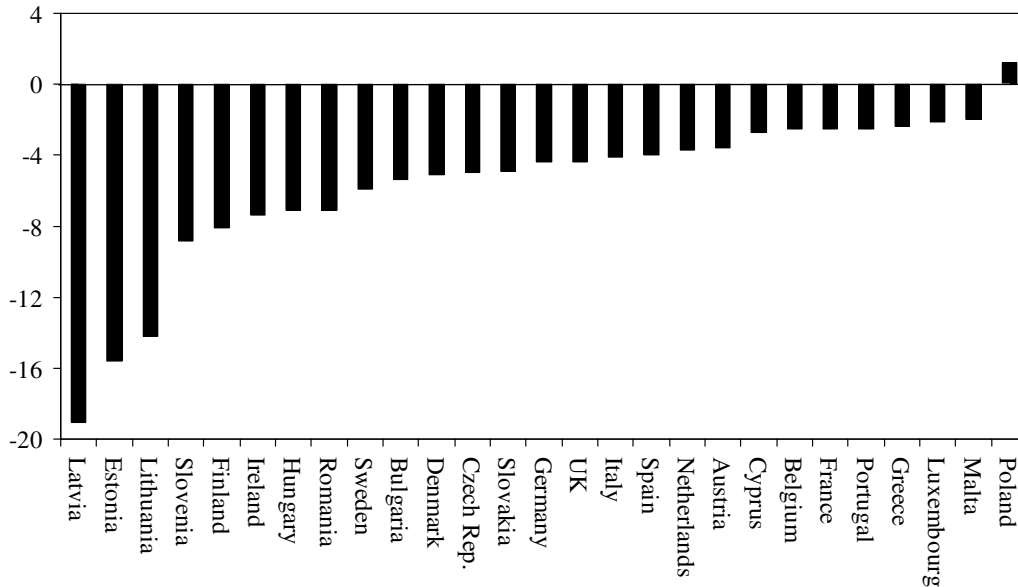


Figure 1: Real GDP growth, 2008:3 – 2009:3, percent

Source: Eurostat

This paper seeks to explain the different output performance in the EU countries using measures of their pre-existing vulnerability and resilience. In other words, the objective is to cast light on the factors that have made countries particularly susceptible to the initial shock from the US and on the factors that have made countries more resilient to the shock. Output is an important measure of economic welfare as it measures average income in society, but it may also affect unemployment, economic deprivation, etc.

The econometric analysis consists of cross section estimations covering all or most of the 27 EU countries. The dependent variable is a measure of output performance during the global financial crisis, while the explanatory variables are different measures capturing the countries' initial conditions or vulnerabilities that existed prior to 2008.

Only a small number of studies use econometric methods to investigate the impact of the global financial crisis on output performance across different countries. Although the studies have used different country and time samples, the overall results are quite similar. The analyses find a robust association between credit growth prior to the crisis and GDP growth during the crisis. Pre-crisis financial leverage, openness to trade and the pre-crisis current account balance are typically also found to help explain the output performance during the crisis.

Berglof et al. (2009) analyse the effect of the global financial crisis on output in emerging Europe using a sample which includes Central and Eastern European countries inside and outside the EU, Central Asian countries and Turkey. The study finds that the size of the growth in the credit-to-GDP ratio 2005–2008, higher total external debt at the end of 2007, and hard pegs are predictors of larger declines in GDP during the crisis. In some specifications, the FDI stock as a share of GDP shows a positive association with GDP growth during the crisis.

Berkmen et al. (2009) analyse the impact of the crisis across a larger sample of developing and emerging countries. They compare the revisions of countries' growth forecasts before and after the crisis struck and find that the growth revision can be explained by rapid credit growth and high leverage, after controlling for the choice of exchange rate system.

Blanchard et al. (2010) also consider a sample of emerging markets, albeit consisting of only 29 countries. As dependent variable they use "unexpected growth", which is computed as the difference between actual GDP growth in 2009 and forecasts made prior to the crisis. They find that the financial channel, in the form of short-term foreign debt, and to a lesser degree the trade channel, measured by trade-weighted growth in partner countries, help explain the heterogeneity in outcomes across the 29 countries.

Claessens et al. (2010) use a sample of 58 emerging and developed markets and analyse the association between pre-crisis conditions and various economic performance indicators such as the duration of the recession, whether there was a decline in GDP, the income loss during the crisis, and the change in the growth rate as compared to the average in the pre-crisis period. They find that housing price increases, credit growth, and the current account balance prior to the crisis are of importance for the performance indicators.

Lane and Milesi-Ferretti (2010) examine the effect of pre-crisis macroeconomic and financial variables on the incidence and severity of the crisis using different global samples of up to 160 countries. They find that pre-crisis variables that capture the level of economic development, the growth in private credit to GDP, the current account and openness to trade help to explain the intensity of the crisis.

Olafsson and Petursson (2010) use a dataset comprising 46 medium-to-high income countries. They seek to explain the depth and the duration of the output loss along with the probability of different forms of financial crisis occurring. They find that a large part of the accumulated output loss can be explained by initial conditions such as pre-existing inflation, the size of the

banking sector, the exchange rate system, international trade linkages and institutional factors.

This paper follows the studies above by using cross-country estimations to explain the output performance of the 27 EU countries during the crisis, an exercise which has not hitherto been undertaken on this sample of countries.³ The choice of sample has one major drawback, which is that the sample is relatively small, never exceeding 27 countries. The limited number of observations aggravates problems associated with outliers and multicollinearity, but other studies have gained important insights using similarly small datasets, e.g. Berglof et al. (2009) and Blanchard et al. (2010).

The choice of sample has several important advantages. First, most of the data can be sourced from Eurostat. The database covers all the EU countries and provides good data comparability since data are collected by national statistical offices following a unified set of rules and subsequently reported to Eurostat.

Second, the EU countries share an overall institutional structure, as they form a single market with free movement of goods, capital, services and people. The countries are in this sense equally susceptible to external economic shocks. There are nevertheless noticeable differences between the economies of the 27 EU countries as they differ in their economic development, economic structure, macroeconomic performance and financial exposure. Most notably, the EU consists of advanced economies that have been highly integrated for decades and the emerging economies from Central and Eastern Europe (CEE) that joined the EU in 2004 and 2007.

Third, despite the unified institutional structure, the EU countries have in practice often exhibited diverging cyclical performance as the countries have been hit by different shocks or symmetric shocks have affected the countries in different ways. This is corroborated in the survey by de Haan et al. (2008) which concludes that the business cycles of many euro countries are unsynchronised and that there is no clear movement towards a single European business cycle. This conclusion appears to hold for countries even after they have joined the EMU (Giannone et al., 2009). The finding that the business cycles are not tightly synchronised in the EU countries suggests that the effects of a global financial crisis may have had different output effects across the EU countries.

³ An alternative approach is to use panel data estimations as in e.g. Brezinski and Stephan (2010). Such estimations assume, however, time-invariant effects from the explanatory variables to the dependent variable, which may not be satisfied given the fundamentally different economic regimes before and during the crisis.

A final argument for considering the different effects of the global financial crisis on countries across the EU pertains to the policy debates on economic governance that the crisis has fostered within the Union. The European Commission has proposed tools for enhanced economic policy coordination, which include broader macroeconomic surveillance in addition to further fiscal policy coordination (EC, 2010). The aim is to establish a scoreboard of indicators and alert thresholds for each indicator to draw attention to countries with problematic levels of macroeconomic imbalances. Several indicators such as the current account balance, the net foreign asset position, the real effective exchange rate, government debt, real estate prices and the ratio of private sector credit growth to GDP have been proposed. Evidently, the relevance of each of these indicators rests on whether the indicator makes a country more susceptible to financial and economic crises (Caballero et al., 2006).

