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The Determinants of Vulnerability to the Global Financial Crisis 2008 to 2009: Credit Growth and Other Sources of Risk

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Contents

The Determinants of Vulnerability to the Global Financial Crisis 2008 to 2009: Credit Growth and Other Sources of Risk*

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Abstract

In this paper, we identify initial macroeconomic and financial market conditions that help explain the distinct response of the real economy of a particular country to the recent global financial crisis. Using four measures of crisis severity, we examine a data set with over 90 potential explanatory factors employing techniques that are robust to model uncertainty. Four findings are of particular note. First, we find empirical evidence for the pivotal role of pre-crisis credit growth in shaping the real economy's response to the crisis. Specifically, a 1% increase in pre-crisis lending translates into a 0.2% increase in the cumulative loss in real output. Moreover, the combination of pronounced growth in lending ahead of the crisis and the country's exposure to external funding from advanced economies is shown to intensify the real downturn. Economies with booming real activity before the crisis are found to be less resilient to the global shock. Buoyant growth in real GDP in parallel with strong growth of credit particularly exacerbated the effects of the recent crisis on the real economy. Finally, we provide empirical evidence on the importance of holding international reserves in explaining the response of the real economy to the crisis. The effect of international reserves accumulation as a shelter to the global shock rises in credit provided by the domestic banking sector. The results are shown to be robust to several estimation techniques, including those allowing for cross-country spillovers.

Keywords: Financial crisis, credit boom, international shock transmission, Bayesian model averaging, cross-country analysis, non-linear effects.

JEL Classifications: C11, C15, E01, O47.

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1 Introduction

The global financial crisis originated in the US household sector around mid-2007. Cheap mortgage loans, systematic misvaluation of assets, and soaring household leverage put the American banking sector under severe stress. The financial effects spread internationally. Although problems were initially confined to the advanced economies, they spilled over to the emerging economies with the collapse of the Lehman Brothers investment bank. In 2011, the world economy was still wrestling with the consequences of the first global recession in decades (Imbs, 2010). Given that the recent global recession has been unlike anything seen for decades, economists have sought to tease out factors that made an essentially local financial crisis so contagious and understand what country-specific vulnerabilities might have acted as catalysts in spreading financial stress.

The findings of the *early empirical literature* have been rather muted. Rose and Spiegel (2010a,b, 2011) find that few, if any, pre-crisis variables are helpful in explaining differences in crisis severity caused by the global financial crisis 2008-09. This pessimistic finding has been contested by a fast growing literature that has emerged in the aftermath of the crisis. Against the backdrop of the crisis origin, with private debt exceeding private income by a great margin (Mian and Sufi, 2011), it comes as no surprise that leverage and credit can have firm repercussions on the real economy (Mian and Sufi, 2009). This finding has been corroborated on a global scale using different country samples, estimation techniques as well as measures of crisis severity (Berkmen et al., 2009; Lane and Milesi-Ferretti, 2010; Cecchetti et al., 2011; Caprio et al., 2010; Giannone et al., 2011).

Beyond a consensus on pre-crisis credit growth as factor in crisis severity, little else has been settled regarding factors that might have heightened exposure of a particular country. External imbalances, real exchange rate misalignments, and international reserves have all been cited as indicators of vulnerability. In their literature survey, Frankel and Saravelos (2010) examine about 80 historical crises and find strong evidence for levels of central bank reserves as predictive of crisis impact. They observed marginal evidence of large current account imbalances and low national savings as amplifiers of crisis effects on the real economy. Frankel and Saravelos (2010) assert these variables are relevant to the recent crisis. Jordà et al. (2011) provide the historical underpinning for the role credit plays in shaping the economy's response to a financial crisis. Examining historical data for developing countries, they find that loan growth is clearly elevated prior to national ("isolated") and global crises, while current account deterioration only shows up ahead of local crises.

Berkmen et al. (2009) note four determinants of the severity of the *recent financial crisis*. In addition to financial leverage and rapid credit growth as catalysts for financial stress, countries with flexible exchange rate regimes are reported to show greater resilience in the face of crisis. For a subset of developing countries, Berkmen et al. (2009) find that economies that export advanced manufacturing goods were harder hit than those exporting food products. Lane and Milesi-Ferretti (2010) focus on cross-country variations in output and consumption growth during 2008 and 2009. Their results, which are in line with Berkmen et al. (2009), indicate that pre-crisis level of development, increases in the ratio of private credit to GDP and current account deficit, and openness to trade can all be helpful in explaining differences in crisis intensity across countries. These results are further corroborated by Cecchetti et al. (2011), who construct a measure for economic output that controls for the global business cycle by means of factor analysis. Bolstering the findings of Lane and Milesi-Ferretti (2010), they report pre-crisis loan growth, financial openness, and a country's exposure to the US as factors that may affect the response of the real sector. In focusing on the role of market freedom indicators, Giannone et al. (2011) take a different tack from the above studies, suggesting that policies favoring liberalization in credit markets (a factor commonly associated with good regulatory quality before the crisis) exacerbated damage to the real economy.

Furthermore, Giannone et al. (2011) lend empirical support to the importance of financial variables (high net interest margins, financial leverage, and overhead costs of the banking sector) in shaping the response of the real economy to the global crisis. Among the few theoretical contributions in this area, Blanchard et al. (2010) provide a short-run open economy model that predicts how countries adjust to adverse financial and trade shocks. An empirical analysis on a sample of 33 emerging economies points to the importance of trade, financial exposure, and trade growth performance of trading partners as main explanatory factors for the heterogeneity in output growth performance during the crisis. Using techniques that are robust to model uncertainty, Crespo Cuaresma and Feldkircher (2012) investigate over 60 crisis determinants based on a data set with wide global coverage. Focusing on emerging Europe, they find that the combination of pre-crisis growth in real GDP and strong net FDI inflows prior the crisis cushioned the impact of the crisis for the region, while pre-crisis growth fueled by external funds was an important source of risk.

This study enriches the existing literature in three ways. First, we calculate measures of crisis severity explicitly controlling for timing of crisis impacts on the real economy. Second, we propose two additional measures to take the long-run stance of the economy into account; one that assumes the impact of the crisis is temporary and the other a permanent deterioration of real output. Third, we employ a rich data set comprising 97 variables that measure macroeconomic risks, external risks, financial risks, fiscal risks prior to the crisis, risks of contagion, and spillovers. The sheer number of potential explanatory variables coupled with the lack of a clear-cut theory that links the real to the financial economy (Cecchetti et al., 2009; Hume and Sentance, 2009) exposes statistical analysis to model uncertainty. We use modern Bayesian model averaging (BMA) techniques to conduct inference on the crisis determinants that is robust to model uncertainty, allow for cross-country spillovers and control for multicollinearity.

The structure of the paper is as follows. Section 2 introduces the data and provides a brief descriptive analysis of four measures of crisis severity. Section 3 lays out the econometric framework and introduces the BMA methods used for the empirical analysis. Section 4 discusses our empirical results, and section 5 concludes.

2 The Effects of the Crisis on the Real Economy

2.1 Measures of Crisis Severity

Most of the empirical studies mentioned above use a pure cross-sectional assessment to capture the effect of the crisis on the real economy. Crisis severity is measured as the impact on GDP or private consumption, which, in turn, is referenced to growth rates in 2008 or 2009. Such an approach neglects the distinct *timing* of the crisis impacts on the real economy.

Berglöf et al. (2009) identify several phases of the global financial crisis. For about a year after the start of the crisis in mid-2007, the effects were largely confined to advanced economies. With the Lehman Brothers bankruptcy filing in September 2008, crisis effects were transmitted to emerging Europe. As a result, examining the impact of the crisis on the real economy by looking simply at growth rates of output or consumption in 2008, 2009, or the cumulative values for that period, blurs the results for a given country.

To move beyond static measures of crisis severity, we draw on quarterly real GDP data for a set of 63 countries, determining dates of crisis outbreak and crisis end for each country. The start of the crisis period is defined as the first quarter the economy posted negative growth for two quarters in a row in the period 2007Q3 to 2011Q4. Using this definition, seven countries in our sample never dip into recession during the study period (Australia, Colombia, Jordan, Israel, Macedonia, Mauritius, and Poland). A closer look at the real output trends for these countries, however, suggests the real downturn translated into a sidewards movement of real activity. We thus redefine our criteria and date the start of the crisis for these seven countries as the first quarter when quarterly growth dipped into negative territory. Our empirical results discussed in section 4 are qualitatively unaffected when excluding these seven countries.[1] Following Cecchetti et al. (2009), we date the end of the crisis as the first quarter when the economy surpassed its pre-crisis peak. For our purposes, the pre-crisis peak is the peak value of real output within the four quarters preceding the previously dated outbreak of the crisis.

Having identified the timing of the crisis for each country, we apply four measures of crisis severity. The first set of measures capture two dimensions of the immediate impact of the crisis on the real economy. Following Cecchetti et al. (2009), we measure the cumulative loss in real output during the crisis and the depth of the crisis. For each country, we calculate:

$$\text{cum.loss} = \frac{\sum_{t=t_{\text{cris.st}}}^{t=t_{\text{cris.end}}} y_t - \text{Peak(y)}}{\text{Peak(y)}} * 100 \quad (1)$$

$$\text{Depth} = \text{Trough(y)-Peak(y)} \quad (2)$$

with y_t denoting real GDP at quarter t, $t_{\text{cris.st}}$ and $t_{\text{cris.end}}$ the country-specific dating of the crisis, Peak(y)=max(y_t), $\forall \quad t \in \{t_{\text{cris.st}} - 4, \ldots, t_{\text{cris.st}} - 1\}$ and Trough(y)=min(y_t), $\forall \quad t \in \{t_{\text{cris.st}}, \ldots, t_{\text{cris.end}}\}$. Next, we take the long-run perspective by calculating output gaps based on the Hodrick-Prescott filter[2] for all countries. By calculating deviations from trend output, we take the cyclical stance of the economy into account:

$$\text{HP.trans} = \frac{\sum_{t=t_{\text{cris.st}}}^{t=t_{\text{cris.end}}} (\text{HP.ext}(y)_t - y_t)}{\sum_{t=t_{\text{cris.st}}}^{t=t_{\text{cris.end}}} \text{HP.ext}(y)_t} * 100 \quad (3)$$

$$\text{HP.per} = \frac{\sum_{t=t_{\text{cris.st}}}^{t=t_{\text{cris.end}}} (\text{HP}(y)_t - y_t)}{\sum_{t=t_{\text{cris.st}}}^{t=t_{\text{cris.end}}} \text{HP}(y)_t} * 100 \quad (4)$$

$$\quad (5)$$

The long-run measures differ according our assumptions. In the first case, we imagine the crisis as having a transitory effect on the real economy. Thus, despite the shock's extraordinary intensity and global nature, the economy eventually digests it. This is captured by our long-run measure **HP.trans** that uses data *up to* the onset of the crisis for a specific country to calculate trend output. Trend output is based on the "state of the world" before the crisis, and we assume the country will eventually return to its pre-crisis growth trajectory. To calculate deviations from trend output, we extrapolate the pre-crisis trend output.[3] Our second measure is based on the assumption that the crisis permanently impairs the real global economy, i.e., long-term trend output is permanently lowered following the crisis period. Consequently, **HP.per** is based on a Hodrick-Prescott trend

[1] Note that there exist more elaborate ways of dating the timing of the crisis as described in Laeven and Valencia (2010). However, the crisis dates provided in Laeven and Valencia (2010) are only on an annual basis, which limits their usefulness for the purposes of this study. The dates identified using our ad hoc rule of two-quarters of negative growth in a row are nevertheless broadly in line with those provided in Laeven and Valencia (2010).

[2] Following the literature, we have set the smoothing parameter to $\lambda = 1600$.

[3] Specifically, we use splines and polynomials to extrapolate trend output for countries that do not share a linear trend in natural output. We use the `R` package `Amelia` that relies on the bootstrapped algorithm described in Honaker (2010).

output using the full sample period. For both **HP.trans** and **HP.per**, we calculate the cumulative deviations of real GDP from trend output as a percentage of trend output during the crisis period.

Crisis periods and our four measures for crisis severity are provided in Table 2. We have ordered the countries along our benchmark measure of cumulative output loss. The countries most strongly affected by the crisis in terms of output loss are the Baltic States, Ukraine, and Ireland. Notably, these countries were also previously identified (EBRD, 2009; Crespo Cuaresma and Feldkircher, 2012) as those that experienced the strongest impacts on their real economies, thereby adding to our confidence in our selection of indicators for measuring crisis severity. Many countries, of course, fail to fully recover from the crisis during our observation period. Of the 63 countries surveyed, 30 economies did not recover to their pre-crisis peak. This implying that measures based on cumulative loss underestimate the consequences of the crisis for half the sample, and we take this into account when interpreting our results. The majority of the countries felt the real downturn during late 2008: 30 countries in 2008Q2, 11 countries in 2008Q3, and 14 countries in 2008Q4. The implied average duration of the crisis is eleven quarters.

