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THE EFFECTS OF CRISES IN EUROPE:

IMPACT, TWINS AND RECOVERY TIME

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Abstract

The goal of this thesis is to examine the effect of a systemic crisis on GDP growth. The balanced panel analysis of 16 European countries over the time period 1970 – 2017 shows that a crisis has severe consequences as growth is reduced by 1.8% for each crisis year. Twin Crises and complex crises prove to be extraordinarily damaging. After the crisis has ended a country undergoes on average two years of recovery time until the pre-crisis growth trend is re-established. The results are highly robust to different control variables, specifications and datasets.

Keywords

output loss, growth, systemic crisis, recovery

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1. Introduction

Pictures of people lining up in front of counters of the British bank "Northern Rock" are in good memory as the subprime crisis spilled over from the US to Europe and the general public worried that their deposits are not safe anymore. Some years later, on the southern end of the continent furious demonstrators in Athens were photographed when they rioted in fear of losing their jobs as a result of the rigorous austerity plan forced upon the country. The two images are proof of the consequences financial crises can have for the average worker. What first starts as a hard to grasp phenomena with asset prices decreasing or government bond spreads increasing can rapidly turn into harsh life changes for many. Total unemployment among the 27 EU countries rose by 4% in the crisis year 2008 (Eurostat, 2009) and future generations in Greece will have to repay a debt mountain of €322 billion over the next 42 years (Baynes, 2018).

The two incidents have different origins as one was caused by disruptions in the banking sector and the other by extensive sovereign debt, but similar negative consequences for the real sector as both times production plunged and a recession unfolded. The present master thesis attempts to investigate whether these two extreme events are exceptional outliers or if financial crises have significant effects on economic output. Furthermore, it will be evaluated if complex crises and so-called twin crises, events where two different crisis types happen at the same time, have particularly harmful consequences. The third question tackled in this paper is whether a country experiences a recovery time after the end of a crisis and if it does so, how many years it takes for the economy to reach the pre-crisis growth level. To find answers to these three inquiries, a newly published systemic crisis database by the ECB and data from 16 European countries over the time span of nearly 50 years will be used for a balanced panel analysis with country fixed effects.

Section 2 is dedicated to an overview of existing research in the field of financial crisis' impacts on output. A special emphasis is placed on subfields relevant for this work such as

financial crisis definition, statistical models, causality issues and different crisis causes. In the next section the data used is described with a detailed look at the features of the ECB's crisis database, followed by a section explaining the characteristics of the different crisis types listed in the database. Section 5 presents the methodology together with the model specification and several diagnostics test. The performed analysis is based on a balanced panel with country fixed effects and Driscoll-Kraay standard errors (Driscoll and Kraay, 1998). The main results of this paper are presented in the 6th section. A significant negative effect of a systemic crisis on GDP growth is found with a decline of 1.8% per crisis year. Alongside with the results come potential explanations of the reasons responsible for the reduction of the growth rate. This section finishes with a series of robustness checks in order to evaluate if the findings hold in different model environments such as a bigger set of control variables or excluding the global financial crisis. Within the robustness checks also an analysis incorporating all 28 EU states plus Norway for the shorter period of 1995 – 2017 can be found. For this alternative dataset the negative impact of a systemic crisis with an estimated 2.4% per crisis year seems to be considerably larger than in the core dataset.

In section 7 an analysis is performed to examine the impact of different crisis types. Three combinations of twin crisis as well as complex crises seem to have a significant marginal effect on output that goes beyond the simple addition of the components. The penultimate section focuses on the crisis recovery. The growth IRF, calculated with the local projection method, reveals that on average a country reaches its normal growth trend two years after the crisis has ended. The last section sums up all results and gives future research recommendations.

2. Literature Review

There exists a broad field of research evaluating the effects of financial crises on economies. One group of studies focuses especially on long time periods, which can extend up to 200 years. Among this group is the work of Reinhart and Rogoff (2014), Bordo, Eichengreen, Klingebiel and Martinez-Peria (2001) and Jordà, Schularick and Taylor (2013). In their

influential book *This Time is Different* Reinhart and Rogoff (2009) defined a detailed dataset of financial crises starting in the year 1800. Using this dataset, the authors evaluated the impact on GDP by looking at 100 systemic crises. To quantify the effect the peak-to-trough fall is used, which is the difference in real GDP per capita between the start of the crisis and the bottom of the downturn. The authors use simple summary statistics and report that average peak-to-trough fall was 11.5% and average peak-to-recovery time was 8.3 years (Reinhart and Rogoff, 2014). Bordo et al. (2001) conduct a regression analysis with observations from 1880 to 1997 and conclude that following a crisis a country on average experiences a downturn of 2 to 3 years connected to an overall output loss of 5 – 10% of GDP. But in general, research papers on financial crises focus on shorter periods, usually not more than the past 50 years.