This paper contributes to the literature in a number of ways. First, it analyses the spread of the global financial crisis to the 27 countries in the European Union. The sample comprises essentially the entire European region, a region sharing many institutional and structural features. Second, the available time sample is relatively long, covering the entire downturn from the collapse of Lehman Brothers until the beginning of 2010. This time sample allows us to examine the effect on output at different horizons. Finally, the explanatory power of a very large set of vulnerability measures is examined.

The rest of the paper is organised as follows: Section 2 sets out a conceptual framework of the spreading of crises to guide the empirical analyses. Section 3 presents the data used in the empirical analyses. Section 4 reports the results of the econometric analyses using only variables that capture vulnerabilities that existed prior to the crisis. Section 5 reports the empirical results when concurrent trade partner growth is included as a control variable. Finally, Section 6 summarises the results.

2. A conceptual framework

To guide the empirical analyses, this section sets out a framework conceptualising the spread of the crisis from the US financial sector to the real economy in European countries. The starting point is the literature on contagion of economic and financial crises across countries as developed by Masson (1999).

Crises can occur simultaneously because the economies are hit by the same common shock. During the global financial crisis, economic developments in the USA directly affected the countries in Europe through trade and

financial channels. Masson (1999) uses the term “monsoonal effect” to describe the occurrence of such common shocks. The contagion may also take place indirectly through a “spillover effect” if an economy which has been hit by the crisis subsequently affects other economies adversely through trade and financial channels. For example, during the global financial crisis, the economic downturn in Germany may have contributed to the downturn in many of its neighbours.

The monsoonal and spillover effect are fundamental causes of contagion, where changes in economic variables in the initial crisis country lead to changes in trade or financial flows. The original shock may, however, also set off changes in sentiment or expectations without underlying fundamental reasons, and the altered expectations may lead to a crisis and thus become self-fulfilling (Obstfeld, 1996; Masson, 1999). During the global financial crisis, information about economic and financial crises in other countries may have triggered downward sentiment shifts or panics which had no underlying or fundamental reason. A crisis in one country may thus be contagious if it triggers self-fulfilling expectations in other countries. Such expectations-based contagion can be labelled “pure contagion”.

The distinction between different sources of contagion is important from a policy viewpoint. Policy coordination between affected countries may, for instance, be more effective if the contagion is expectations-driven (pure contagion) while less effective if caused by a common shock. The existence of pure or expectations-based contagion is *sui generis* hard to uncover empirically, but nevertheless of substantial importance from a policy point of view.

The individual country’s economic circumstances at the outset of the crisis may also help explain differences in output performance. The degree of *vulnerability or resilience* may for instance be proxied by variables capturing the initial financial exposure, the public debt, the income level, etc. The vulnerability variables can play two roles:

- 1) The vulnerability variables may explain the *magnitude of the direct contagion shock* and of the ensuing policy. An example would be large pre-crisis external liabilities, which facilitate capital outflows in a crisis. Another example would be the initial government debt stock, as a low debt stock may allow expansionary fiscal policies, while a large debt stock may rule out such a policy response.
- 2) The vulnerability variables may explain the *sensitivity of output to a given contagion shock* or policy measure. A capital outflow may have little effect on output in an economy which relies primarily on domestic financing, but have a large effect in an economy with a history of relying on capital imports. Similarly, expansionary fiscal policy may be counter-productive in a country with a large pre-existing public debt as the result may be financing problems and loss of confidence.

3. Data and variables

The variables used in the empirical analysis are shown in Table 1 together with their summary statistics. The source of the data is mainly the Eurostat database. For the banking sector, data are extracted from the Statistical Data Warehouse of the ECB, which uses data from all the central banks in the EU. Some other variables are taken from the OECD, the Bank for International Settlements and the International Monetary Fund. The precise data source for each variable is given in Appendix A.

Dependent variable

The dependent variable is the percentage change in real GDP computed at different time intervals. As default, the dependent variable is the change in real GDP from the third quarter of 2008 to the third quarter of 2009. For robustness analyses, three other measures are computed, including the average change in real GDP growth in 2009 or the GDP growth over six quarters from the fourth quarter of 2008 to the first quarter of 2010. The growth rates of the EU countries differed considerably *before* the crisis, and to isolate the effect of the crisis a measure of the “unexpected GDP growth” is used which is meant to provide an estimate of the effect of the crisis. Following Blanchard et al. (2010) the unexpected GDP growth in 2009 is computed as the actual growth rate in 2009 minus the IMF forecast for 2009 published in the April 2008 issue of the *World Economic Outlook* (IMF, 2008a).

The four different measures of GDP growth after the global financial crisis are shown in Figure 2. The three measures of actual GDP growth are closely correlated although it clearly follows that the timing of the declines in GDP varied across the countries. The unexpected GDP growth broadly follows the actual GDP growth in 2009, but the discrepancy is larger for the CEE countries than for the EU countries in Western Europe (EU15), since in April 2008 the CEE countries were forecast to have higher growth rates than the EU15 countries.

Table 1: Variables and summary statistics

Variable	Denomination	Mean	S.D.	Min.	Max.	Obs.
GDP growth 2008:3–2009:3	Percent	–5.68	4.45	–19.10	1.20	27
GDP growth 2009	Percent	–5.51	4.24	–18.00	1.70	27
GDP growth 2008:3–2010:1	Percent	–5.44	5.01	–19.59	3.22	27
Unexpected GDP growth 2009	Percent	–8.13	4.62	–20.30	–2.75	27
Private loans 2007	Share of GDP	1.06	0.62	0.28	3.00	27
Private loans growth 2005–2007	Share of 2005 private loans	0.51	0.40	0.04	1.54	25
Loans-to-deposits 2007	Ratio	1.26	0.42	0.63	2.38	27
Gross international liabilities 2007 ^a	Share of GDP	2.96	2.57	0.78	13.10	26
Net international investment position 2007	Share of GDP	–0.31	0.48	–1.02	1.02	27
Current account balance 2007	Percent of GDP	–5.06	9.44	–26.80	9.70	27
Exports 2007	Share of GDP	0.59	0.32	0.23	1.77	27
General government debt 2007	Percent of GDP	43.34	26.71	3.80	103.50	27
General government balance 2007	Percent of GDP	–0.18	2.73	–5.10	5.20	27
GDP 2007	Trillion EUR	0.46	0.69	0.01	2.43	27
GDP per capita in PPS 2007	Thousand EUR	24.63	11.44	9.40	68.60	27
Real effective exchange rate change 2003–2007	Percent	11.42	16.19	–5.89	60.99	26
Average annual HICP inflation 2003–2007	Percent	3.09	1.91	1.02	9.56	27
Exchange rate dummy: euro	..	0.59	..	0.00	1.00	27
Exchange rate dummy: float	..	0.22	..	0.00	1.00	27
Partner growth 2008:3–2009:3 ^b	Percent	–2.27	1.45	–5.90	–0.74	27
Unexpected partner growth 2009 ^b	Percent	–3.22	1.80	–7.99	–1.05	27

Note: ^a Luxembourg is excluded as its gross international liabilities in 2007 amounted to 117.98 times GDP.

^b Export-weighted GDP growth of export partners in the given period, scaled by the export share of GDP in 2009.