The correlation between our four measures of crisis severity ranges between 0.88 and 0.92 for all measures except **HP.per**. Deviations from trend output assuming the crisis impact is permanent are only correlated with other measures in the range of -0.04 to 0.31. Figures 2 to 5 show the two measures of trend output together with real GDP for 16 economies that have been strongly affected by the crisis. The cumulative deviations from **HP.trans** and **HP.per** differ strongly for nearly all economies in our sample. Since the crisis resembles a break in linear trend growth, cumulative deviations from **HP.trans** are more pronounced than our other measures of crisis severity. The cross-sectional distribution of the four measures is graphically depicted in Figure 1. The top panel, left-hand side illustrates the distribution of the cumulative output loss measure (**cum.loss**), the right-hand side the depth of the crisis. Both distributions are skewed to the left. Observations that are classified as outliers are the Baltic States and Ukraine. The bottom panel of Figure 1 shows the cross-sectional distribution for the two long-run measures of the crisis. The left-hand side shows the distribution for the long-run measure that assumes a transitory effect. This distribution is well in line with the short-run measures. In contrast, the distribution that assumes a permanent impact of the crisis on the real economy is more tight and identifies outliers on both sides of the distribution. In particular, the countries on the far left of the distribution differ considerably from those in the left-tails of the other measures for crisis severity. Certain emerging markets appear to be strongly affected (Turkey, Botswana, Georgia, Belarus, and Singapore), while Jordan shows a positive output gap during the study period. Note that the HP-filtered trend output is prone to an endpoint problem, i.e., the smoothed series tend to be close to the real values at both ends of the underlying time series. As a result, trend output for the most recent observations may be underestimated in this study. This should be borne in mind when interpreting the empirical results presented in section 3.[4]

2.2 Potential Drivers of Crisis Severity: Vulnerabilities and Transmission Channels

The vast list of potential catalysts and mitigators of the recent crisis implies uncertainty for any researcher attempting to concentrate on a particular subset of the potential explanatory factors. For this reason, we strive from the outset to be as broad as possible in defining potential drivers of

[4] A practical solution is to extend the time series with forecasts. This, of course, mitigates the endpoint problem, but exposes the analysis to forecast uncertainty and challenges assumptions about future trend development. In an experiment not reported here, we extended the data by four quarters using interpolated values of annual forecasts from the April 2012 vintage of the IMF's World Economic Outlook database. The correlation with trend output based on realized values of real GDP only exceeded 0.9 for most countries.

crisis severity. We have collected data on 97 candidate variables that can be roughly divided into variables approximating *macroeconomic risk factors* (e.g., pre-crisis growth rates of real GDP and prices, measures of the output gap, and the investment rate), *external risk factors* (e.g., pre-crisis capital flows, external debt loads, international reserves, misalignments in the exchange rate, the current account position, and measures for financial openness), *fiscal risks* (e.g., pre-crisis fiscal deficit, public debt, and a measure for fiscal freedom), *financial risks* (e.g., data on stock market, market capitalization, domestic credit, and competition in the banking sector) and *contagion and spillover risks* (e.g., financial exposure to advanced economies and trade exposure to advanced economies). All potential crisis determinants are measured prior the crisis and are available on an annual basis. We adopt the convention of measuring flow variables as an average over a longer period (typically 2000-2006), while stock variables are measured as of end-2006.[5] For a detailed description of the data, see Table 1 in the Data Appendix. Most variables are available with global coverage. Missing values expressed as a percentage of the total number of observations given in Table 1 are for most variables between 0 and 5.8 %, a reasonably small number. Instead of limiting our sample to countries with complete sets of data, we use a regression-based data imputation method so that all variables have full sample coverage.[6] Country coverage is limited to those countries with real GDP available on a quarterly basis, i.e., 63 emerging and advanced economies.[7]

3 The Econometric Model

For each of our four crisis severity measures, we estimate linear regressions of the following form:

$$y = \mathbf{1}\alpha_s + X_s\beta_s + \varepsilon \quad (6)$$

with y denoting one of the four measures of crisis severity, X_s an $N \times k_s$ matrix of potential covariates, and ε an N-dimensional vector of random shocks that is assumed to be normally distributed, independent, and homoskedastic. The empirical analysis has N=63 countries and $K \geq 97$ candidate regressors, depending on the particular regression specification.

The large number of candidate variables brings with it problems related to model uncertainty that could lead to severely flawed inference. To overcome these problems, we apply model averaging methods that avoid having to choose individual specifications and base inference on a weighted average of single regressions rather than a single selected model. In the Bayesian framework, these weights arise naturally as *posterior model probabilities* (PMP) of the corresponding individual specifications.

Let us denote the set of complementary models by $\mathcal{M} = \{M_1, M_2, \ldots, M_{2^K}\}$, where K stands for the total number of explanatory variables. Inference on any parameter δ in Bayesian model

[5]Due to data limitations, for some country variables are measured before 2006.

[6]Here, we use the `R` package `mice` for multiple imputation using fully conditional specification as described in the manual ((van Buuren and Groothuis-Oudshoorn, 2011)).

[7]Our collected data cover Western Europe (AUT, BEL, CHE, CYP, DEU, DNK, ESP, FIN, FRA, GBR, GRC, IRL, ISL, ITA, MLT, NLD NOR, PRT, SWE); Emerging Europe (BGR, BLR, CZE, EST, GEO, HRV, HUN, KGZ, LTU, LVA, MDK, POL, ROM, RUS, SVK, SVN, UKR); Middle East & Africa (BWA, ISR, JOR, MUS, TUN, TUR, ZAF); Asia & Pacific (AUS, BRN, HKG, JPN, KOR, MYS, NZL, PHL, SGP, THA); and America & Caribbean (ARG, BRA, CAN, CHL, COL, CRI, JAM, MEX, PER, USA).

averaging takes the form:

$$p(\delta|y) = \sum_{j=1}^{2^K} p(\delta|M_j, y)p(M_j|y) \tag{7}$$

with $p(\cdot|y)$ denoting posterior distributions and $p(\cdot|M_j, y)$ denoting posterior distributions under the assumption that M_j is the true model. Inference on some parameter or combination of parameters δ is based on single inferences under models $M_j, j = 1, \ldots, 2^K$, where the individual estimates are weighted by their respective posterior model probabilities ($p(M_j|y)$). These (normalized) probabilities are obtained in a Bayesian setting using the integrated likelihood $p(y|M_j) = \int p(y|M_j, \theta_j)p(\theta_j|M_j)d\theta_j$ and the respective model prior $\overline{p}(M_l)$,

$$p(M_j|y) = \frac{p(y|M_j)\overline{p}(M_j)}{\sum_{l=1}^{2^K} p(y|M_l)\overline{p}(M_l)}. \tag{8}$$

A key quantity in BMA is the posterior inclusion probability (PIP) of a covariate defined as:

$$PIP_z \equiv \sum_{\mathcal{M}:m_z=1}^{2^K} p(M_i|y)$$

with $m_z = 1$ indicating that variable z is included in the model. Thus, the PIP associated with a particular variable is the sum of the posterior model probabilities of all models that include this variable. To ease interpretation of the PIP, we draw on the scale proposed in Eicher et al. (2011). The PIP of a variable is characterized as weak (50-75% PIP), substantial (75-95%), strong (95-99%), or decisive (99%+) evidence. While the sum in equation 7 is not directly computable for large values of K, Markov Chain Monte Carlo (MCMC) algorithms (Madigan and York, 1995; Fernández et al., 2001) provide a reasonable approximation of the required statistic.

The Bayesian framework requires the specification of prior distributions on the model parameters α, β_s, and σ^2, as well as on the model space $\mathcal{M}$. We follow the standard convention in BMA, assuming a zero-centered normal distribution on the slope coefficients β_s, scaled by Zellner's g (Zellner, 1986) hyperparameter:

$$\beta_s|\sigma^2, M_s, g \sim N\big(0, \sigma^2 g(X_s' X_s)^{-1}\big). \tag{9}$$

The penalty for including new variables in the model can be regulated through the hyperparameter g in the marginal likelihood. Following Feldkircher and Zeugner (2009) and Ley and Steel (2010), we abstain from fixing g to a particular value. Instead, we make it data dependent and use a hyper-g prior.[8] This approach has been shown to lead to inference less prone to noise in the data (Feldkircher and Zeugner, 2011). Improper priors on the intercept $p(\alpha) \propto 1$ and variance $p(\sigma) \propto \sigma^{-1}$ indicate the lack of prior information.

Finally we have to make assumptions about the model space, that is which kind of models are a priori more likely. As in Ley and Steel (2009) , we opt for an uninformative binomial-beta prior for inclusion of a given variable with a prior expected model size of $K/2$ regressors. Loosely speaking, we initially ascribe the same prior probability to all models and then relax this assumption and elicit

[8] We anchor the hyper-g prior so that the prior expected shrinkage factor $g/(1+g)$ matches the one induced by the unit information prior $g/(1+g) = N/(1+N)$.

an informative prior on those models when linear interaction terms are part of the model space. The strong heredity prior, as noted in Chipman (1996), is described in the Technical Appendix and punishes unstructured models in the presence of interaction variables to ensure interpretability of posterior moments of the estimated coefficients.

4 The Determinants of Crisis Severity

4.1 Short-Run Impact of the Crisis on the Real Economy

The results of the BMA exercise under the set of priors specified above are presented in Table 3. We report the posterior inclusion probability (PIP) of each variable and the mean of the posterior distribution of the corresponding parameter (PM) with its standard deviation (PSD). The posterior moments are based on the full set of evaluated models, including those that do not include the variable scrutinized (where the corresponding parameter is thus zero). We also assess the precision with which a coefficient has been estimated by calculating the ratio of posterior mean to posterior standard deviation. Following Masanjala and Papageorgiou (2008), variables where this ratio exceeds 1.3 in absolute terms are dubbed effective and marked with an asterisk in the estimation tables.

The table presents our results for the three models. For the sake of brevity, we provide a snapshot of our full estimation results, highlighting the posterior statistics for the *most important* variables in terms of posterior inclusion probability.[9] For each model, we include dummy variables for Ukraine and Belarus. These dummy variables were selected from a pre-BMA run that included the full set of dummy variables. Ukraine was among the most hardest-hit economies in our sample. As might be expected, the data supports a negative intercept term for the Ukrainian economy. Belarus, in contrast, appears comparably resilient to the crisis, due at least in part to its favorable trade arrangements with Russia. The Belarus economy shares macroeconomic characteristics associated with pronounced vulnerabilities that are picked up by a positive intercept dummy.

Model 1 refers to the unconditional model regressing cumulative output loss on the complete set of explanatory variables (97 explanatory variables + 2 country dummies). The model reveals the change in domestic credit provided by the banking sector over the period from 2000 to 2006 (**chg.dom.cred.bank.0006**) as a robust determinant of crisis severity. The estimated posterior mean implies that a 1% increase in pre-crisis borrowing translates to a 0.2% increase of cumulative loss in real output. The robustness of pre-crisis credit growth corroborates findings in the literature, but no similar empirical evidence for other variables flagged as important vulnerabilities such as the current account position, fiscal soundness, and the buffer provided by accumulating foreign reserves. On top of pre-crisis credit growth, Model 1 lends empirical support to only one of the additional variable, the dummy for the Belarus economy. The positive intercept mirrors the conjecture that the economy, based on its fundamentals, should be worse off than it actually is.

We proceed by examining the role of credit expansions in detail. Credit booms often precede financial crises (Bordo and Meissner, 2012), and are triggered by such events as sharp rises in the current account deficit, large capital inflows, strong economic growth, real exchange rate appreciation, soaring asset prices (Mendoza and Terrones, 2008), an upswing in the business cycle, and low interest rates (Bordo and Meissner, 2012) in the context of a credible monetary regime (Borio and White, 2004). Hume and Sentance (2009) stresses that the lending boom of the 2000s, which was extraordinarily long by historical standards, took place in an environment of low inflation and modest growth in economic activity. We analyze these and other factors by looking at interaction

[9] Complete results available on request.

terms with pre-crisis lending with selected variables. For logical consistency, we group the variables that serve as our interaction parents into risk categories.

Macroeconomic risks: Economic growth fueled by excessive lending is frequently identified as a key source of risk for emerging economies. This applies especially to emerging Europe (Berkmen et al., 2009), which felt the real downturn most strongly. We control for signs of overheating and income levels to disentangle the various effects in emerging and advanced economies. The global savings glut may also explain the initial phase of the credit boom (Hume and Sentance, 2009) to the extent that excessive savings rates in some countries held down interest rates and fueled lending booms elsewhere. Finally, we try to capture differences in the regulations of starting a business as a qualitative measure for a macroeconomic risk. We interact the change in pre-crisis domestic credit with pre-crisis growth of real GDP (**rgdpgr.0006**), real GDP per capita in 2006 (**rgdpcap.06**), the average pre-crisis inflation rate (**infl.0006**), pre-crisis gross savings (**gr.savings.gdp.06**), a direct measure for pre-crisis growth above potential (**dGap_0006Exo**), and a variable to capture the amount of money and time it takes to start a new limited-liability corporation (**bus.reg.06**).

External risks: These are variables related to the current account, external debt, and exchange rate misalignments. We include a "twin deficit" (**twin.def**) interaction of the current and capital accounts with the fiscal balance. Since credit booms are often accompanied by strong capital flows, we interact pre-crisis lending with the average net FDI inflows over the period from 2000 to 2006 (**net.fdi.infl.gdp.0006**). We further include quantitative indicators such as a dummy for inflation targeters and the money to GDP ratio (**infl.targeter**, **money.gdp.06**), as well as qualitative indicators for independence and stability of the monetary regime (**monInd.06**, **exch.rate.stab.06**). Finally, we include a measure of exchange rate overvaluation (**reerm.06**).

Fiscal risks: We expect countries with sound fiscal footing in the run-up to the crisis to enjoy greater room to manoeuvre in the fiscal policy sphere as they attempt to buffer the impact of the crisis on the real economy (Berkmen et al., 2009). We test whether economies that experienced large twin fiscal deficits (i.e., the interaction of general government debt in 2006 with the average pre-crisis government balance **twin.fis**) and high pre-crisis lending were less resilient to the crisis.

Financial risks: Countries with leveraged financial systems and open financial markets are expected to be more prone to magnifying the real effects of financial stress (Berkmen et al., 2009; Cecchetti et al., 2011). As booms in lending are also often accompanied by low interest rates and a rise in asset prices, we interact the change in pre-crisis credit with the level of credit in 2006 (**dom.cred.bank.06**), the average deposit rate over the period from 2000 to 2006 (**depRate.0006**), the change in the value of total stocks traded (**chg.stocks.gdp.0006**) and an index of "credit informativeness" to capture the degree to which market participants and households feel informed about credit developments (**credDepth.06**).

Contagion and spillover risks: Here, we try to capture contagion via the trade and the financial channel. The trade channel is represented by interaction variables for trade exposure to the US and the EU-15, as well as trade openness in general (**trade.to.eu15.us.totTrade.0006**, **openness0206**). The financial channel is represented by exposure to US banks as a percentage of total external debt (**finExp.toUS.extDebt.06**) and claims of banks in advanced economies on domestic economies (**adv.claims.gdp.06**). These variable give us a measure of the economy's external debt load and a measure for contagion as crisis emanated as a financial crisis in the advanced economies. Finally, we look at restrictions to the capital account as measured by the Chinn-Ito financial openness index (**finOpenn.06**).