One crucial point among the different studies is the used definition for financial crises and the according start and end dates of the crises. One group of researchers use crisis databases that can be considered as 'standard' databases. Usually this is either Reinhart and Rogoff (2009) or Laeven and Valencia (2008, 2013) and before 2008 it was Caprio and Klingebiel (1996) or Demirgüç-Kunt and Detragiache (1998). Another group of papers use the mentioned 'standard' databases but combine them with each other or add own amendments, as Hutchinson and Noy (2005) did. They simply combine Caprio and Klingbiel (1996) and Demirgüç-Kunt and Detragiache (1998) by defining a crisis if it is mentioned in either of the two databases. A third group of authors come up with their own, sometimes exotic calculations for systemic crises. Romer and Romer (2015) focus on disruptions of the credit supply and classify a financial crisis on a scale from 0 to 15, with 7 being a moderate crisis. This is a new approach as all the other mentioned databases work with a binary definition where a country either is in a crisis or not. The lack of a universal definition for systemic crises leads to difficulties in comparing the outcomes of studies with each other, as often different definitions were used. The differences in definitions have a not negligible effect on the results. The ECB recognized this problem and published in 2017 a new database with the focus on precise chronological definitions of crisis

events to support the calibration of models in macroprudential analysis and policy (ECB, 2017). This paper will for the first time use this newly published dataset as part of a panel analysis to estimate the general impact of a crisis on output.

Panel analysis is a common statistical tool used to quantify the impact of systemic crises. It is used in the work of Furceri and Zdzienicka (2011), Dell'Ariccia, Detragiache and Raja (2005), Teulings and Zubanov (2014) as well as Oulton and Sebastiá-Barriel (2017). An unbalanced panel of 154 countries from 1970 – 2008 is used by Furceri and Zdzienicka (2011) to analyse debt crises. They use several control variables that are believed to influence growth to single out the true effect of a crisis. Furthermore, the two-step GMM-system estimator is used to address problems of endogeneity. Their analysis suggests that if a country is in a debt crisis the contemporaneous output is lowered by 5.5% on average. Oulton and Sebastiá-Barriel (2017) use fixed effects panel regressions, which are estimated by the Arellano-Bond (Arellano and Bond, 1991) method and not by the common least squares regression method as the former is able to deal with the issue of lagged dependent variables not being exogenous. The authors find that a banking crisis decreases GDP per capita by 1.8% for every crisis year. In addition to the panel analysis, impulse response functions (IRF) are used to illustrate the response of output to a financial crisis. The IRFs are generated with the local projection method developed by Jordá (2005). Teulings and Zubanov (2014) slightly change the method suggested by Jordá and show with their IRFs that 7 years after the start of a crisis the loss of GDP reaches its maximum. For the present thesis data from 16 countries over 48 years will be analysed with a fixed effects model specification. An IRF based on the local projection method will be used to compute the response of growth to a crisis.

Another crucial point in the analysis of financial crises is the question of causality. Just because GDP growth decreases in times of financial crises does not directly imply that the decline was caused by the crisis. It could be possible that a third unknown factor is responsible for the economic downturn. A potential third variable could trigger problems in the banking

sector and at the same time negatively affect aggregate demand, what in this case would lead to the conclusion that financial crises and GDP growth are independent of each other. To investigate if banking crises have an impact on economic output Dell'Ariccia et al. (2005) analysed if industries more dependent on bank loans suffer relatively more during a banking crisis. The results show that financially dependent sectors lose about 1 percentage point of performance in each crisis year compared to sectors less dependent on banks. Thus, the authors conclude that a financial crisis has real effects on industries. The direction of the causality has to be tested too, as it could be possible that declining growth causes a crisis and not vice versa. Jordà et al. (2013) approach this issue by comparing recessions accompanied by a financial crisis to normal recessions. By looking at data from 14 countries during 1870 to 2008 they find that a recession accompanied by a crisis is significantly much longer and more painful than a regular downward business cycle. Similar results are revealed by Bordo et al. (2001) using the same method of comparing the two types of recessions. These findings let assume that crises are at least partly responsible for the occurring economic slowdown. In order to not overload this paper, causality will not be questioned. It will be assumed that the results obtained by the mentioned scholars hold true for the analysed countries and time period.