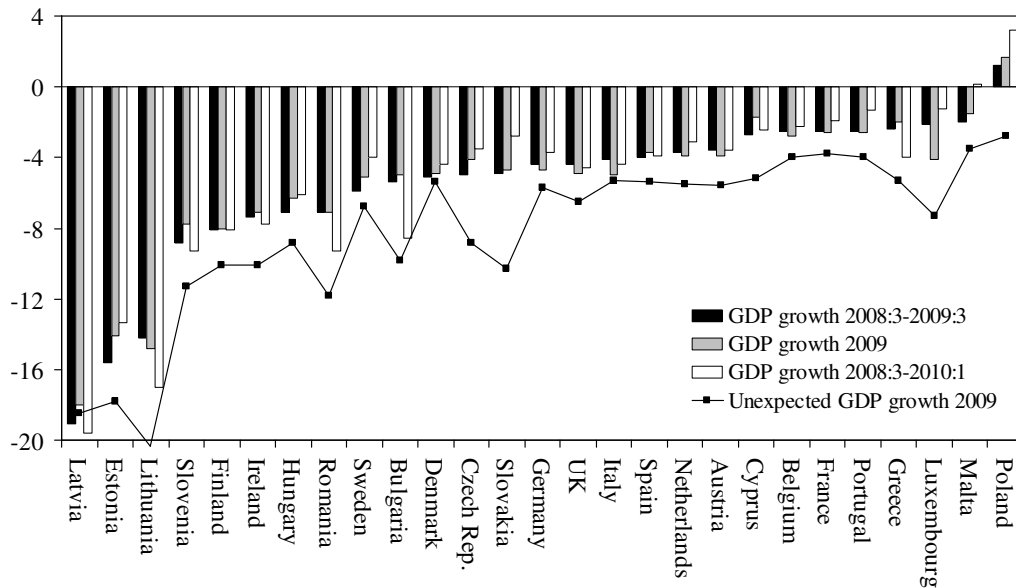


Figure 2: GDP growth and unexpected GDP growth, percent, different samples

Vulnerability variables

Many proxies of vulnerability may help explain the output performance following the global financial crisis. The crisis started by financial distress in the USA spreading to Europe, which makes it reasonable to include variables depicting the exposure and leverage of the financial sectors in the EU countries, both externally and internally. Other variables depicting the openness and size of the economy and the pre-crisis macroeconomic stance and policy may also be of importance. As discussed in Section 2, each of the vulnerability variables may affect the size of the contagion shock or the size of the effect on output of the contagion shock.

The variables are typically from 2007 or earlier, i.e. prior to the outbreak of the global financial crisis, which essentially makes the vulnerability variables exogenous to the unfolding of the crisis.

The private loans 2007 is a stock variable computed as the stock of loans to the private sector *excluding financial institutions* in 2007 relative to GDP in 2007. This measure of the financial depth generally attains higher values for the EU15 countries than for the CEE countries. The variable can be seen as a measure of financial development, but may be denote vulnerability to financial shocks. The private loans growth 2005-2007 is the percentage growth in loans to the private sector excluding financial institutions from

2005 to 2007. It takes large values in countries that experienced credit-led bubbles prior to the crisis. Due to data availability problems for 2005, the variable is not available for Cyprus and Slovakia. The loans-to-deposits ratio is a measure of financial leverage; a high loans-to-deposits ratio may signal financial fragility if deposits are more stable than others sources of funding. The variable is above 1 for many countries, i.e. loans exceed deposits, suggesting that loans are financed by other means than deposits.⁴

Gross external liabilities are included as liquidity strains in financial markets may be of particular importance if a country has large foreign liabilities.⁵ The variable is also a proxy of the openness of the financial sector. Luxembourg is a special case as its gross external liabilities as share of GDP are many times larger than the second largest observation. The current account balance is another measure of external vulnerability. Calvo et al. (2003, 2006) argue that sudden stops in countries with initially large current account deficits can lead to severe economic downturns. Some EU countries, including the Baltic States, Bulgaria, Romania and Greece, had very large current account deficits prior to the crisis. The last measure of external vulnerability is the net international investment position.

The export share measures the openness of an economy in terms of trade and its dependence on exports. Luxembourg has a very open economy, as exports in 2007 amounted to 177.3 percent of GDP, while the second highest value for exports as a share of GDP was 89.6 percent for Malta.

Government finance variables may be other measures of vulnerability. The debt and balance of the general government exhibit large variation across the EU countries. The variables may be seen as affecting capital flows and country ratings, but also the ability of governments to use fiscal policies to counteract the effects of the crisis.

The size and income level of each of the 27 EU economies are included among the explanatory variables. The size of their economies may have shielded some large countries and made them less susceptible to shocks in the financial and goods markets. Wide differences between the per capita income levels reflect the fact that the EU contains both advanced and emerging economies.

⁴ Kindleberger and Aliber (2005) and Reinhart and Rogoff (2009) provide comprehensive historical narratives of the making of financial crises. Both studies emphasise that crises often follow periods of excessive optimism in which financial vulnerabilities are built up through rapid financial deepening and increased leverage.

⁵ We also obtained data on cross-border loans as a percentage of GDP, but the variable is not included as it is very closely correlated with the gross external liabilities variable (correlation coefficient = 0.95).

The change in the real effective exchange rate in the years preceding the crisis is also included. The rate of real appreciation was higher than the EU average for most CEE countries, with the exception of Poland and Slovenia. The appreciation of the real effective exchange rate may reflect a process of those countries catching-up with the EU15 countries, but may also indicate a loss in competitiveness, as seen in the accompanying economic bubbles in many countries. Inflation over the five years to 2007 was also above the EU average in most CEE countries.

Two dummy variables capturing the different exchange rate regimes in the EU are included. One dummy variable equals 1 for the members of the euro-zone and 0 otherwise, while the other takes the value 1 for countries with a floating exchange rate regime and 0 otherwise. The data for the exchange rate regimes are from the *De Facto Classification of Exchange Rate Regimes and Monetary Policy Frameworks* produced by the International Monetary Fund (IMF, 2008b).

Partner growth

Finally, the partner growth variable captures the GDP growth of each EU country's eight biggest export partners weighted by their share of total exports to all eight countries in 2009. The variables are scaled by the export share of GDP to take account of openness of the individual countries. A similar variable is used in Blanchard et al. (2010) to capture the direct impact of the trade collapse and has the advantage of being largely exogenous to the output performance of each individual country.

Many of the vulnerability variables are closely correlated. This applies in particular to the financial variables, which in many cases are correlated by definition. GDP per capita in purchasing power terms is highly correlated with several other variables such as the current account balance (0.70), net international investment position (0.74), loans as a share of GDP (0.82) and gross external liabilities (0.80). These variables are also highly correlated with exports as a share of GDP (0.76).

The correlation coefficient between private sector loan growth and the current account balance is -0.72 for the 25 countries for which data are available (see Figure 3). These variables are again correlated with the change in the real effective exchange rate and the inflation rate. The pattern is largely driven by the CEE countries which experienced economic booms and in many cases overheating in the years prior to the global financial crisis, in part facilitated by easy access to foreign capital.

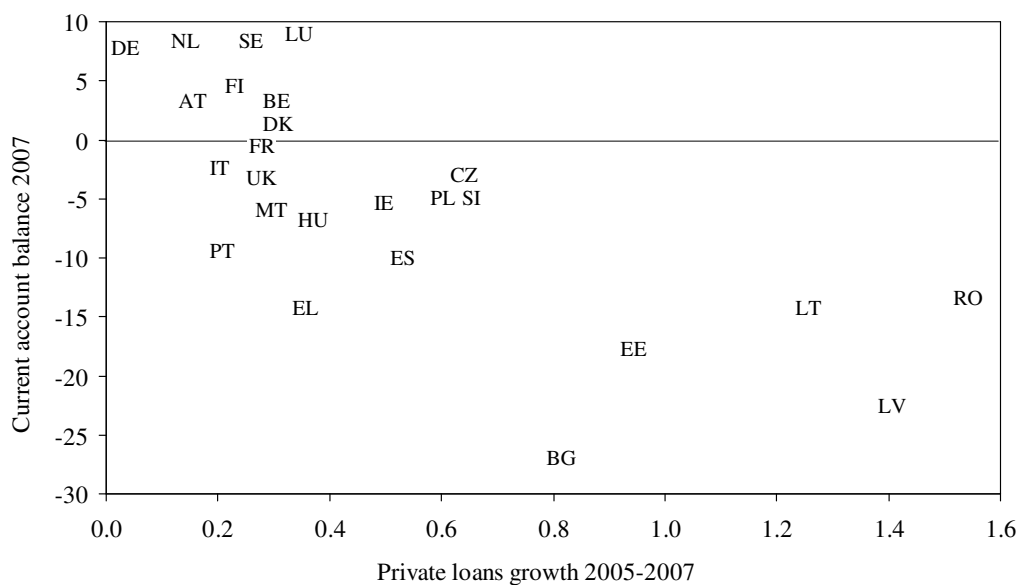


Figure 3: Private loans growth 2005–2007, percent, and the current account balance 2007, percent of GDP

Taking the explanatory variables together it is possible to paint a simplified picture of the European economies immediately prior to the outbreak of the global financial crisis. The EU15 countries generally exhibited economies with high incomes, considerable financial depth (both internally and externally) and relatively large governments. The CEE countries exhibited economies with lower per capita income, which in many cases had experienced substantial financial deepening, current account deficits and substantial real appreciation in the years prior to the crisis.