Model 2 includes these 24 interaction terms in addition to the 99 potential explanatory variables used in Model 1. The results are presented in Table 3. After controlling for interaction terms of pre-crisis growth in domestic credit with the above-mentioned variables, credit growth is no longer a robust variable. Even so, the linear interaction term with foreign claims from banks in advanced countries (**chg.dom.cred.bank.0006#adv.claims.gdp.06**) robustly explains crisis severity as measured by cumulative loss during the crisis period. The interaction term enters with negative sign and is efficiently estimated. The dummy variable for Ukraine also receives large posterior support. The estimated coefficient is negative mirroring the country's extraordinary experience during the global financial crisis. Note that the robustness of the Ukrainian dummy variable implies that variation in cumulative output loss specific to Ukraine cannot be soaked up by the set of variables at hand. Finally, export composition seems to play a role in shaping an economy's response to the global crisis. In particular, countries with a large share of food in exports are more resilient to a real downturn relative to their non-food exporting peers. This finding is in line with Berkmen et al. (2009) and implies that food exports are more shielded from the general collapse in world trade that was triggered by the global financial crisis.

Since the interpretation of linear interaction terms without their parents is cumbersome, in particular so if the interaction terms are composed of continuous variables, we opt for eliciting an informative prior on the model space.

Model 3 summarizes results based on the strong-heredity prior as described in Chipman (1996) (see Technical Appendix for details). Eliciting a heredity prior implies that models that contain linear interaction terms are punished if their respective main terms are missing. The *strong heredity* prior is strict in that it rules out models that contain an interaction term unless all main terms are included. Since the posterior means of the standard BMA results resemble a mixture of models with and without main parents, the strong heredity prior eases interpretability of the results.[10] The results are presented in the last column of Table 3. The coefficient and significance of the interaction term of pre-crisis credit growth and claims of advanced countries remain nearly unchanged. Moreover, the dummy for the Ukrainian economy is still robust and efficiently estimated, as is the variable capturing the share of food in total exports. The posterior means of pre-crisis credit growth and the ones attached to foreign claims on the economy deserve some further explanation. Both coefficients are positively estimated, which is at odds with the results of Model 1 and the literature on crisis determinants.

Both the coefficients and their interpretations vary for Model 1 and Model 3. In Model 1, the coefficient attached to pre-crisis credit growth mirrors the partial effect of credit on crisis severity. In Model 3, the coefficient of pre-crisis growth in lending is conditional on foreign claims. In the case where there is *no contagion risk* as measured by foreign claims, credit growth is marginally positively associated with cumulative output loss. In the case of no excessive credit growth, foreign funding as measured by advanced claims has a positive impact on real output. It is the *combination of pronounced growth in pre-crisis lending and pronounced risk of contagion* that turns out to be a significant vulnerability indicator. We examine this further by calculating the marginal effect of accumulating foreign claims on output loss that is conditional on pre-crisis credit growth. The marginal effect is calculated based on posterior means of the coefficient attached to **adv.claims.gdp.06** and **chg.dom.cred.bank.0006#adv.claims.gdp.06** for those models among the 1,000 models with largest posterior support that contained the interaction term and its main effects (981 models out of 1,000).[11] The findings are summarized in Figure 6 (top panel, left side), and show the median and the 0.05% and 0.95% confidence bounds for the distribution of posterior means varied with rates of pre-crisis credit growth based on our sample (-60%

[10]See also Brambor et al. (2006), who argue for always including the main terms with the interaction term.

[11]Note that the effects are interpreted as "conditional on inclusion," while the posterior means provided in Tables 3 - 6 are based on the complete set of models visited by the MCMC algorithm, including those without scrutinized regressors.

to 936%).

The results corroborate our findings above. When credit growth is contained, foreign funding acts as a cushion to the real downturn. This effect turns negative, however, when credit growth is more pronounced. Evaluated at the mean of pre-crisis credit growth (186%), a 1% increase in foreign claims is associated with a 0.2% increase in cumulative output loss.

As a second measure of crisis severity, we look at the depth of the crisis measured as the trough to pre-crisis peak in real output. This measure could be seen as a complementary dimension of crisis severity as it resembles output volatility rather than total crisis costs. The results are summarized in Table 4. *Model 1* lends marginal support to the robustness of changes in real per capita income over the pre-crisis period (**chg.rgdpcap.0006**) having amplified the effects of the crisis in the real economy. As is typical of a boom-bust cycle, countries with buoyant pre-crisis growth experience a steeper downturn during the period of the recent crisis. *Model 3* reveals further evidence on the nature of this particular boom-bust cycle with posterior support for the interaction of pre-crisis credit growth with pre-crisis growth in real GDP (**chg.dom.cred.bank.0006#rgdpgr.0006**). Figure 6 (top panel, right side) illustrates the marginal effect of pre-crisis growth in real output on the depth of the crisis. The figure shows that countries with the economic expansion fueled via credit lending experienced a steeper downturn on average during the recent crisis. Evaluated at the mean of pre-crisis credit growth, a 1% increase in the average annual growth rate of real output translates into a 1.5% increase in the depth of the crisis. As the figure shows, this effect rises substantially for more elevated rates of credit growth. There are likely many factors underlying boom-bust cycles fueled by a lending boom. Strong credit lending is often accompanied with a surge of capital inflows, which exposes the boom economy to the risk of a sudden drying up of capital with the onset of systemic financial stress that precipitates a bust.

In the conditional specification of Model 3, pre-crisis lending itself turns out to be marginally positively related to the depth of the crisis. The marginal effect of pre-crisis lending conditional on pre-crisis growth in real activity is depicted in Figure 6 (bottom panel, left side). The figure shows that in economies with low rates of pre-crisis growth in real output, growth in lending acts as a cushion to the impact of the crisis. The marginal effect turns negative, however, for economies growing at rates above average (3.8%). Figure 6 (top panel, right side) adds the further insight that, even in the absence of credit growth, countries growing at rates above average were likely to suffer worse from a global shock. That is, there are other drivers than excessive lending that might be considered vulnerable accompanying excessive pre-crisis growth in real activity. Finally, while the interaction terms might be considered as an indirect way to measure the effect of overheating on the response to the crisis the model reveals additional robust evidence for a direct measure of growth above potential (**dGap_0006Exo**). This measure captures the time (in quarters) an economy has exceeded its trend output during the 2000-2006 period. Countries that witnessed real activity above potential were often less resilient in the downturn.

4.2 Long-Run Deviations from Trend Output

The previous section discussed the impact of the crisis on the real economy without taking into account each economy's position in the business cycle. Loss in real GDP was simply attributed to the crisis. While the short-run costs of the crisis might be high, the long-run impact on the economy could be even worse depending on the nature of the crisis. We calculate two measures of the crisis impact on the real economy. Our first measure (**HP.per**) assumes the crisis is a one-off event with no impact on the long-run growth path of the economies. The second measure (**HP.trans**) assumes the crisis has permanently impaired real output, leading to a deterioration of trend output.

Results based on deviations from trend output assuming transitory crisis impact (**HP.trans**) corroborate our previous findings. The results are summarized in Table 5. *Model 1* reveals marked pre-crisis lending and pre-crisis growth of real activity as the only robust crisis determinants. However, posterior support as measured by the respective PIP is marginal. The coefficient attached to pre-crisis lending is in the range of the BMA regression explaining the depth of the crisis, i.e., much smaller in magnitude compared to explaining crisis severity by deviations from cumulative output loss provided in Table 3. In contrast to the previous estimation exercises, there are no further insights from the model when interaction terms are included.

Finally, we turn to cumulative deviations from trend output assuming the impact of the crisis on trend output is permanent (**HP.per**). In *Model 1*, there is marginal support for food exports and market capitalization of stock markets as mitigating the impact of the crisis, while countries with strong FDI inflows prior the crisis felt the real downturn more. Notably, all three coefficients are not well estimated and the posterior inclusion probability is only marginally above the 0.5 threshold. The BMA results for *Model 3* point to a very saturated model with a mean number of 43 variables on average. This implies low information content in the data.[12] However, two covariates receive considerably larger posterior support than others, i.e., the share of food components in total exports and the interaction term of pre-crisis lending with the level of international reserves in 2006. Confirming our previous results, food exporters appear more resilient to the crisis based on the positive coefficient attached to that variable. There is also evidence that international reserves shape a country's response to the crisis, in particular, when interacted with pre-crisis lending. The relationship of accumulating international reserves and economic growth is generally ambiguous, however. There is empirical evidence that international reserves spur economic growth in those emerging economies that follow an export-led growth model, whereas holders of large reserves in advanced economies see no benefits on real output from reserve accumulation (Lin, 2011). The empirical crisis literature often reports that accumulation of international reserves provide a buffer to external shocks (Frankel and Saravelos, 2010) or spurs post-crisis economic recovery (Dominguez et al., 2012). However, the role of reserve accumulation against a background of strong credit lending is ambiguous. *Model 3* reveals a positive coefficient attached to the variable relating international reserves as a percentage of the economy's external debt to pre-crisis lending (**chg.dom.cred.bank.0006#int.res.extDebt.06**). The marginal effect of reserve accumulation is illustrated in Figure 6 (bottom panel, right side). The figure shows that the marginal effect is increasing with the rate of pre-crisis lending. In case pre-crisis credit growth is contained, the marginal effect is negative. This complies with an argument put forward in Aizenman and Lee (2007) that says that since foreign reserves are typically financed by domestic borrowing and liabilities, there are considerable opportunity costs from holding massive international reserves. Aizenman and Lee (2007) show that these opportunity costs are even higher for emerging economies since the typically lower level of capital goes in parallel with a higher marginal product of capital. In this sense, the negative marginal effect conditional on contained credit growth measures opportunity costs deterring real output. As credit growth increases, accumulation of international reserves bolsters the long-run impact of the crisis.

4.3 Robustness Checks

We now perform a few additional BMA regressions to ensure the sensitivity of our results. We start by assessing the sensitivity of our results to the use of imputed values for **adv.claims.gdp.06**. This seems appropriate as this variable was identified as a robust source of risk and features among

[12] The low information content in the data can be seen by the expected value of the posterior shrinkage factor $E(g/(1+g)|Y)$. See Feldkircher and Zeugner (2009) for the relationship of the posterior shrinkage factor and a modified F-statistic.

the explanatory variables with the largest share of missing values (around 10%). The re-estimated results shown in Table 3 exclude the countries where we used imputed data for **adv.claims.gdp.06**. The results for Models 1 and 3 are broadly unchanged. With the exception of **HP.per**, the posterior inclusion probabilities for both models based on the reduced sample and the full sample are correlated for all four different measures of crisis severity in the range of 0.78 to 0.98. We thus conclude that our results are not shaped by including imputed values for the variable measuring foreign claims.

Next, we allow for cross-sectional spillovers by estimating a spatial autoregressive (SAR) model:

$$y = \mathbf{1}\alpha_s + \rho \mathbf{W} y + X_s \beta_s + \varepsilon, \tag{10}$$

with $\mathbf{W}$ capturing cross-country linkages. A typical element of $\mathbf{W}$ is given by $[\mathbf{W}]_{ii} = 0$ and $[\mathbf{W}]_{ij} = d_{ij}^{-1}$ for $i \neq j$, where d_{ij} is the distance between countries i and j. Economic ties across countries are thus measured by geographical distances to reflect trade costs (and thus bilateral trade integration). The merits of estimating a regression in its SAR representation are that it can reveal further insights about the role of contagion. A positive posterior estimate of ρ indicates that countries whose neighbors experience distress in terms of output loss are on average less resilient to the crisis. In other words, ρ measures how much variation in crisis severity can be absorbed via spillovers through the trade channel. Our results reveal a posterior estimate of ρ that lies in the range of 0.23 to 0.43 for all measures except the long-run measure that assumes a permanent effect of the crisis (**hp.per**).[13] Here, we obtain $p(\rho|Y) = -0.21$, a somewhat counterintuitive result. For all four measures, taking spatial correlation into account leads qualitatively to the same results in terms of robust variables. The positive posterior estimate attached to the matrix that resembles economic ties across countries corroborates that stress was spread via the trade channel during the recent crisis. This is in addition to the previously established robustness of the financial channel as captured via the external financial exposure of countries.

Finally, the sheer number of potential explanatory variables that compose our model space might cause our posterior estimates to be plagued by multicollinearity. Following Durlauf et al. (2008), we elicit a prior that punishes models that comprise highly collinear variables (see Technical Appendix for details). Our general findings are re-established for all four crisis severity measures. Controlling for multicollinearity reveals pre-crisis growth in lending, claims of foreign banks , international reserves, and the component of food in export share as robustly related to crisis severity. The attached coefficients also match in terms of size and sign as those based on the standard estimation. Moreover, results based on the prior proposed in Durlauf et al. (2008) reveal marginal support for the change in the value of total stocks traded (**chg.stocks.gdp.0006**), the fiscal twin deficit (**twin.fis**), gross savings (**gr.savings.gdp.06**), and a qualitative measure for minimum wage regulations (**min.wage.06**). However, the posterior standard deviations attached to the coefficients are large and posterior support is often marginal.

5 Conclusions

The global financial crisis began to unfold in mid-2007 in the US against a backdrop of systematically misvalued assets, massive private-sector borrowing, and a global savings glut. The crisis engulfed countries at varying pace and with varying impact. Did, and if so, how did macroeconomic and financial market conditions prevailing before the crisis shape the effects of the crisis on the real sectors of individual nations? We have sought to contribute to the work in this field in several

[13] Note that we use a different prior setup for the SAR model in line with Crespo Cuaresma et al. (2012).

ways. First, we use a broad data set that covers 95 macroeconomic and financial market conditions that could potentially explain the real downturn. Second, we calculate four measures for crisis severity covering the immediate repercussions of the crisis on the real sector, as well as measures to gauge the long-run implications of the crisis on individual economies. All measures are based on a country-specific dating of the crisis to control for the distinct timing of its impact on the real economy. Finally, we use techniques that are robust to model uncertainty, allow for cross-country spillovers, as well as a straightforward interpretation of multiplicative interaction terms.

We obtain the following general results on pre-crisis *macroeconomic conditions* that explain the response to the crisis. In line with Berkmen et al. (2009), we find that countries with food constituting a large share of their exports were more resilient to the crisis. Note that this finding could be interpreted as a regional dummy for Latin American countries, where the impact of the crisis on the real economy was much milder compared to other developing regions, in particular emerging Europe. Similarly, we found empirical evidence of Ukraine experiencing strong effects on its real economy, while the Belarus economy outperformed its macrofundamentals. The robust coefficient on the dummy variables for Ukraine and Belarus imply country-specific effects that cannot be explained with the data at hand. We do not find robust evidence for other variables that often appear in the empirical crisis literature such as a country's current account position or measures of fiscal discipline.

Our results for *macrofinancial factors* clearly corroborate the pivotal role of pre-crisis credit growth. Economies with pronounced growth in pre-crisis borrowing felt the real downturn more strongly. Depending on the measure of crisis severity, posterior means of the coefficient associated to pre-crisis credit growth lie in the range of -0.007% to -0.2%. This implies that a 1% increase in pre-crisis growth in borrowing translates into an additional loss in cumulative real output of 0.2% on average. The role of credit growth plays in the global financial crisis is well documented (Berkmen et al., 2009; Lane and Milesi-Ferretti, 2010; Cecchetti et al., 2011; Caprio et al., 2010), but we find further support for a measure of the country's risk of contagion via external funding. In particular, the interaction with claims of advanced economies on the domestic economy appear to exacerbate the effects of the crisis. Countries with high credit growth and considerable exposure to external funding saw their economies more severely affected during times of financial distress.

We also find evidence that economies with strong pre-crisis growth in real activity were less resilient to the crisis. This finding is corroborated using indirect measures of excessive growth in real output, as well as more direct indicators to capture the degree of pre-crisis growth above potential. More specifically, a 1% increase in pre-crisis growth in real activity translates into a 0.6% increase in the depth of the crisis, when credit growth is zero. Similarly, an additional quarter the economy has been growing above potential prior the crisis is associated with a 0.08% increase in depth of the crisis as measured by the distance between the crisis peak and crisis trough. Furthermore, our results indicate that pre-crisis growth fueled by domestic credit lending exacerbated the costs of the crisis. These factors are also present to a minor degree when crisis severity is measured by taking deviations from trend output, where the dynamics of trend output are restricted to pre-crisis conditions.

Finally, we assess the relationship of international reserve accumulation in explaining the response of the real economy to the crisis. In contrast to Frankel and Saravelos (2010), we did not establish a direct relationship between reserve accumulation and crisis severity. However, looking at the interaction with credit growth reveals the accumulation of international reserves as an important shelter to the crisis. This effect rises with the rate of pre-crisis credit growth.

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Technical Appendix

Model Space Prior

A typical approach to prior specification is to discriminate among models according to the number of regressors they include. Assuming that each covariate enters the regression with probability ϑ, the prior mass for model j amounts to $\overline{p}(M_j) = \vartheta^{k_j}(1-\vartheta)^{K-k_j}$. Many empirical studies tend to fix $\vartheta = 1/2$, which implies equal prior model probabilities of 2^{-K}. Consequently, the posterior odds ratio solely resembles the Bayes factor and model comparison is governed by their relative likelihoods. However, Ley and Steel (2009) show that fixing $\vartheta = 1/2$ puts most the mass on models with $K/2$ regressors since they are dominant in number. They recommend treating ϑ as random and placing a beta prior on it. The expected model size is then:

$$P(k = k_j) = \frac{\Gamma(1+b)}{\Gamma(1) + \Gamma(b) + \Gamma(1+b+K)} \binom{K}{k_j} \Gamma(1+k_j)\Gamma(b+K-k_j) \quad k_j = 0, \ldots, K \tag{11}$$

The parameter to be elicited is μ the prior expected model size, which then determines $b = (K-\mu)/\mu$.

Strong Heredity Prior

By employing the binomial-beta prior centered around $K/2$ regressors, we are non-informative on the model size. However, we use an informative prior that puts some structure on the handling of linear interaction terms. Specifically, we use a model composed of three variables (A, B and the linear interaction term AB):

$$Pr(\vartheta_{AB} = 1 | \vartheta_A, \vartheta_B) = \begin{cases} p_{00}, & \text{if } (\vartheta_A, \vartheta_B) = (0,0) \\ p_{01} = & \text{if } (\vartheta_A, \vartheta_B) = (0,1) \\ p_{10} = & \text{if } (\vartheta_B, \vartheta_A) = (1,0) \\ p_{11} = & \text{if } (\vartheta_A, \vartheta_B) = (1,1) \\ \end{cases}$$

The probability of inclusion for the linear interaction terms ($Pr(\vartheta_{AB} = 1 | \vartheta_A, \vartheta_B)$ depends on the inclusion of its main terms (ϑ_A, ϑ_B). Via p one can choose the degree of structure one would like to fuse into the analysis. We pursue the "strong heredity principle" that does not allow for models that include interaction terms without their respective parents.[14] Consequently, we set $(p_{00}, p_{01}, p_{10}, p_{11}) = (0, 0, 0, 1)$. This ignores all models with interaction terms and missing parent variables.

Multicollinearity

Following Durlauf et al. (2008), we elicit a prior that takes the correlation among regressors into account. Here, the prior amounts to $\overline{p}(M_j) = |R_j| \vartheta^{k_j}(1-\vartheta)^{K-k_j}$, with $|R_j|$ denoting the determinant of the correlation matrix associated to model j. As the correlation among regressors increases, the determinant approaches zero (implying that the model receives low posterior support a priori).

[14] See Chipman (1996) for further details, and Crespo Cuaresma (2012); Crespo Cuaresma et al. (2012) for an application in the context of BMA.

Data Appendix

Variable	Description	Source	Min.	Mean	Max.	NAs in %
Crisis Severity Measures						
cum.loss	Cumulative output loss of real GDP during the crisis period, in % of pre-crisis peak value.	IMF, IFS database, author's calculations.	-258.77	-49.27	-0.45	0.0
depth	Trough (during crisis) minus pre-crisis peak of real GDP.	IMF, IFS database, author's calculations.	-29.64	-8.08	-0.50	0.0
HP.trans	Cumulated deviations of real GDP from trend output. Trend output calculated by means of the Hodrick-Prescott filter using quarterly data from 2000 to outbreak the crisis.	IMF, IFS database, author's calculations.	-29.99	-9.31	0.64	0.0
HP.per	Cumulated deviations of real GDP from trend output. Trend output calculated by means of the Hodrick-Prescott filter using quarterly data from 2000 to 2011.	IMF, IFS database, author's calculations.	-6.11	-1.32	1.21	0.0
Macroeconomic Risks						
GDP & Investment						
rgdpcap.06	2006 GDP per capita in PPP	Penn World Tables 7.0	7.57	9.73	10.85	0.0
chg.rgdpcap.0006	Percentage change in GDP per capita in PPP 2000-2006.	Penn World Tables 7.0	103.58	122.78	172.54	0.0
rgdpgr.0006	Average annual growth rate of real GDP 2000-2006.	IMF, WEO April 2011	0.91	3.86	8.48	0.0
rgdpgr.06	Growth rate of real GDP, 2006.	IMF, WEO April 2011	0.99	5.26	12.23	0.0
rgdpgr.sd.0006	Standard deviation of annual growth rates from 2000 to 2006.	IMF, WEO April 2011	0.36	1.82	8.78	0.0
invest.gdp.0006	Investment rate in % of GDP, 2000-2006 average	IMF, WEO April 2011	16.90	22.50	32.47	1.6
inv.freedom.06	Freedom of investment indicator, range from 0 (no freedom) to 10 (most freedom)	Fraser Institute, Economic Freedom database	30.00	62.38	90.00	1.6
pop.06	Population in millions	IMF, WEO April 2011	-1.18	2.42	5.70	0.0
pop.gr.0006	Population growth, percentage change 2000-2006.	IMF, WEO April 2011	-5.77	4.46	17.85	0.0
Money & Inflation						
money.gdp.06	Money and quasi money (M2) in % of GDP, 2006	World Bank, WDI	16.73	83.77	260.47	1.6
chg.money.gdp.0006	Percentage change in money and quasi money (M2) in % of GDP 2000-2006	World Bank, WDI	-32.86	186.27	815.85	1.6
m.growth.06	Indicator of money growth in 2006, range from 0 to 10 (growth of M3 in line with long-term real output growth).	Fraser Institute, Economic Freedom database	0.00	8.14	9.53	3.2
infl.0006	Inflation, 2000-2006 average	IMF, WEO April 2011	-1.20	5.28	48.02	0.0
infl.06	Inflation, 2006.	IMF, WEO April 2011	0.15	4.19	11.55	0.0
mon.freedom.06	Indicator of monetary freedom in 2006	Heritage Foundation	49.76	81.84	92.51	1.6
sound.money.06	Sound money indicator, range from 0 to 10 (more access to sound money)	Fraser Institute, Economic Freedom database	5.35	8.70	9.72	3.2
monInd.06	Monetary independence index (1= most independent) in 2006.	The trilemma indexes, Aizenmann, Chinn and Ito, `http://web.pdx.edu/~ito/trilemma_indexes.htm`.	0.15	0.59	1.00	3.2
Monetary Regime						
floater	Dummy variable for countries with no exchange rate anchor	Author's calculations based on	0.00	0.44	1.00	0.0

infl.targeter	Dummy variable for inflation targeters	IMF classification (2008)	0.00	0.33	1.00	0.0
black.market.exchange.rates.06	Indicator on black market exchange rates, 2006. Ranges from 0 to 10 (no black market exchange rate for domestic currency).	Fraser Institute, Economic Freedom database	8.88	9.97	10.00	3.2
exch.rate.stab.06	Exchange rate stability index (1=most stable) in 2006.	See variable monInd.06	0.00	0.31	0.84	3.2
fin.freedom.06	Indicator on financial freedom, 2006. Ranges from 0 to 100.	Heritage foundation	30.00	64.13	90.00	1.6
Trade & Trade composition						
openness.0206		UN Comtrade data base	19.74	75.60	305.60	0.0
trade.bal.gdp.0206	Trade balance in % of GDP, 2000-2006 average	UN Comtrade data base	-35.28	-3.28	45.38	0.0
manuf.exports.0006	Exports of manufactured goods in % of total exports, 2000-2006 average	UN Comtrade data base	0.80	17.28	78.97	0.0
petrol.exports.0006	Exports of petroleum, petroleum products and related materials in % of total exports, 2000-2006 average	UN Comtrade data base	0.02	7.17	52.86	0.0
food.exports.0006	Exports of food and live animals in % of total exports, 2000-2006 average	UN Comtrade data base	0.05	9.58	59.70	0.0
merchTrade.gdp.0006	Merchandise trade in % of GDP, 2000-2006 average	World Bank, WDI	19.75	78.28	313.79	0.0
Business environment & Labor Market						
unempl.06	Unemployment rate, 2006	IMF, IFS and WEO	1.29	8.34	36.00	0.0
lab.market.reg.06	Indicator on labor market regulations, 2006. Ranges from 0 to 10.	Fraser Institute, Economic Freedom database	2.90	6.45	9.20	3.2
labor.freedom	Indicator on labor freedom, 2006. Ranges from 0 to 100.	Heritage Foundation	39.10	66.44	99.90	1.6
marg.tax.rate.06	Indicator on top marginal tax rate, 2006. Ranges from 0 (higher tax rate) to 10 (lower tax rate).	Fraser Institute, Economic Freedom database	1.00	5.56	10.00	4.8
min.wage.06	Indicator on hiring regulations and minimum wage requirements, 2006. Ranges from 0 to 10 (less difficulties of hiring).	Fraser Institute, Economic Freedom database	2.20	7.06	10.00	6.3
price.controls.06	Indicator on price controls, 2006. Ranges from 0 to 10 (no controls).	Fraser Institute, Economic Freedom database	0.00	5.22	10.00	3.2
start.bus.06	Indicator on freedom to starting a business in 2006. Ranges from 0 to 10 (less difficulties starting a business).	Fraser Institute, Economic Freedom database	6.25	8.96	9.93	6.3
bus.reg.06	Indicator on business regulations in 2006. Ranges from 0 to 10 (no regulations).	Fraser Institute, Economic Freedom database	3.82	6.10	7.84	3.2
business.freedom.06	Indicator on business freedom, 2006. Ranges from 0 to 100.	Heritage Foundation	43.10	76.02	99.90	1.6
Institutional quality						
legal.rights.06	Strength of legal rights index from 0 (weak) to 10 (strong)	World Bank, WDI	2.00	6.43	10.00	3.2
cpi.corruption.06	CPI (Transparency International's Corruption Perception Index)	Transparency International	2.10	5.79	9.60	1.6
freedom.from.corr.06	Freedom from corruption index, 2006. Ranges from 0 to 100.	Heritage Foundation	20.00	57.25	97.00	1.6
prop.rights.06	Property rights index, 2006, Ranges from 0 to 100.	Heritage Foundation	30.00	63.33	90.00	1.6
External Risks						