4. Empirical results with only vulnerability variables

This section presents the results of different econometric analyses in which the output performance during the crisis is modelled as a function of different pre-crisis vulnerabilities. The analysis is complicated by the presence of multicollinearity between several of the explanatory variables and a small number of observations (maximum 27). The identification problems that emerge from multicollinearity show up in the form of coefficients that are imprecisely estimated and very sensitive to specification changes. The upshot is that it is difficult or nearly impossible to identify the relative importance of different explanatory factors (Mankiw, 1995).

We address the multicollinearity issue pragmatically by initially regressing the output performance on one or at most two explanatory variables at a time. In this respect we follow the methodology used in all of the econometric studies discussed in Section 1. The estimations are undertaken using four different dependent variables, i.e. GDP growth 2008:3–2009:3, GDP growth in 2009, GDP growth 2008:3–2010:1 and unexpected GDP growth in 2009. As might be expected given the correlation of these four variables (see also Figure 2), the results are very similar across the four different dependent variables. With very few exceptions, the signs, the sizes of the coefficients and the statistical significance levels concur across the four specifications. Table 2 therefore only shows the results when the dependent variable is the rate of GDP growth 2008:3–2009:3; the full results are reported in Appendix B.

Column (2.1) shows the results of the OLS estimations. The estimation using private loans in 2007 as the explanatory variable returns a coefficient that is positive and statistically insignificant. In contrast, the private loans growth variable attains a coefficient that is negative and statistically significant at the 1 percent level.⁶ The coefficient to the loans-to-deposits ratio is also negative and economically significant. The implication of these results is that the size of the loan stock did not in itself make the country more vulnerable, but changes in the loan stock and the loan stock relative to deposits were associated with larger output declines after the outbreak of the global financial crisis.

The estimations for the external financial variables suggest that the gross international liability position was unimportant, while a negative net international investment position and current account deficits prior to the crisis were associated with a weaker GDP performance during the crisis.

Surprisingly, the openness of the economy measured as a ratio of exports to GDP does not correlate with the output performance during the crisis in a statistically significant manner in this simple specification. The positive coefficient of the government debt variable suggests that countries with large stocks of accumulated government debt were not “punished” by larger GDP contractions during the crisis. The government balance seems unimportant. Countries with large economies and high per capita income have done relatively well in terms of output performance, but the effect is estimated imprecisely.

⁶ The coefficient estimate implies that private loans growth of 100 percent instead of the average of 50 percent is associated with a 4 percentage-point larger GDP decline.

Table 2: Regressions with GDP growth 2008:3–2009:3 as dependent variable

	(2.1)		(2.2)		(2.3)	
	OLS, all countries		LAD, all countries		OLS, Baltics excluded	
	Coef.	Pseudo R^2	Coef.	Pseudo R^2	Coef.	R^2
Private loans 2007 ^a	1.894 (1.388)	0.044	0.855 (1.718)	0.039	0.414 (1.070)	0.009
Private loans growth 2005–2007	-7.791 ^{***} (2.702)	0.456	-9.703 ^{***} (2.461)	0.183	-2.150 ^{**} (0.932)	0.080
Loans-to-deposits 2007	-7.492 ^{***} (2.352)	0.509	-8.214 ^{***} (1.495)	0.204	-2.591 [*] (1.256)	0.139
Gross international liabilities 2007 ^a	0.250 (0.336)	0.021	0.347 (0.330)	0.016	-0.055 (0.204)	0.004
Net international investment position 2007	3.239 [*] (1.671)	0.122	1.833 (1.169)	0.071	0.772 (0.814)	0.026
Current account balance 2007	0.220 [*] (0.110)	0.217	0.061 (0.092)	0.033	0.011 (0.041)	0.002
Exports 2007 ^a	0.598 (2.059)	0.001	-1.761 (4.524)	0.032	-2.288 (2.014)	0.051
General government debt 2007	0.094 ^{**} (0.034)	0.317	0.048 ^{**} (0.018)	0.156	0.036 ^{**} (0.016)	0.156
General government balance 2007	-0.261 (0.233)	0.026	-0.176 (0.197)	0.019	-0.157 (0.172)	0.038
GDP 2007	1.655 [*] (0.815)	0.066	0.634 (1.009)	0.026	0.423 (0.414)	0.017
GDP per capita in PPS 2007	0.117 [*] (0.064)	0.091	0.056 (0.036)	0.091	0.200 (0.039)	0.010
Real effective exchange rate change 2003–2007	-0.166 ^{**} (0.074)	0.360	-0.086 (0.069)	0.131	-0.047 ^{***} (0.016)	0.079
Average annual HICP inflation 2003–2007	-0.921 (0.542)	0.156	-0.413 [*] (0.214)	0.078	-0.407 ^{**} (0.155)	0.110
Exchange rate dummy: euro	7.774 ^{***} (2.735)	0.460	10.500 ^{***} (1.793)	0.219	1.143 [*] (0.575)	0.028
Exchange rate dummy: float	7.163 ^{**} (2.944)		9.200 ^{***} (2.097)		0.533 (1.239)	

Note: White heteroskedastic robust standard errors are shown in brackets; normal standard errors in the MAD estimations. Superscripts ^{***}, ^{**}, ^{*} denote that the coefficient is statistically different from 0 at the 1, 5 and 10 percent levels of significance respectively. The constant term is not reported.

^a Luxembourg is excluded due to extreme values for the explanatory variable.

Real exchange rate appreciation during the period 2003–2007 is associated with lower GDP growth during the crisis. The effect is relative modest in economic terms, as a 10 percentage-point appreciation is associated with

growth that is around 1.5 percentage points lower. High inflation and a fixed exchange rate are also correlated with lower growth.

Two main observations transpired from the OLS estimations in (2.1) where GDP growth during the crisis is explained by pre-existing vulnerabilities taken individually. First, the *level* or depth of domestic and international financial intermediation appears not to have affected the output performance in the EU countries, whereas pre-crisis financial deepening and financial leverage are negatively correlated with GDP growth. Figures 4 and 5 illustrate the latter findings.

The second finding is that the results involving statistically significant coefficients chart a broad picture of the economies that experienced the largest output declines after the global financial crisis. As discussed in Section 2, a number of EU countries, in particular the CEE countries but also other countries in the European periphery, experienced substantial economic booms in the years leading up to the crisis. These booms were typically fuelled by large capital inflows and rapid growth in lending to households and companies and coincided with real appreciation and, in the countries with fixed exchange rates, high inflation. The results in (2.1) suggest that these countries were vulnerable to the shocks of the global financial crisis, and this resulted in substantial output declines.