Current Account & Savings						
ca.gdp.0006	Current account in % of GDP, 2000-2006 average	IMF, WEO April 2011	-10.73	0.13	50.85	0.0
gross.savings.06	Gross savings in % of GDP, 2006.	World Bank (WDI), IMF (IFS)	9.65	23.10	53.51	0.0
twin.def	Multiplicative term of ca.gdp.0006 with gen.govBal.0006		-45.26	17.21	463.21	0.0
Exchange Rate Misalignment / Output Gap						
reerm.06	Measure for overvaluation of the real exchange rate based on a panel regression on macro fundamentals, in %, 2006	Author's calculations based on the IMFs CGER assessment, fully described in Lee et al. (2008).	-47.99	3.37	114.02	1.6
outputGap_0006Exo	Deviation from trend output in % in 2000-2006; calculation based on yearly GDP data up to 2006 using the Hodrick-Prescott Filter with the smoothness parameter $\lambda = 1600$	Author's calculations.	-7.69	-2.47	1.95	0.0
outputGap_06Exo	Deviation from trend output in % in 2006; calculation based on yearly GDP data up to 2006 using the Hodrick-Prescott Filter with the smoothness parameter $\lambda = 1600$.	Author's calculations.	-0.58	10.39	34.36	0.0
dGap_0006Exo	Ratio of how often a country was above trend growth in the period from 2000 to 2006	Author's calculations.	14.29	46.49	71.43	0.0
emp.06	Exchange market pressure index covering changes in the nominal exchange rate and changes in international reserves, in %, 2006; negative values indicate pressure in the exchange market.	Author's calculations based on Aizenman et al. (2012).	-0.24	-0.03	0.86	0.0
emp.0006	See above, average over the period from 2000 to 2006.	Author's calculations based on Aizenman et al. (2012).	-13.96	-3.18	7.69	0.0
empSD.0006	See above, standard deviation over the period from 2000 to 2006.	Author's calculations based on Aizenman et al. (2012).	2.52	11.88	42.56	0.0
External Debt						
ext.debt.exp.06	External debt in % of GDP, 2006	IMF, IFS and IIP database	0.00	425.83	4235.46	0.0
ext.debt.gdp.06	External debt in % of total exports, 2006	IMF, IFS and IIP database	0.00	104.48	665.40	0.0
adv.claims.gdp.06	Consolidated foreign claims of reporting banks (USA, AUS, AUT, BEL, CAN, FIN, FRA, DEU, GRC, IRL, ITA, JAP, NLD, PRT, ESP, SWE, CHE, GBR) in % of GDP, 2006.	BIS Quarterly Review, June, 2011, Table 9D	1.98	52.86	230.30	9.5
us.claims.gdp.06	Consolidated claims of US banks in % of GDP, 2006	BIS Quarterly Review, June, 2011, Table 9D	0.01	5.10	100.00	9.5
finExp.toUS.extDebt.06	Financial Exposure to US Banks in % External Debt in 2006.	BIS	0.00	7.07	49.63	0.0
Capital Flows & Controls						
net.fdi.infl.gdp.0006	Net FDI inflows in % of GDP, 2000-2006 average	IMF, IFS database	0.92	7.33	35.85	0.0
net.pf.debt.infl.0006	Net portfolio debt inflows in % GDP in 2006.	World Bank, WDI	-2.81	7.16	96.03	3.2
net.pf.equ.infl.0006	Net portfolio equity inflows in % GDP in 2006.	World Bank, WDI	-0.23	3.55	82.06	3.2
NFA.gdp.06	Net foreign assets in % of GDP, 2006.	IMF, IFS database	-119.40	-11.43	273.13	1.6

cap.controls.06	Capital controls index, 2006. Ranges from 0 to 10 (no controls).	Fraser Institute, Economic Freedom database	0.77	4.86	9.23	3.2
finOpenn.06	Financial Openness Index, measuring a country's degree of capital account openness (Chinn-Ito index, 1=most open) in 2006.	See variable monInd.06.	0.00	0.78	1.00	3.2
int.rate.controls.06	Interest rate controls/Negative real interest rates indicator, 2006. Ranges from 0 to 10 (interest rates determined by the market)	Fraser Institute, Economic Freedom database	5.00	9.70	10.00	3.2
Reserves						
int.res.gdp.06	International reserves (excl. gold) in % of GDP, 2006	IMF, IFS database	0.20	17.56	90.49	0.0
int.res.extDebt.06	International reserves (excl. gold) in % of external debt, 2006	IMF, IFS database	0.00	38.13	442.38	0.0
Fiscal Risks						
gen.govDebt.06	General government debt in % of GDP, 2006	IMF, WEO April 2011	1.89	47.12	191.34	1.6
gen.govBal.0006	General government budget balance in % of GDP, 2006	IMF, WEO April 2011	-6.84	-1.13	12.84	0.0
gov.spend.06	Government spending indicator, 2006. Ranges from 0 to 100.	Heritage Foundation	2.19	55.38	92.13	1.6
fiscal.freedom.06	Fiscal freedom indicator, 2006. Ranges from 0 to 100.	Heritage Foundation	33.22	71.17	94.07	1.6
twin.fis	Multiplicative term of gen.govDebt.06 and gen.govBal.0006		-1229.76	-103.77	777.00	0.0
size.of.gov.06	Size of government indicator. Ranges from 0 to 10 (smaller size).	Fraser Institute, Economic Freedom database	3.73	6.28	9.25	3.2
Financial Risks						
Banking Sector & Financial Markets						
stocks.gdp.06	Stocks traded, total value (% of GDP) in 2006.	World Bank, WDI	0.13	60.82	328.90	3.2
chg.stocks.gdp.0006	Stocks traded, total value (% of GDP) , change from 2000 to 2006.	World Bank, WDI	-86.73	475.69	4725.96	3.2
for.bank.comp.06	Indicator on foreign banks' competition, 2006. Ranges from 0 to 10 (more competition).	Fraser Institute, Economic Freedom database	3.00	8.10	10.00	3.2
for.ownership.restr.06	Indicator on foreign ownership / investment restrictions, 2006. Ranges from 0 to 10 (no restrictions).	Fraser Institute, Economic Freedom database	3.95	7.15	9.19	3.2
foreign.banksacc.06	Indicator on freedom of citizens to own foreign banks accounts, 2006. Ranges from 0 to 10 (no restrictions).	Fraser Institute, Economic Freedom database	0.00	8.41	10.00	3.2
Mark.cap.06	Market capitalization of listed companies (% of GDP) in 2006.	World Bank, WDI	3.27	86.94	471.35	3.2
ownership.banks.06	Indicator on ownership of banks, 2006. Ranges from 0 (higher tax rate) to 10 (privately held deposits) .	Fraser Institute, Economic Freedom database	5.00	8.57	10.00	3.2
Credit & Interest rate						
dom.cred.bank.06	Domestic credit provided by banking sector in % of GDP, 2006	World Bank, WDI	-13.42	98.79	304.96	0.0
chg.dom.cred.bank.0006	Domestic credit provided by banking sector in % of GDP, change from 2000 to 2006.	World Bank, WDI	-59.59	186.08	936.26	0.0

credDepth.06	Credit depth of information index from 0 (low) to 6 (high)	World Bank, WDI	0.00	4.08	6.00	1.6
depRate.06	Deposit rate in % per annum, 2006	IMF, IFS database	0.57	4.77	21.65	1.6
depRate.0006	Deposit rate in %, average from 2000-2006.	IMF, IFS database	0.05	5.58	39.48	1.6
cred.mark.reg.06	Indicator of credit market regulations in 2006, ranges from 0 to 10.	Fraser Institute, Economic Freedom database	6.60	8.91	10.00	3.2
Contagion & Spillover Risks						
trade.to.eu15.gdp.0006	Goods imports from and exports to the EU-15 in % of GDP, 2000-2006 average	UN Comtrade data base	2.20	29.14	113.81	0.0
trade.to.eu15.totExp.0006	Goods imports from and exports to the EU-15 in % of total exports, 2000-2006 average	UN Comtrade data base	4.30	91.01	309.46	0.0
trade.to.eu15.totTrade.0006	Goods imports from and exports to the EU-15 in % of total trade, 2000-2006 average	UN Comtrade data base	4.03	41.00	81.07	0.0
trade.to.eu15.us.totTrade.0006	Goods imports from and exports to the EU-15 and the US in % of total trade, 2000-2006 average	UN Comtrade data base	10.45	56.52	98.48	0.0
trade.to.US.totTrade.0206	Goods imports from and exports to the U.S.A. in % of total trade, 2002-2006 average	UN Comtrade data base	0.00	11.51	72.64	0.0
reg.trade.barriers.06	Indicator on regulatory trade barriers in 2006. Ranges from 0 to 10 (no barriers).	Fraser Institute, Economic Freedom database	2.24	7.22	9.12	3.2
tariffs.06	Indicator on tariffs in 2006. Ranges from 0 to 10 (no tariffs).	Fraser Institute, Economic Freedom database	4.50	7.71	10.00	3.2
nontariff.tradeBarrier.06	Indicator on non-tariff trade barriers in 2006. Ranges from 0 to 10 (no non-tariff barriers).	Fraser Institute, Economic Freedom database	3.68	6.65	8.90	3.2
Regional Dummy Variables						
oil.exporter	Dummy variable for oil exporting countries.	Author's calculations	0.00	0.17	1.00	0.0
oil.prod.08	Total oil produced per day in % of total worldwide oil production in 2008.	Author's calculations based on data provided at `http://www.mongabay.com/reference/stats/rankings/2173.html`	0.00	0.68	11.46	0.00
UKR	Dummy variable for Ukraine.	Authors' calculations.	0.00	0.02	1.00	0.00
BLR	Dummy variable for Belarus.	Authors' calculations.	0.00	0.02	1.00	0.00

Table 1: Data description and summary statistics. NAs in % refers to the number of missing observations in total observations.

Country	cum.loss	depth	HP.trans	HP.per	Start	End
LVA	-258.774	-29.638	-29.985	-1.466	2008Q1	2011Q4
EST	-186.824	-26.507	-25.259	-1.846	2008Q1	2011Q4
UKR	-179.555	-22.972	-20.001	-1.496	2008Q2	2011Q4
LTU	-167.456	-22.361	-21.865	-1.232	2008Q2	2011Q4
IRL	-151.855	-13.294	-17.180	-0.840	2008Q1	2011Q4
ISL	-116.851	-13.438	-18.209	-0.698	2008Q2	2011Q4
SVN	-103.928	-11.546	-16.040	-0.932	2008Q3	2011Q4
GRC	-101.903	-18.752	-13.714	-0.247	2008Q2	2011Q4
ROM	-98.886	-13.199	-16.123	-1.185	2008Q4	2011Q4
HRV	-95.385	-9.586	-13.236	-0.453	2008Q2	2011Q4
JPN	-87.456	-10.151	-10.207	-0.790	2008Q2	2011Q4
FIN	-83.059	-11.349	-12.724	-0.844	2008Q2	2011Q4
HUN	-82.564	-9.037	-11.034	-0.784	2008Q2	2011Q4
DNK	-80.980	-8.619	-10.984	-0.961	2008Q3	2011Q4
ITA	-76.813	-7.534	-8.262	-0.630	2008Q2	2011Q4
GBR	-71.957	-7.648	-8.725	-0.476	2008Q1	2011Q4
RUS	-69.687	-12.664	-15.281	-1.426	2008Q3	2011Q3
JAM	-62.215	-6.475	-7.551	-0.099	2007Q3	2011Q4
BGR	-61.443	-9.535	-13.460	-0.999	2008Q4	2011Q4
LUX	-61.366	-8.845	-13.720	-1.041	2008Q3	2011Q4
TUR	-57.865	-14.773	-14.303	-3.677	2008Q2	2010Q3
ESP	-53.514	-5.297	-10.050	-0.442	2008Q2	2011Q4
PHL	-48.421	-9.249	-12.630	-3.259	2008Q1	2010Q1
MEX	-44.771	-10.096	-10.004	-2.082	2008Q3	2010Q4
DEU	-43.701	-7.413	-6.286	-0.723	2008Q2	2011Q2
SWE	-41.001	-8.257	-9.404	-2.784	2008Q3	2010Q3
PRT	-40.606	-4.537	-4.993	-0.196	2008Q2	2011Q4
CZE	-40.279	-7.151	-13.161	-1.091	2008Q4	2011Q4
BRN	-39.333	-6.097	-5.367	-0.764	2007Q3	2010Q4
BWA	-35.612	-14.677	-10.023	-6.108	2008Q4	2009Q3
NOR	-34.116	-4.711	-6.917	-0.510	2008Q3	2011Q4
NLD	-34.041	-4.909	-7.357	-0.236	2008Q2	2011Q4
USA	-31.641	-5.442	-7.688	-0.775	2008Q2	2011Q3
FRA	-31.564	-4.061	-6.711	-0.465	2008Q2	2011Q4
AUT	-31.370	-5.766	-6.812	-0.900	2008Q2	2010Q4
SVK	-30.085	-7.283	-11.796	-1.345	2008Q4	2010Q4
HKG	-27.979	-8.426	-9.685	-1.978	2008Q2	2010Q1
SGP	-24.600	-9.595	-9.804	-4.096	2008Q2	2009Q3
THA	-23.938	-8.689	-7.003	-2.158	2008Q2	2009Q3
GEO	-22.868	-7.600	-12.094	-3.607	2009Q1	2010Q2
BEL	-21.327	-4.282	-5.948	-0.967	2008Q3	2010Q4
KGZ	-21.131	-13.162	-7.190	-2.482	2010Q2	2011Q2
MLT	-19.957	-4.582	-5.678	-0.737	2008Q4	2010Q3
CYP	-16.733	-3.241	-8.358	-0.703	2009Q1	2011Q4
CRI	-15.109	-5.478	-7.408	-0.635	2008Q2	2009Q4
CAN	-14.845	-3.701	-5.393	-1.393	2008Q3	2010Q2
TUN	-14.198	-7.348	-7.711	-2.886	2011Q1	2011Q4
BLR	-13.908	-11.926	-7.558	-4.104	2011Q3	2011Q4
MYS	-13.872	-6.359	-5.147	-1.340	2008Q2	2009Q3
CHE	-12.485	-3.198	-4.940	-0.692	2008Q3	2010Q2
BRA	-10.809	-3.037	-4.474	-2.547	2008Q4	2009Q3
KOR	-10.700	-4.222	-4.069	-1.662	2008Q2	2009Q2
NZL	-10.647	-2.267	-4.907	-0.823	2008Q1	2009Q4
ZAF	-8.839	-2.735	-6.230	-1.013	2008Q4	2010Q1
CHL	-7.473	-3.115	-5.930	-1.900	2008Q3	2009Q3
PER	-4.721	-2.830	-3.395	-1.453	2008Q4	2009Q3
ARG	-3.518	-2.595	-6.593	-1.899	2008Q4	2009Q2
ISR	-2.208	-1.200	-3.599	-0.807	2008Q4	2009Q2
MKD	-2.134	-1.308	-1.308	-1.049	2011Q3	2011Q4
MUS	-1.482	-1.116	0.641	0.328	2008Q2	2008Q4
JOR	-1.157	-0.911	-2.448	1.212	2009Q1	2009Q2
COL	-0.858	-0.920	-3.393	-0.650	2008Q4	2009Q1
POL	-0.826	-0.760	-2.155	0.084	2008Q4	2009Q1
AUS	-0.453	-0.501	-1.406	-0.200	2008Q4	2008Q4

Table 2: Measure for crisis severity.