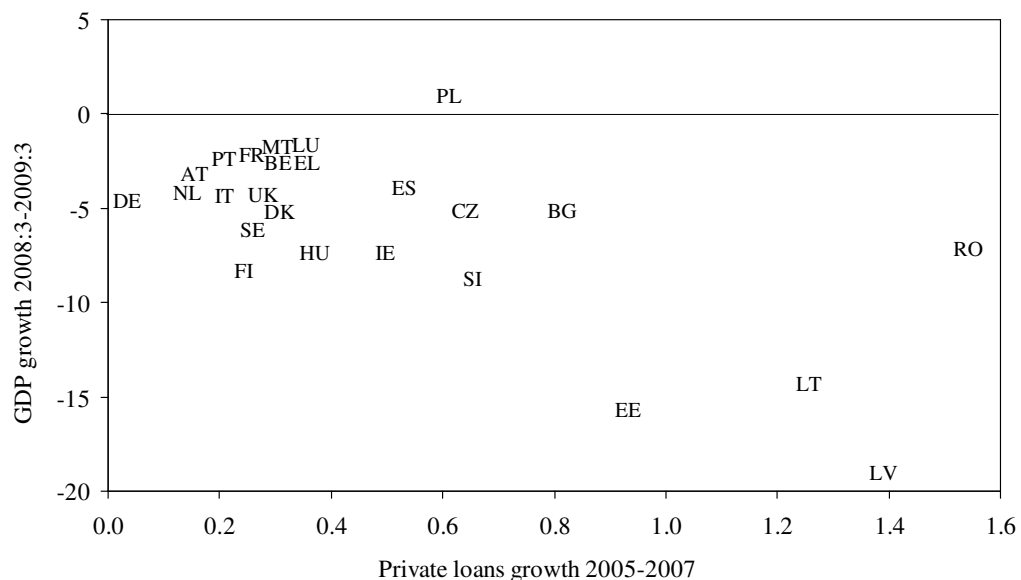


Figure 4: Private loans growth 2005-2007 and GDP growth 2008:3–2009:3; percent

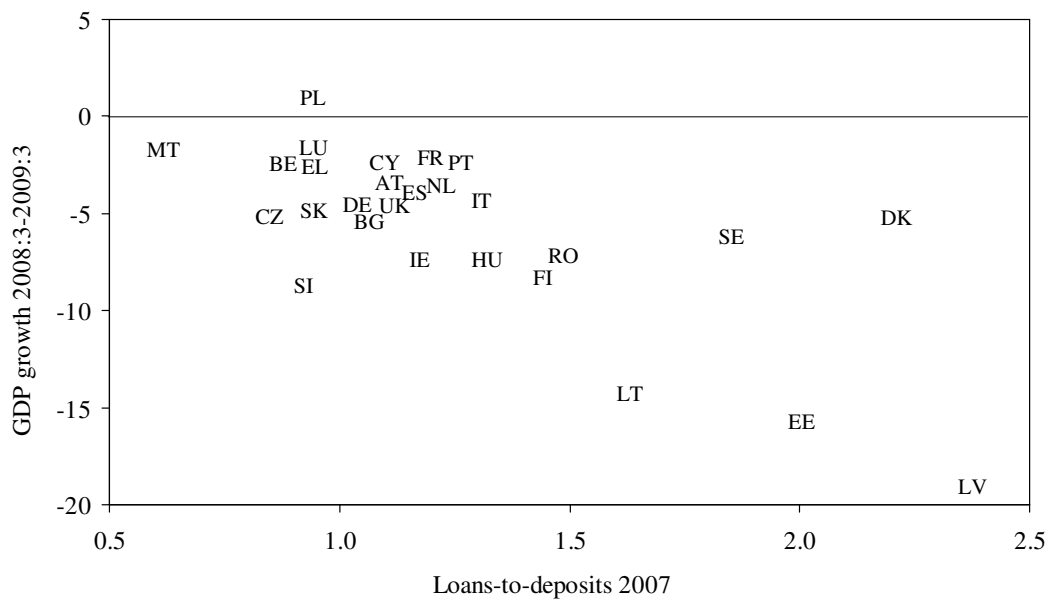


Figure 5: Loans-to-deposits 2007 and GDP growth 2008:3–2009:3; ratio and percent

It follows from Figures 4 and 5 that there is substantial heterogeneity across the countries in the sample and this raises the possibility that outliers affect the results unduly. Column (2.2) shows the results when the models are estimated using Least Absolute Deviation (LAD) instead of OLS. The results are very similar to those in (2.1) obtained using OLS; the sign to the export variable is now negative but the estimated coefficient is highly insignificant.

The downturn in the wake of the global financial crisis was more pronounced in most of the CEE countries than in the EU15 countries. The three Baltic States represent the most extreme case, with output falling by 14 percent or more from 2008:3 to 2009:3. Column (2.3) shows the results when the Baltic States are excluded. The results of the estimations change somewhat. The coefficients generally become smaller (in numerical terms), but the sign and statistical significance are retained in many cases. The coefficients to the private loans growth 2005–2007 and the loans-to-deposits remain statistically significant at the 10 percent level, but the estimated coefficients are smaller (in numerical terms) than those in the full sample. The coefficients to the current account balance 2007 and the net investment position 2007 remain positive, but they are not statistically significant.

The conclusion is that the added variability from the Baltic States is important for the baseline results in both statistical and economic terms, although removing them from the sample does not lead to conclusions that fundamentally contradict those obtained using the full sample. Moreover, the exercise of removing countries with large variation brings in an element of randomness, which can be illustrated in Figure 5. If the Baltic States are removed the negative correlation between the loans-to-deposit ratio and GDP growth 2008:3–2009:3 is weakened, but if alternatively Denmark and Sweden are removed, the correlation would have become even stronger.

The explanatory variables are entered individually in the regressions reported in Table 2. This leaves the possibility that an omitted variables bias affects the results. To address this issue we proceed by undertaking an estimation in which all the explanatory variables are included simultaneously. The degrees of freedom are very low and the subsequent step is therefore to apply different backward stepwise procedures. Table 3 shows the results.

Column (3.1) shows the result when all explanatory variables are included simultaneously. (Luxembourg has been excluded due to extreme values for some of its explanatory variables.) The coefficients to all the variables attain the same sign as in Column (2.1) with one noticeable exception: the coefficient to the export variable is now negative and statistically and economically significant. The many statistically insignificant coefficients are a consequence of the low number of degrees of freedom.

We address the issue of insignificant coefficients by applying a backward stepwise reduction procedure. All variables are initially included and at each successive step the variable with the lowest numerical t -value is removed, while it is examined whether previously excluded variables attain sufficiently high t -values to warrant re-inclusion in the model. The procedure continues in as many steps are required to ensure that only variables that are statistically significant at a predetermined significance level enter the model.