Dependent Variable: **cum.loss**	*Model 1*			*Model 2*			*Model 3*		
	PIP	PM	PSD	PIP	PM	PSD	PIP	PM	PSD
chg.dom.cred.bank.0006	0.998	-0.196*	0.035	0.021	0.000	0.025	1.000	0.001	0.153
adv.claims.gdp.06	0.071	-0.015	0.063	0.076	0.017	0.070	0.955	0.216*	0.151
UKR	0.063	-3.811	17.352	0.947	-127.202*	42.176	0.935	-129.165*	48.409
food.exports.0006	0.032	0.016	0.119	0.807	1.117*	0.639	0.743	0.941*	0.653
twin.fis	0.271	0.016	0.029	0.180	0.008	0.019	0.482	0.021	0.027
twin.def	0.039	-0.004	0.025	0.020	-0.001	0.014	0.366	-0.029	0.057
exch.rate.stab.06	0.024	0.359	4.717	0.024	0.586	4.931	0.223	5.987	16.508
business.freedom.06	0.026	-0.011	0.105	0.051	-0.038	0.190	0.203	-0.173	0.400
monInd.06	0.075	-2.115	8.624	0.028	-0.587	4.295	0.200	-4.453	12.540
infl.0006	0.055	0.063	0.411	0.018	-0.015	0.213	0.138	-0.365	1.421
emp.06	0.023	-0.622	6.129	0.030	-1.125	7.672	0.137	-6.020	17.552
gr.savings.gdp.06	0.225	-0.411	0.840	0.052	-0.062	0.308	0.132	-0.161	0.524
dGap_0006Exo	0.045	-0.026	0.146	0.032	-0.016	0.108	0.128	-0.047	0.199
gen.govDebt.06	0.112	-0.040	0.128	0.097	-0.025	0.086	0.128	-0.029	0.095
finOpenn.06	0.032	-0.792	6.323	0.024	-0.452	3.949	0.127	-3.006	11.111
pop.gr.0006	0.029	0.030	0.253	0.054	0.083	0.403	0.122	0.192	0.609
BLR	0.626	77.501	66.155	0.052	5.495	30.527	0.100	11.253	50.022
...	...	...	...	...	...	...	...	...	...
chg.dom.cred.bank.0006#adv.claims.gdp.06	-	-	-	0.970	-0.002*	0.001	0.949	-0.002*	0.001
chg.dom.cred.bank.0006#twin.def	-	-	-	0.209	0.000	0.001	0.317	-0.001	0.001
chg.dom.cred.bank.0006#twin.fis	-	-	-	0.039	0.000	0.000	0.141	0.000	0.000
chg.dom.cred.bank.0006#exch.rate.stab.06	-	-	-	0.047	0.006	0.035	0.094	0.014	0.055
chg.dom.cred.bank.0006#infl.0006	-	-	-	0.022	0.000	0.001	0.083	0.001	0.003
chg.dom.cred.bank.0006#monInd.06	-	-	-	0.046	-0.005	0.026	0.080	-0.007	0.041
chg.dom.cred.bank.0006#dGap_0006Exo	-	-	-	0.034	0.000	0.000	0.043	0.000	0.001
chg.dom.cred.bank.0006#infl.targeter	-	-	-	0.045	0.003	0.016	0.043	0.004	0.027
chg.dom.cred.bank.0006#net.fdi.infl.gdp.0006	-	-	-	0.030	0.000	0.001	0.042	0.000	0.002
chg.dom.cred.bank.0006#int.res.extDebt.06	-	-	-	0.026	0.000	0.000	0.042	0.000	0.000
chg.dom.cred.bank.0006#finOpenn.06	-	-	-	0.075	-0.006	0.027	0.041	-0.002	0.030
chg.dom.cred.bank.0006#depRate.0006	-	-	-	0.015	0.000	0.001	0.037	0.000	0.004
chg.dom.cred.bank.0006#rgdpgr.0006	-	-	-	0.067	-0.001	0.005	0.035	-0.001	0.006
...	...	...	...	...	...	...	...	...	...

Table 3: Model 1: Baseline Model. Model 2: Baseline Model + interaction terms. Model 3: Baseline model + interaction terms, strong heredity prior. All results based on 10 million posterior draws after a burn-in phase of 5 million draws, a binomial-beta prior on the model space and the hyper-g prior on g. Reported coefficients are unconditional on inclusion. Variables with $abs(PM)/abs(PSD) > 1.3$ are marked with an asterisk and are dubbed "efficiently estimated".

Dependent Variable: **Depth**	*Model 1*			*Model 2*			*Model 3*		
	PIP	PM	PSD	PIP	PM	PSD	PIP	PM	PSD
chg.dom.cred.bank.0006	0.403	-0.007	0.009	0.024	0.000	0.005	0.928	0.004	0.073
rgdpgr.0006	0.206	-0.364	0.783	0.021	-0.020	0.167	0.647	-0.597	1.069
dGap_0006Exo	0.266	-0.042	0.078	0.168	-0.022	0.053	0.571	-0.081	0.100
chg.stocks.gdp.0006	0.203	0.000	0.001	0.039	0.000	0.000	0.340	0.000	0.001
int.res.extDebt.06	0.033	0.000	0.003	0.019	0.000	0.002	0.339	-0.003	0.015
twin.fis	0.060	0.000	0.002	0.015	0.000	0.001	0.324	0.002	0.005
BLR	0.041	0.327	2.083	0.047	0.807	4.692	0.291	5.545	14.102
chg.rgdpcap.0006	0.552	-0.128	0.122	0.036	-0.005	0.032	0.284	-0.049	0.113
infl.0006	0.018	0.000	0.026	0.012	-0.003	0.042	0.267	-0.137	0.464
pop.gr.0006	0.031	0.006	0.047	0.014	0.003	0.030	0.257	0.098	0.228
money.gdp.06	0.019	0.000	0.003	0.005	0.000	0.001	0.252	0.002	0.021
adv.claims.gdp.06	0.022	0.000	0.003	0.007	0.000	0.002	0.247	0.001	0.023
food.exports.0006	0.032	0.002	0.018	0.024	0.003	0.019	0.232	0.030	0.083
bus.reg.06	0.038	-0.049	0.343	0.008	-0.005	0.090	0.228	-0.481	1.639
depRate.0006	0.018	0.001	0.028	0.007	0.001	0.024	0.223	0.089	0.362
monInd.06	0.024	-0.052	0.489	0.009	-0.017	0.267	0.222	-0.702	3.352
gen.govDebt.06	0.075	-0.003	0.012	0.016	0.000	0.005	0.221	-0.008	0.024
UKR	0.032	-0.191	1.374	0.018	-0.138	1.244	0.189	-1.697	6.870
...	...	...	...	...	...	...	...	...	...
chg.dom.cred.bank.0006#rgdpgr.0006	-	-	-	0.954	-0.003*	0.001	0.450	-0.002	0.003
chg.dom.cred.bank.0006#int.res.extDebt.06	-	-	-	0.118	0.000	0.000	0.245	0.000	0.000
chg.dom.cred.bank.0006#adv.claims.gdp.06	-	-	-	0.020	0.000	0.000	0.149	0.000	0.000
chg.dom.cred.bank.0006#money.gdp.06	-	-	-	0.010	0.000	0.000	0.136	0.000	0.000
chg.dom.cred.bank.0006#dGap_0006Exo	-	-	-	0.021	0.000	0.000	0.135	0.000	0.000
chg.dom.cred.bank.0006#infl.0006	-	-	-	0.018	0.000	0.000	0.130	0.000	0.001
chg.dom.cred.bank.0006#depRate.0006	-	-	-	0.009	0.000	0.000	0.111	0.000	0.001
chg.dom.cred.bank.0006#twin.fis	-	-	-	0.015	0.000	0.000	0.110	0.000	0.000
chg.dom.cred.bank.0006#chg.stocks.gdp.0006	-	-	-	0.015	0.000	0.000	0.095	0.000	0.000
chg.dom.cred.bank.0006#openness.0206	-	-	-	0.015	0.000	0.000	0.087	0.000	0.000
chg.dom.cred.bank.0006#monInd.06	-	-	-	0.009	0.000	0.001	0.079	-0.001	0.010
chg.dom.cred.bank.0006#rgdpcap.06	-	-	-	0.015	0.000	0.000	0.077	-0.001	0.007
...	...	...	...	...	...	...	...	...	...

Table 4: Model 1: Baseline Model. Model 2: Baseline Model + interaction terms. Model 3: Baseline Model + interaction terms, strong heredity prior. All results based on 10 million posterior draws after a burn-in phase of 5 million draws, a binomial-beta prior on the model space and the hyper-g prior on g. Variables with $abs(PM)/abs(PSD) > 1.3$ are marked with an asterisk and are dubbed "efficiently estimated".

Dependent Variable: **HP.trans**	*Model 1*			*Model 2*			*Model 3*		
	PIP	PM	PSD	PIP	PM	PSD	PIP	PM	PSD
chg.dom.cred.bank.0006	0.530	-0.009	0.009	0.029	0.000	0.004	0.907	-0.004	0.032
BLR	0.304	3.509	5.844	0.161	2.269	6.253	0.476	8.112	11.070
chg.rgdpcap.0006	0.549	-0.123	0.119	0.547	-0.082	0.081	0.466	-0.082	0.102
rgdpgr.0006	0.107	-0.138	0.460	0.077	-0.078	0.304	0.402	-0.441	0.737
gr.savings.gdp.06	0.091	-0.020	0.077	0.029	-0.003	0.024	0.354	-0.092	0.158
min.wage.06	0.102	0.061	0.206	0.032	0.012	0.076	0.351	0.216	0.341
dGap_0006Exo	0.179	-0.020	0.047	0.094	-0.009	0.032	0.339	-0.035	0.061
adv.claims.gdp.06	0.067	-0.002	0.007	0.018	0.000	0.003	0.322	0.001	0.016
twin.fis	0.088	0.001	0.002	0.020	0.000	0.001	0.320	0.002	0.004
infl.0006	0.038	0.001	0.044	0.028	-0.007	0.066	0.319	-0.125	0.318
int.res.extDebt.06	0.021	0.000	0.002	0.010	0.000	0.001	0.301	0.002	0.009
trade.freedom.06	0.228	-0.035	0.071	0.104	-0.013	0.042	0.261	-0.033	0.067
unempl.06	0.056	0.009	0.043	0.046	0.008	0.042	0.225	0.042	0.099
money.gdp.06	0.051	0.001	0.007	0.010	0.000	0.002	0.224	0.005	0.015
food.exports.0006	0.028	0.001	0.014	0.136	0.018	0.050	0.220	0.026	0.061
pop.gr.0006	0.039	0.008	0.058	0.037	0.008	0.048	0.219	0.063	0.146
m.growth.06	0.078	0.063	0.255	0.095	0.077	0.262	0.206	0.173	0.449
depRate.0006	0.026	0.003	0.040	0.018	0.003	0.040	0.194	0.068	0.222
UKR	0.018	-0.025	0.617	0.026	-0.165	1.255	0.121	-0.796	3.713
...	...	...	...	...	...	...	...	...	...
chg.dom.cred.bank.0006#int.res.extDebt.06	-	-	-	0.070	0.000	0.000	0.236	0.000	0.000
chg.dom.cred.bank.0006#adv.claims.gdp.06	-	-	-	0.589	0.000	0.000	0.215	0.000	0.000
chg.dom.cred.bank.0006#rgdpgr.0006	-	-	-	0.268	-0.001	0.001	0.193	0.000	0.001
chg.dom.cred.bank.0006#infl.0006	-	-	-	0.036	0.000	0.000	0.155	0.000	0.001
chg.dom.cred.bank.0006#gr.savings.gdp.06	-	-	-	0.013	0.000	0.000	0.115	0.000	0.000
chg.dom.cred.bank.0006#trade.to.eu15.us.totTrade.0006	-	-	-	0.074	0.000	0.000	0.099	0.000	0.000
chg.dom.cred.bank.0006#depRate.0006	-	-	-	0.017	0.000	0.000	0.077	0.000	0.001
chg.dom.cred.bank.0006#dGap_0006Exo	-	-	-	0.055	0.000	0.000	0.076	0.000	0.000
chg.dom.cred.bank.0006#money.gdp.06	-	-	-	0.016	0.000	0.000	0.070	0.000	0.000
chg.dom.cred.bank.0006#twin.fis	-	-	-	0.009	0.000	0.000	0.070	0.000	0.000
chg.dom.cred.bank.0006#reerm.06	-	-	-	0.015	0.000	0.000	0.051	0.000	0.000
...	...	...	...	...	...	...	...	...	...

Table 5: Model 1: Baseline Model. Model 2: Baseline Model + interaction terms. Model 3: Baseline Model + interaction terms, strong heredity prior. All results based on 10 million posterior draws after a burn-in phase of 5 million draws, a binomial-beta prior on the model space and the hyper-g prior on g. Variables with $abs(PM)/abs(PSD) > 1.3$ are marked with an asterisk and are dubbed "efficiently estimated".

Dependent Variable: **HP.per**	*Model 1*			*Model 2*			*Model 3*		
	PIP	PM	PSD	PIP	PM	PSD	PIP	PM	PSD
chg.dom.cred.bank.0006	0.228	0.000	0.001	0.182	0.000	0.008	0.960	0.003	0.041
food.exports.0006	0.550	0.025	0.032	0.641	0.030	0.030	0.758	0.048	0.053
int.res.extDebt.06	0.455	-0.002	0.005	0.230	-0.001	0.003	0.713	-0.002	0.010
Mark.cap.06	0.549	0.004	0.004	0.532	0.003	0.004	0.684	0.005	0.006
net.fdi.infl.gdp.0006	0.529	-0.058	0.077	0.286	-0.019	0.047	0.659	-0.064	0.125
twin.def	0.333	0.002	0.004	0.399	0.003	0.004	0.638	0.004	0.010
rgdpcap.06	0.476	0.338	0.506	0.377	0.228	0.377	0.614	0.474	1.024
money.gdp.06	0.442	0.004	0.006	0.350	0.003	0.005	0.587	0.004	0.012
chg.stocks.gdp.0006	0.522	0.000	0.000	0.416	0.000	0.000	0.582	0.000	0.001
rgdpgr.0006	0.436	-0.174	0.315	0.304	-0.081	0.177	0.559	-0.189	0.597
oil.exporter	0.292	0.167	0.519	0.328	0.283	0.562	0.556	0.638	1.189
monInd.06	0.305	0.239	0.736	0.284	0.266	0.615	0.550	0.578	1.934
NFA.gdp.06	0.459	-0.004	0.006	0.401	-0.003	0.005	0.538	-0.005	0.009
outputGap_06Exo	0.444	-0.021	0.036	0.631	-0.038	0.038	0.531	-0.032	0.076
nontariff.tradeBarrier.06	0.414	-0.220	0.380	0.329	-0.113	0.229	0.529	-0.249	0.538
gr.savings.gdp.06	0.414	-0.024	0.043	0.187	-0.006	0.022	0.524	-0.029	0.090
empSD.0006	0.300	-0.013	0.034	0.243	-0.012	0.032	0.519	-0.034	0.073
dGap_0006Exo	0.405	-0.010	0.018	0.222	-0.004	0.012	0.518	-0.010	0.036
reerm.06	0.268	-0.002	0.008	0.171	0.001	0.007	0.512	-0.004	0.025
UKR	0.294	0.457	1.297	0.160	0.152	1.120	0.349	0.409	3.808
BLR	0.412	-1.228	2.500	0.222	-0.587	2.045	0.397	-1.306	6.048
...	...	...	...	...	...	...	...	...	...
chg.dom.cred.bank.0006#int.res.extDebt.06	-	-	-	0.901	0.000*	0.000	0.515	0.000	0.000
chg.dom.cred.bank.0006#chg.stocks.gdp.0006	-	-	-	0.316	0.000	0.000	0.249	0.000	0.000
chg.dom.cred.bank.0006#twin.def	-	-	-	0.165	0.000	0.000	0.237	0.000	0.000
chg.dom.cred.bank.0006#rgdpcap.06	-	-	-	0.179	0.000	0.001	0.235	-0.001	0.004
chg.dom.cred.bank.0006#net.fdi.infl.gdp.0006	-	-	-	0.154	0.000	0.000	0.205	0.000	0.000
chg.dom.cred.bank.0006#openness.0206	-	-	-	0.257	0.000	0.000	0.202	0.000	0.000
chg.dom.cred.bank.0006#money.gdp.06	-	-	-	0.237	0.000	0.000	0.197	0.000	0.000
chg.dom.cred.bank.0006#rgdpgr.0006	-	-	-	0.163	0.000	0.000	0.192	0.000	0.001
chg.dom.cred.bank.0006#twin.fis	-	-	-	0.307	0.000	0.000	0.190	0.000	0.000
...	...	...	...	...	...	...	...	...	...

Table 6: Model 1: Baseline Model. Model 2: Baseline Model + interaction terms. Model 3: Baseline model + interaction terms, strong heredity prior. All results based on 10 million posterior draws after a burn-in phase of 5 million draws, a binomial-beta prior on the model space and the hyper-g prior on g. Variables with $abs(PM)/abs(PSD) > 1.3$ are marked with an asterisk and are dubbed "efficiently estimated".

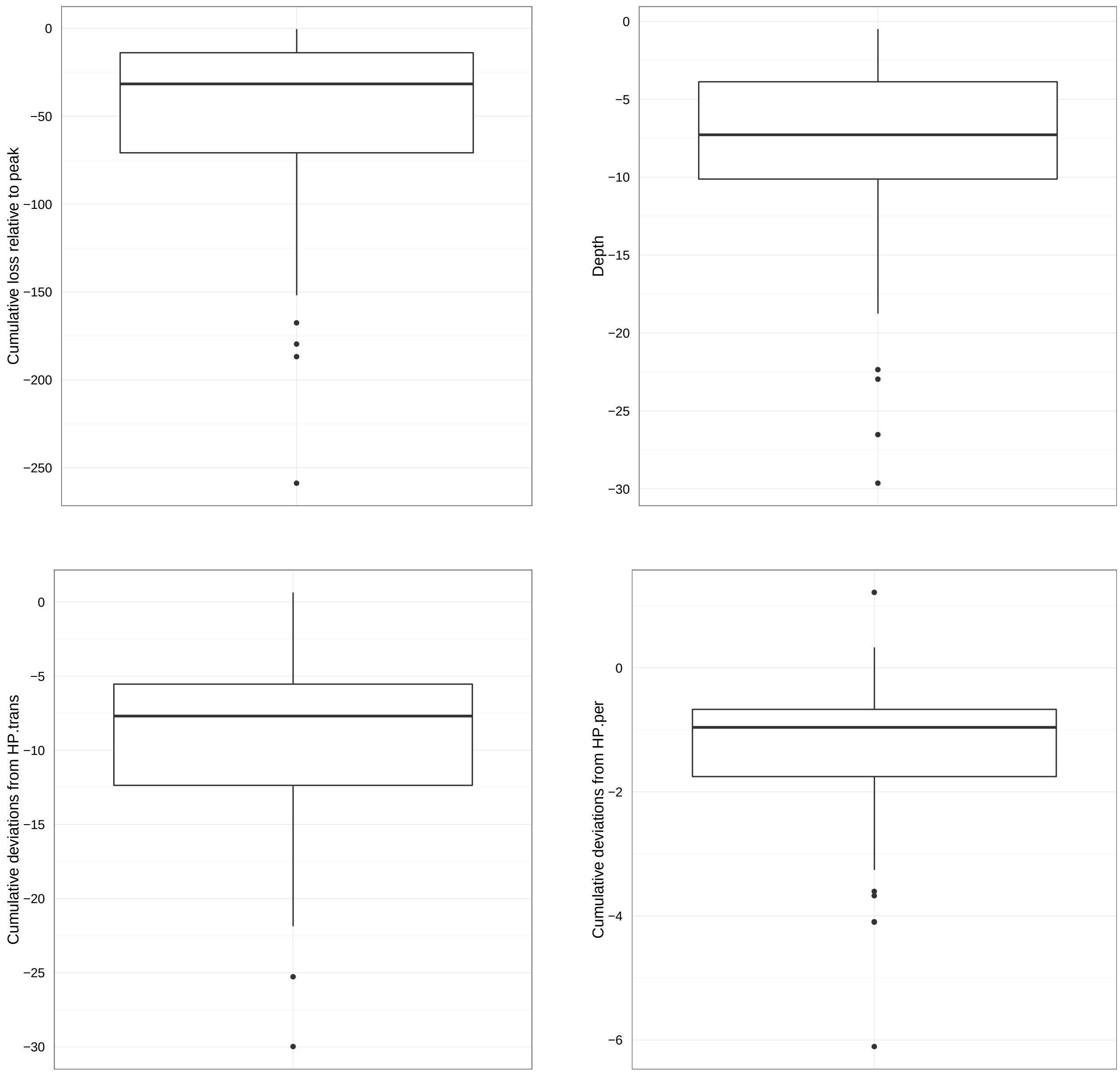

Figure 1: Cross-sectional Distribution of Crisis Severity Measures. The boxplot displays the 25th, the 50th (solid line) and the 75th percentile of the distribution. The plot whiskers extend to the most extreme data point which does not exceed 1.5 times the interquartile range from the box. Values above (in absolute terms) marked as outliers. Top panel, left-hand side displays the cross-sectional distribution of cumulative output loss, right-hand side the one of crisis depth. Bottom panel, left-hand side cumulative deviations from trend output (transitory), right-hand side from trend output assuming the crisis had a permanent effect.

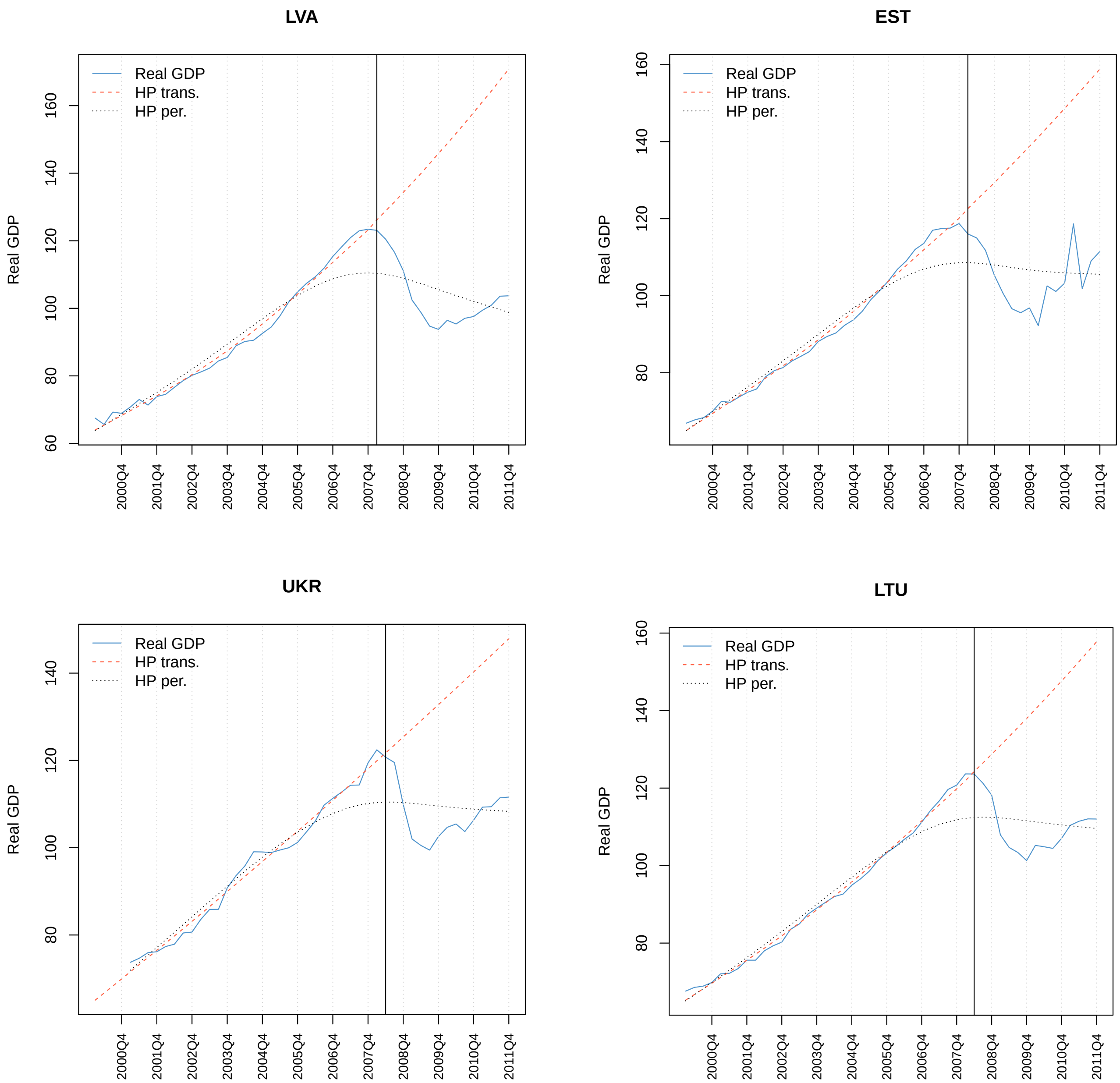

Figure 2: Long-run impact of the crisis on the real economy.

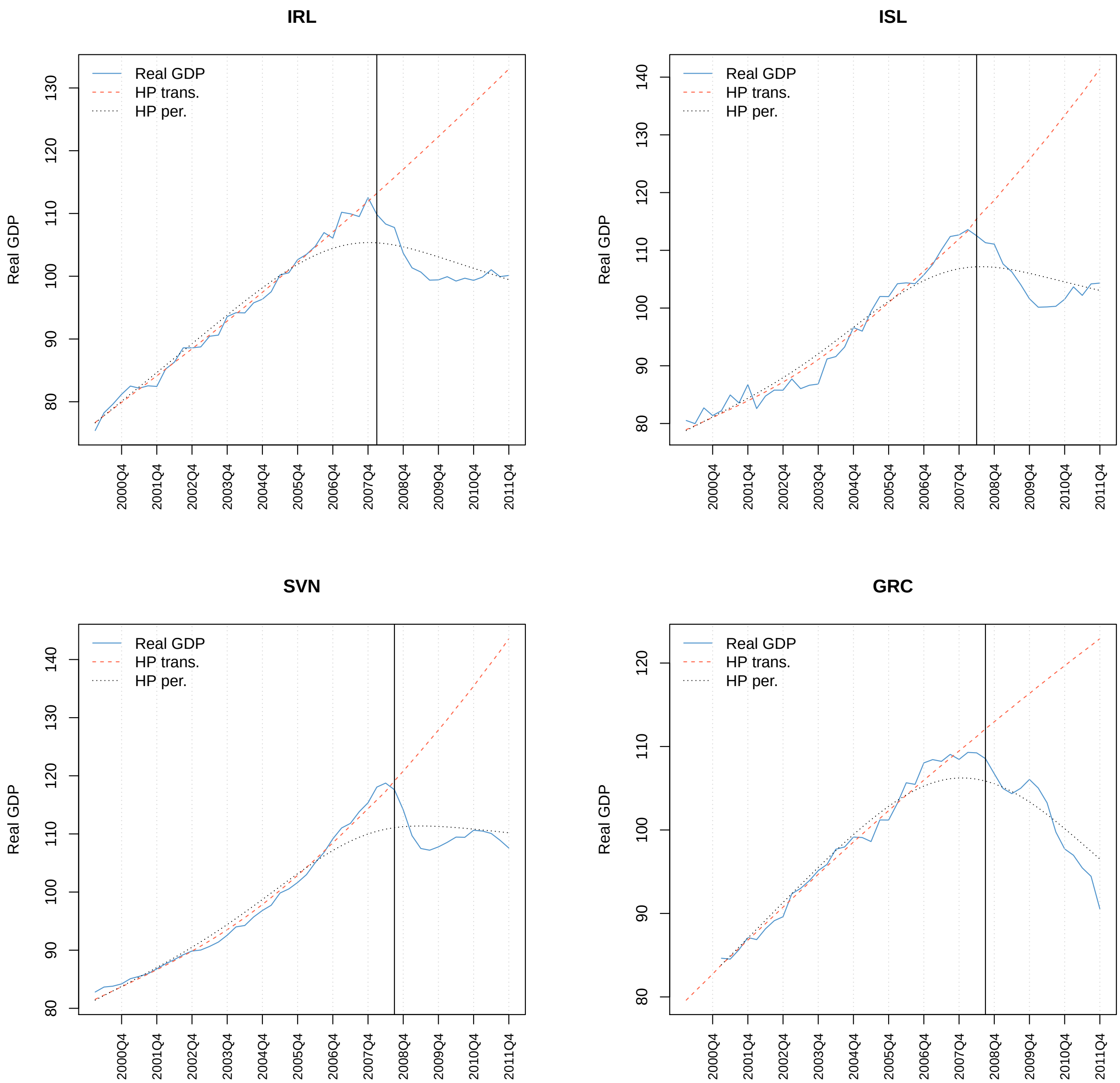

Figure 3: Long-run impact of the crisis on the real economy.