Table 3: Regressions with GDP growth 2008:3–2009:3 as dependent variable

	(3.1)	(3.2)	(3.3)	(3.4)	(3.5)	(3.6)
Private loans 2007	3.442 (2.936)	3.291** (1.459)	..	..	..	..
Private loans growth 2005–2007	–5.528 (5.659)	..	..	–9.257*** (1.433)	..	–5.187** (2.008)
Loans-to-deposits 2007	–12.779*** (3.090)	–8.804*** (1.671)	–7.954*** (2.532)	–7.641*** (1.292)	–7.038*** (1.913)	–5.938*** (2.018)
Gross international liabilities 2007	0.250 (0.420)	..	..	..	..	..
Net international investment position 2007	–0.632 (3.310)	..	..	4.036*** (1.159)	..	..
Current account balance 2007	0.426 (0.248)	0.188** (0.066)	..	..	..	..
Exports 2007	–13.348*** (4.051)	–8.955*** (2.182)	–5.571*** (1.813)	–12.893*** (2.467)	–4.247** (1.800)	–5.398** (1.880)
General government debt 2007	0.068 (0.060)	0.057*** (0.017)	..	x	0.081*** (0.024)	x
General government balance 2007	0.459 (0.549)	..	..	x	0.622** (0.294)	x
GDP 2007	–2.403*** (0.803)	–0.597*** (0.151)	..	–2.724** (0.953)	x	x
GDP per capita in PPS 2007	–0.239 (0.180)	..	..	..	x	x
Real effective exchange rate change 2003–2007	0.087 (0.077)	..	..	..	..	..
Average annual HICP inflation 2003–2007	0.644 (0.399)	..	..	0.512** (0.220)	..	..
Exchange rate dummy: euro	–8.522** (3.095)	–3.708** (1.748)	..	–3.333** (1.438)	..	..
Exchange rate dummy: float	–5.470 (2.920)	..	..	..	2.697** (0.974)	..
No. observations	24	24	24	24	24	24
R ²	0.922	0.840	0.563	0.866	0.747	0.734

Note: Luxembourg is excluded due to extreme values for some of the explanatory variable. x indicates that the variable has been omitted prior to a general-to-specific procedure. White heteroskedastic robust standard errors are shown in brackets. Superscripts ***, **, * denote that the coefficient is statistically different from 0 at the 1, 5 and 10 percent levels of significance respectively. The constant term is not reported.

Column (3.2) shows the result of the general-to-specific procedure in which all variables are statistically significant at the 5 percent level. The results correspond largely to those attained in the regressions in which the explanatory variables were included separately. The coefficient of the stock of private loans is positive, which suggests that deep financial markets did not

worsen the downturn. Domestic leverage and current account deficits are associated with deeper downturns. The coefficient to the export share in GDP at the outset of the crisis is negative as was also found in the model with all variables included. As before, the coefficient to the government debt variable is positive.⁷ Interestingly, large economies do not seem to have performed better during the crisis when the specification conditions are a number of other variables, including the export share. The effect of membership of the eurozone appears to be negative in this specification.

Column (3.3) gives the results when only coefficients that are significant at the 1 percent level are retained. Only two variables “survive”, i.e. the variables of domestic financial leverage and trade openness.

The application of a general-to-specific methodology entails a number of complications, in particular if multicollinearity is present (Hamilton, 2009: 202–203). Because of the mechanical removal of the variable which with the lowest numerical *t*-value, the final results may be very sensitive to changes of the initial specification; inclusion or removal of an irrelevant variable in the model prior to the general-to-specific procedure may lead to very different results. To assess the sensitivity of the results, we undertake a number of estimations in which some of the explanatory variables are removed *before* the general-to-specific methodology is applied.

Columns (3.4)–(3.6) show the results when different variables are excluded from the original model before the backward stepwise procedure is applied. Variables are retained if they are statistically significant at the 5 percent level. Column (3.4) shows the results when the fiscal variables are excluded. The results change somewhat, but the main findings remain: the stock variables measuring financial depth seem to be of limited importance, while measures of financial deepening and leverage prior to the crisis help explain the output performance during the crisis. Column (3.5) displays the result when the two income variables are excluded and Column (3.6) when both government and income variables are excluded. Only three variables are statistically significant in (3.6), which are private loans growth, loans-to-deposits and the export share. It is notable that the latter two variables are statistically significant in all specifications in Table 3. It is also notable that exactly the same model as that in (3.6) emerges if a *forward* stepwise procedure at the 5 percent level is applied (not shown explicitly).

We have experimented with a sample excluding the Baltic States (as well as Cyprus, Slovakia and Luxembourg). Using a general-to-specific methodol-

⁷ A possible interpretation is that a large accumulated debt is an indication that active fiscal policies have been pursued in the past and that this policy has been continued during the crisis.

ogy starting with all the explanatory variables listed in Table 3 yields results that are difficult to interpret. However, if the income variables are excluded, the resulting reduced model contains the loans-to-deposit variable, the export share and inflation, all with negative coefficients. If the government variables are excluded the only variable that “survives” is private loans growth. These results must, evidently, be interpreted with great care given the very low number of degrees of freedom, but the results basically confirm the finding from the analysis using only one explanatory variable, namely that measures of financial deepening prior to the crisis possess explanatory power and help explain the output performance during the crisis.

As argued above, the general-to-specific methodology suffers from a number of methodological problems. The substantive or theoretical implications of the reduction choices are not considered, and there is no evaluation of the possible weaknesses of the models produced at each step. We therefore complement the general-to-specific estimations in Table 3 with some exploratory estimations in which different subsets of vulnerability variables are used, including variables that reflect possible overheating of the economy. The results are shown in Table 4.

Table 4: Regressions with GDP growth 2008:3–2009:3 as dependent variable

	(4.1)	(4.2)	(4.3)	(4.4)	(4.5)
Loans-to-deposits ratio 2007	-8.025 ^{***} (2.499)	-5.938 ^{***} (2.018)	-7.421 ^{***} (1.906)	-6.394 ^{***} (2.263)	-6.458 ^{***} (2.201)
Exports 2007	-5.642 ^{***} (1.664)	-5.642 ^{***} (1.664)	-6.210 ^{***} (1.474)	-5.216 ^{***} (1.854)	-5.432 ^{***} (1.883)
Private loans growth 2005–2007	..	-5.247 ^{**} (2.233)	..	..	-6.222 [*] (3.102)
Current account balance 2007	..	..	0.171 ^{**} (0.068)	..	0.062 (0.083)
Real effective exchange rate change 2003–2007	..	..	..	-0.094 [*] (0.049)	0.064 (0.074)
Constant	7.476 ^{***} (3.263)	3.755 [*] (1.987)	7.980 ^{***} (2.504)	6.234 ^{**} (2.948)	8.074 ^{**} (2.881)
R^2	0.569	0.672	0.687	0.660	0.750
Observations	26	24	26	26	24

*Note: Luxembourg is excluded due to extreme values for some of the explanatory variable. White heteroskedastic robust standard errors are shown in brackets. Superscripts ^{***}, ^{**}, ^{*} denote that the coefficient is statistically different from 0 at the 1, 5 and 10 percent levels of significance respectively.*

Column (4.1) shows the results when the loans-to-deposits ratio and the exports ratio are included. The result differs marginally from that in Column (3.3) in Table 3 because more countries are included in the sample. Columns (4.2)–(4.4) show the results when the three main vulnerability measures are added to the model individually. Each of the variables is statistically significant at least at the 10 percent level and the coefficient estimates appear reasonable. Private loans growth 2005–2007, the current account balance 2007 and the real effective exchange rate 2003–2007 are highly correlated and it is therefore not surprising that the results are quite similar in qualitative terms. The correlation partly reflects the fact that the economic booms in many EU periphery countries in the years prior to the global financial crisis were characterised by substantial capital inflows and rapid private loans growth, which coincided with appreciation of real effective exchange rates.

If all three variables are included in column (4.5), only private loans growth retains statistical significance, while the other variables become statistically insignificant and the estimated coefficients change markedly. This suggests that private loans growth, domestic financial leverage and export dependence are the principal variables explaining the output performance during the global financial crisis, although other variables may also have played a role. These results are broadly in accordance with the results from the general-to-specific procedure shown in Table 3.

5. Controlling for trade partner growth

In Section 4 the output performance during the crisis was explained using only variables that reflected vulnerabilities existing at the outset of the global financial crisis. Part of the immediate impact of the global financial crisis may, however, also relate to developments outside the individual country. The prime example would be economic setbacks in traditional trading partners, which affect export demand and, consequently, output performance without any immediate vulnerabilities explaining such a fall (Bems et al., 2010). Following Blanchard et al. (2010) we include the variable of export-weighted partner GDP growth, which captures trade collapse and the size of the crisis in partner countries.

Column (5.1) in Table 5 shows the results of regressions when pre-crisis vulnerability variables are included individually along with partner growth as a control variable. Overall the qualitative results from Table 2 are preserved. The private loans growth 2005–2007, the loans-to-deposits ratio, the current account balance and the real effective exchange rate retain their significance with the control variable included, and the models explain up to 2/3 of the variance in output performance. The stock of private loans is insignificant

while the coefficient to the gross international liabilities is positive and statistically significant. It is notable, however, that the estimated coefficients of the partner growth vary substantially across the different estimations, although they are all positive and above 1.

Column (5.2) shows the results when the Baltic States are excluded. The results correspond to those in Table 2, i.e. the estimated coefficients generally retain their sign but become smaller (in numerical terms) and are estimated less precisely. Interestingly, when the Baltic States are excluded, the coefficient for partner growth regressed individually with the dependent variable is insignificant. But again the results are dependent on the inclusion of Luxembourg — when the observations for both the Baltic states and Luxembourg are excluded, the coefficient for partner growth is 1.095 and it is significant at the 1 percent level (the standard error is 0.346). The variables for private loans growth and loans-to-deposits remain statistically significant although their coefficients fall substantially in numeric terms.

Analyses that use unexpected growth, i.e. actual growth in 2009 minus forecast growth for 2009, as dependent variable give qualitatively the same results as when the actual output performance is used (not shown). Interestingly though, when unexpected partner growth is added to the models as a control variable, then contrary to other time periods, the coefficient for partner growth is close to zero, as opposed to around or more than one in other time periods, and the coefficient is not statistically significant, except in the model with the loans-to-deposits ratio and current account balance. This would suggest that the pre-crisis fundamentals of each country explain the unexpected fall in output performance, making partner growth less relevant.

Table 5: Regression with GDP growth 2008:3–2009:3 as dependent variable and weighted partner growth as control variable

	(5.1)			(5.2)		
	All EU countries			Baltic States excluded		
	Coef. vuln. variable	Coef. partner growth	R ²	Coef. vuln. variable	Coef. partner growth	R ²
	..	1.757 ^{**} (0.845)	0.329	..	0.261 (0.486)	0.018
Private loans 2007 ^a	0.486 (1.156)	2.625 ^{***} (0.501)	0.587	0.228 (0.968)	1.081 ^{***} (0.370)	0.168
Private loans growth 2005–2007	–6.167 ^{**} (2.443)	1.099 (0.717)	0.563	–2.128 ^{**} (0.970)	0.192 (0.473)	0.090
Loans-to-deposits 2007	–6.284 ^{***} (2.133)	1.232 ^{**} (0.545)	0.658	–2.853 ^{**} (1.343)	0.405 (0.452)	0.181
Gross international liabilities 2007 ^a	0.375 ^{**} (0.171)	2.732 ^{***} (0.450)	0.629	0.098 (0.179)	1.122 ^{***} (0.416)	0.175
Net international investment position 2007	3.959 ^{**} (1.646)	1.918 ^{***} (0.530)	0.508	1.308 (0.866)	0.496 (0.378)	0.079
Current account balance 2007	0.195 ^{**} (0.094)	1.634 ^{**} (0.599)	0.499	0.025 (0.043)	0.318 (0.488)	0.026
Exports 2007 ^a	10.318 ^{***} (2.645)	3.683 ^{***} (0.504)	0.750	4.508 (3.451)	2.112 ^{**} (0.784)	0.219
General government debt 2007	0.056 ^{**} (0.022)	1.116 (0.847)	0.398	0.040 ^{**} (0.017)	–0.153 (0.547)	0.161
General government balance 2007	–0.041 (0.206)	1.739 ^{**} (0.839)	0.330	–0.141 (0.179)	0.190 (0.538)	0.057
GDP 2007	–0.156 (0.661)	1.793 [*] (0.975)	0.330	0.286 (0.551)	0.182 (0.567)	0.024
GDP per capita in PPS 2007	0.187 ^{***} (0.064)	2.134 ^{***} (0.439)	0.544	0.054 (0.053)	0.573 (0.410)	0.047
Real effective exchange rate change 2003–2007	–0.090 ^{**} (0.040)	2.161 ^{***} (0.326)	0.668	–0.038 (0.023)	1.006 ^{**} (0.361)	0.216
Average annual HICP inflation 2003–2007	–0.694 [*] (0.366)	1.585 [*] (0.806)	0.415	–0.396 ^{**} (0.156)	0.211 (0.471)	0.122
Exchange rate dummy: euro	6.062 ^{**} (2.810)	1.033 (0.687)	0.551	1.160 [*] (0.573)	0.264 (0.482)	0.046
Exchange rate dummy: float	5.452 [*] (2.826)			0.550 (1.255)		

Note: White heteroskedastic robust standard errors are shown in brackets. Superscripts ^{***}, ^{**}, ^{*} denote that the coefficient is statistically different from 0 at the 1, 5 and 10 percent levels of significance respectively. The constant term is not reported.

^a Luxembourg is excluded due to extreme values for the explanatory variable.

Table 6 shows the results of estimations in which the explanatory variables from Table 4 are augmented by partner growth. Column (6.1) shows the

results when all the variables are included simultaneously; it is notable that the coefficient to the exports in 2007 attains what should be the “wrong sign”. The variable is therefore excluded in Column (6.2), but the three additional explanatory variables, the private loans growth, the current account balance and the real effective exchange rate, are still statistically insignificant. When the variables are included separately, the first two attain significance, while the real effective exchange rate remains insignificant. Overall the results from Table 4 appear also to hold in this case in which partner growth is included as a control variable.

Table 6: Regressions with GDP growth 2008:3–2009:3 as dependent variable

	(6.1)	(6.2)	(6.3)	(6.4)	(6.5)
Partner growth 2008:3–2009:3	1.996** (0.710)	1.527*** (0.243)	1.571*** (0.272)	1.758*** (0.304)	1.746*** (0.329)
Loans-to-deposits ratio 2007	–3.629 (2.422)	–4.371** (1.680)	–4.050** (1.586)	–4.700*** (1.529)	–4.168** (1.625)
Exports 2007	2.863 (4.116)	..	..	..	..
Private loans growth 2005–2007	–3.334 (2.622)	–3.822 (2.680)	–3.290** (1.301)	..	..
Current account balance 2007	0.023 (0.059)	0.036 (0.052)	..	0.102** (0.044)	..
Real effective exchange rate change 2003–2007	0.028 (0.056)	0.034 (0.056)	..	..	0.064 (0.074)
Constant	2.988 (3.785)	4.732*** (1.627)	4.322** (1.650)	4.482** (1.622)	8.074** (2.881)
R ²	0.816	0.811	0.806	0.792	0.750
Observations	24	24	24	26	24

*Note: Luxembourg is excluded due to extreme values for some of the explanatory variable. White heteroskedastic robust standard errors are shown in brackets. Superscripts ***, **, * denote that the coefficient is statistically different from 0 at the 1, 5 and 10 percent levels of significance respectively.*

6. Final comments

The bankruptcy of Lehman Brothers in September 2008 led to extreme instability in global financial markets and, therefore, represents an important milestone in the unfolding of the crisis. The shock spread rapidly to the EU and eventually resulted in substantial downturns. It is noticeable, however, that the effect on output differed markedly across the 27 EU countries. The idea of this paper was to examine the extent to which differences in pre-

existing economic fundamentals, measures of vulnerability and resilience, can explain the different economic performance across the 27 countries.

A number of papers have examined the importance of various measures of pre-crisis vulnerabilities for output performance after the global financial crisis using different datasets, mostly consisting of emerging economies. This paper sets out to assess whether the results of these econometric analyses are also applicable to the 27 countries in the European Union. The EU countries share many institutional characteristics, but exhibit substantial heterogeneity regarding economic development and their economic performance prior to the crisis.