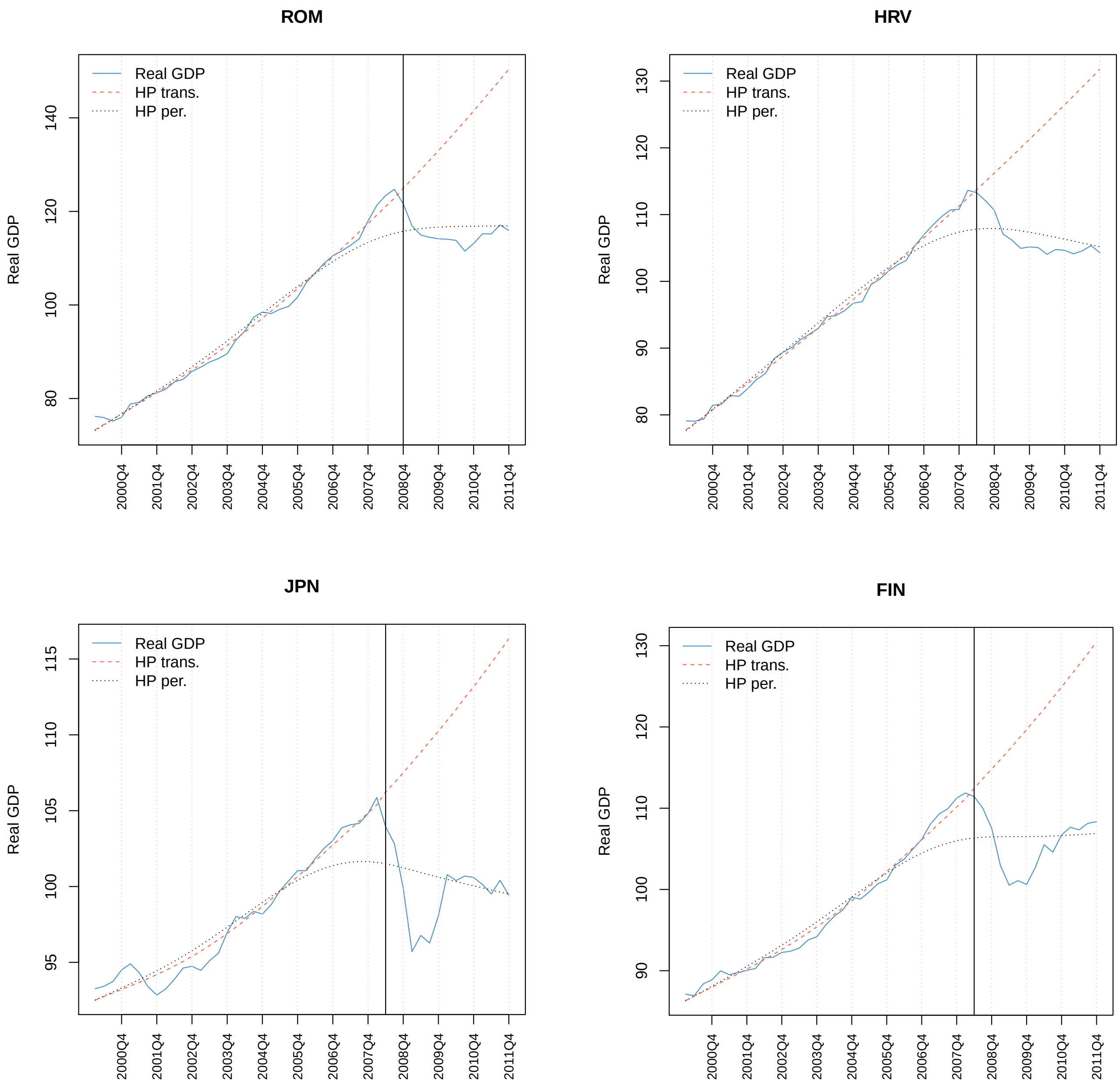

Figure 4: Long-run impact of the crisis on the real economy.

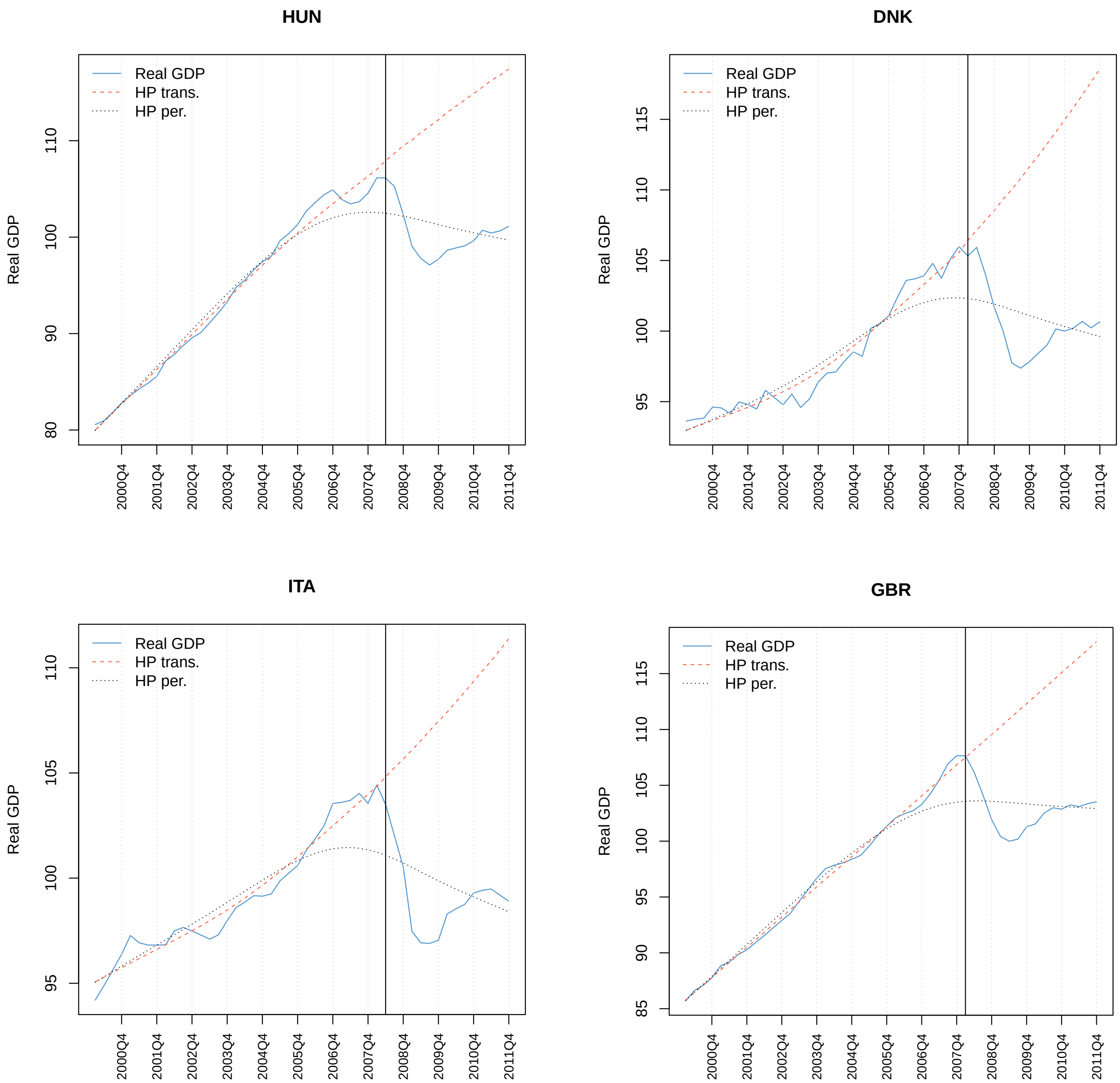

Figure 5: Long-run impact of the crisis on the real economy.

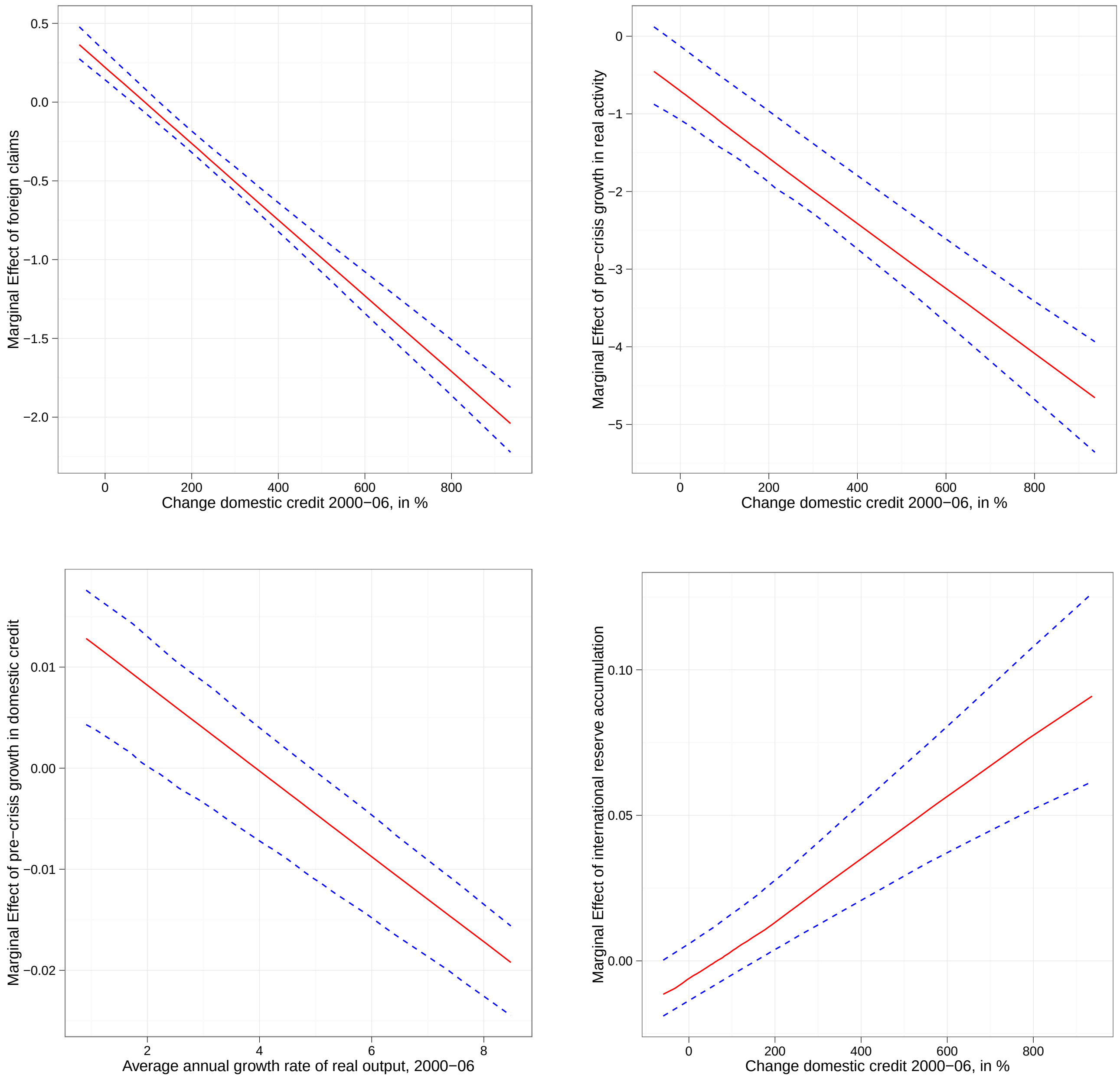

Figure 6: Posterior distribution of the marginal effects. The figure is based on the posterior means of the 1000 models with highest posterior model probability that included all three variables that compose the marginal effect (981,756, 756 and 627 respectively). The solid (red) line corresponds to the median, the dotted (blue) lines to the 5th and 95th percentiles. Top panel, left-hand side shows the marginal effect of foreign claims on cumulative output loss (**cum.loss**), right-hand side of pre-crisis growth in real activity on the depth (**depth**) of the crisis. Both effects are conditional on pre-crisis credit growth. The bottom panel, left-hand side illustrates the effect of pre-crisis credit growth on the depth (**depth**) of the crisis conditional on pre-crisis growth in real activity. The right-hand side of the bottom panel illustrates the marginal effect of accumulation in international reserves on cumulative loss in trend output (**hp.per**) conditional on pre-crisis credit growth.

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