In the light of the limited number of observations, the empirical approach must be kept simple; GDP growth during the crisis is regressed on explanatory variables individually or jointly. The use of explanatory variables that are dated mainly to the time before the outbreak of the global financial crisis reduced concerns about reverse causality. The main problem facing the empirical analysis was the difficulty in identifying the effects of individual vulnerabilities given substantial multicollinearity and the small sample size. Our estimation procedures and the interpretation of the results seek to take account of the identification problems that emerge from multicollinearity and the small number of data points.

The main finding in this paper is that the results for the EU countries are largely commensurable to those attained using different datasets mainly consisting of emerging economies. The determinants of output performance after the outbreak of the global financial crisis in the EU countries can be summarised as follows:

7. Variables depicting financial leverage and financial deepening, both domestically and externally, appear to have substantial explanatory power. This includes variables such as private loans growth, current account deficits, loans-to-deposits and the net international investment position.
8. Variables depicting the level of financial depth have either little explanatory power or may even have contributed to a better output performance. This may signify that countries with deep financial markets have been better able to take measures counter-acting the effects of the crisis.
9. Variables directly or indirectly capturing the effects on trade also proved to be of importance. Countries with large trade volumes prior to the crisis or with trading partners that suffered from large output contractions have been adversely affected.
10. Government deficits or government debt stocks do not seem to have affected output negatively, signifying that countries with more profligate governments have not been punished in terms of output losses in the early stages of the global financial crisis.

11. Variables proxying the economic stance or the degree of overheating prior to the crisis, i.e. the real effective exchange rate, inflation and the exchange rate system, do not provide consistent results in the estimations. The financial sector variables have more explanatory power, possibly because the pre-crisis economic stance in large part was determined by financial developments.
12. The Baltic States stand out for their very large output contractions during the global financial crisis. Unsurprisingly the inclusion of these countries matters a lot for the results, but this is also the case for other countries which are outliers in some of the regressions presented in this paper.

Much research remains to be done before the causes of the global financial crisis and its effect on output performance will be thoroughly understood. One unanswered question is whether it is possible to produce composite measures of crisis vulnerability, which would be able to explain output performance or other variables of interest. The indicators of vulnerabilities may be computed using principal components or other factor methods. Research suggests, however, that even if it is possible to construct such indicators for the global financial crisis, they may have little power in forecasting or predicting the next crisis (Rose and Spiegel, 2010). The factors behind one crisis supposedly differ from those behind the next crisis.

Another unanswered question is whether it is possible to model the output effects of the global financial crisis directly, i.e. based on concurrent variables such as export and capital flows that denote or reflect changes in demand. These variables directly affecting output may in turn be explained by vulnerabilities and other country-specific factors. We hope to pursue this issue in future research on the economic performance in Europe after the global financial crisis.

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Appendix A: Data sources

Table A.1: Variable names and sources

Variables	Source
GDP growth	Eurostat; namq_gdp_k
“Unexpected GDP growth”	IMF (2008a), Eurostat; namq_gdp_k
Private loans 2007	SDW: MFI balance sheets: non-MFIs excluding general government
Private loans growth 2005–2007	SDW: MFI balance sheets: non-MFIs excluding central government
Loans-to-deposits 2007	SDW: MFI balance sheets: total loans/total deposits
Gross international liabilities 2007	IMF International financial statistics: financial account
Net international investment position	IMF International financial statistics: financial account
Current account balance 2007	Eurostat: tec00043
Exports 2007	Eurostat: nama_exi_c
General government debt 2007	Eurostat: gov_dd_edpt1
General government balance 2007	Eurostat: gov_dd_edpt1
GDP 2007	Eurostat; nama_gdp_c
GDP per capita in PPS 2007	Eurostat; nama_gdp_c
Real effective exchange rate change 2003–2007	Eurostat; tsdec330
Average annual HICP inflation 2003–2007	Eurostat: tsieb060
Partner growth	Eurostat ComExt: traditional external trade
Unexpected partner growth	Eurostat ComExt: traditional external trade, IMF (2008a)

Notes: SDW denotes the Statistical Data Warehouse of the European Central Bank, <http://sdw.ecb.europa.eu/>. MFI is an abbreviation for Monetary Financial Institution.

Appendix B: Regression results using different measures of GDP performance

Table B.1: Regressions explaining GDP growth after the global financial crisis

	(B1.1)		(B1.2)		(B1.3)		(B1.4)	
	GDP growth 2008:3–2009:3		GDP growth 2009		GDP growth 2008:3–2010:1		Unexpected GDP growth 2009	
	Coef.	R ²	Coef.	R ²	Coef.	R ²	Coef.	R ²
Private loans 2007 ^a	1.894 (1.388)	0.044	1.782 (1.439)	0.042	2.365 (1.782)	0.055	3.519** (1.524)	0.138
Private loans growth 2005–2007	-7.791*** (2.702)	0.456	-7.218*** (2.522)	0.439	-9.502*** (2.508)	0.540	-9.378*** (2.240)	0.617
Loans-to-deposits 2007	-7.492*** (2.352)	0.509	-7.029*** (2.208)	0.495	-7.757*** (2.584)	0.431	-6.015** (2.485)	0.305
Gross international liabilities 2007 ^a	0.250 (0.336)	0.021	0.227 (0.323)	0.018	0.293 (0.418)	0.022	0.375 (0.429)	0.042
Net international investment position 2007	3.239* (1.671)	0.122	2.464 (1.641)	0.078	3.992** (1.725)	0.146	3.321* (1.830)	0.119
Current account balance 2007	0.220* (0.110)	0.217	0.183* (0.104)	0.166	0.290*** (0.098)	0.298	0.251** (0.092)	0.264
Exports 2007 ^a	0.598 (2.059)	0.001	-1.533 (3.066)	0.006	-0.178 (3.639)	0.000	-3.595 (3.518)	0.028
General government debt 2007	0.094** (0.034)	0.317	0.089*** (0.032)	0.316	0.099** (0.037)	0.280	0.116*** (0.030)	0.452
General government balance 2007	-0.261 (0.233)	0.026	-0.258 (0.213)	0.028	-0.178 (0.235)	0.010	-0.175 (0.241)	0.011
GDP 2007	1.655* (0.815)	0.066	1.285 (0.783)	0.041	1.709* (0.893)	0.056	2.415*** (0.860)	0.131

	(B1.1)		(B1.2)		(B1.3)		(B1.4)	
	GDP growth 2008:3–2009:3		GDP growth 2009		GDP growth 2008:3–2010:1		Unexpected GDP growth 2009	
	Coef.	R ²	Coef.	R ²	Coef.	R ²	Coef.	R ²
GDP per capita in PPS 2007	0.117* (0.064)	0.091	0.078 (0.065)	0.044	0.142* (0.074)	0.105	0.122 (0.084)	0.092
Real effective exchange rate change 2003–2007	-0.166** (0.074)	0.360	-0.157** (0.067)	0.348	-0.188** (0.067)	0.364	-0.193*** (0.056)	0.440
Average annual HICP inflation 2003–2007	-0.921 (0.542)	0.156	-0.840 (0.494)	0.143	-1.221** (0.523)	0.217	-1.154*** (0.410)	0.227
Exchange rate dummy: euro	7.774*** (2.735)	0.460	7.229** (2.613)	0.450	8.852*** (2.706)	0.480	7.960*** (2.808)	0.439
Exchange rate dummy: float	7.163** (2.944)		7.060** (2.843)		8.542** (3.087)		6.777** (2.976)	

Note: White heteroskedastic robust standard errors are shown in brackets. Superscripts ***, **, * denote that the coefficient is statistically different from 0 at the 1, 5 and 10 percent levels of significance respectively.

^a Luxembourg is excluded due to extreme values for the explanatory variable.

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