Not every crisis has the same characteristics. Some are solely caused by disruptions in one area whereas others have multiple origins like a simultaneous banking and currency crisis. The latter were studied by Hutchison and Noy (2005) who compared the so-called "twin crises" to crisis events when only the banking sector or the exchange rate were troubled. The outcomes of their work show that single currency and banking crises reduce growth by 5%-8% and 8-10% respectively over 2-4 years crisis duration. However, the effects of twin crises do not exceed the pure additional negative impact of the two crises and thus the assumption that twin crises have amplifying dynamics is neglected. On the contrary Furceri and Zdzienicka (2011) find that banking-currency twin-crises have a marginal negative effect that goes beyond the

pure addition of the two effects. Section 7 is dedicated to the thorough analysis of the research question if the different crisis types change the impact on output.

In summary, existing research has shown a very robust negative impact of financial crises on GDP. The estimates range from around 1.5% up to 6% loss of GDP growth for each crisis year. Furthermore, proofs were found for the financial crises independent direct impact on the real sector. The declines of economic output could not be fully explained by normal business cycles or other third factors. When it comes to multiple origin crises there exists mixed evidence whether twin events are worse than the added effects of their components or not.

3. Data

The used dataset consists of GDP data, the systemic crisis database and the control variables. The values for real GDP are obtained from the World Bank and are measured in constant 2010 bn US$. The start and end dates for systemic crises are taken from the *ECB/ESRB EU crises database* (ECB 2017), where crises were identified in a two-step approach. First, a purely analytical analysis using a financial stress index, which takes price changes in key financial market segments into account, resulted in a list of events of high financial distress. In the second step the list got revised by the National Authorities who now relied on qualitative information. An event got flagged as a systemic crisis if at least one of the following criteria was fulfilled: (1) The supply of credit to the non-financial sector shrinks what contributes to substantially negative economic outcomes, (2) financial market infrastructure is dysfunctional and/or there are bankruptcies among large banks, (3) policies were adopted to preserve financial stability (ECB, 2017). Furthermore, the revising National Authorities could add events to the systemic crises list that were not detected by the financial stress index but fulfilled the criteria.

Apart from the systemic crises the ECB dataset lists 43 residual events, which are periods of elevated financial distress but were not considered to be a systemic crisis. In the final dataset 50 systemic crises were detected among the 28 EU countries and Norway during 1970 – 2017. When compared to the financial crisis list of Laeven and Valencia (2008, 2013), one of the most

used among scholars studying financial crises, the most obvious difference is that the LV database only allows a crisis to have one origin (banking, currency or sovereign debt) whereas the ECB works with non-exclusive categories. This results in the allowance of complex crises with multiple origins. Depending on what risk materialised, the event in the ECB database is labelled with one or multiple types from the following set of options: (1) banking risk, (2) significant asset price correction, (3) sovereign debt risk, (4) currency risk or (5) transition. In some incidents a complex event in the ECB dataset covers multiple different events listed by Laeven and Valencia. Overall a total of 30 events can be found in both datasets, whereas the ECB list contains 16 events not listed by Laeven and Valencia and the LV list contains 1 event that the ECB did not consider as a systemic crisis. Therefore, the ECB seemed to apply less strict requirements to label an event as a systemic crisis compared to the criteria used in the LV list. GDP data was not available for all countries during the period 1970 - 2017, why the sample for the analysis was reduced to 16 countries in order to ensure a balanced panel. The analysed economies experienced a total of 27 systemic crises lasting on average 4.6 years. The crisis dates are listed with monthly data whereas the dataset used for this thesis deals with yearly data. Therefore, a country is considered to be in a crisis if it experienced 6 or more months of crisis in the respective year.

Three control variables were selected to account for influences on economic output other than systemic crises. In accordance with the expenditure approach of the GDP, the variables private household consumption, general government expenditure and domestic investment are included. The net exports are excluded as they showed no significant effect on GDP growth in the used dataset. All control variables are expressed as % of GDP and are obtained from the World Bank. More information on the data can be found in Appendix B.

4. Characteristics of Different Crisis Origins

The following section explains the characteristics of the different crisis types mentioned in the ECB database. A total of five non-exclusive categories exist in the ECB database to label

the risks that materialise during a crisis. These are: sovereign risk, banking risk, currency risk, significant asset price correction and transition. The last category will not be analysed further in this paper, as the circumstances in these events are caused by the fall of the Soviet Union and are thus considered to be rather unique and not relevant for macroprudential analysis.

Sovereign risk relates to situations when a government faces difficulties to obtain enough funding for due payments which can result in a sovereign default. Even though sovereign defaults nowadays are more associated with emerging markets, major European countries have a long history of external defaults. Prior to 1900 Spain defaulted no fewer than 13 times followed by France with a total of eight defaults (Reinhart and Rogoff, 2009), what shows that these rich countries went through similar difficulties in their emerging phase as countries do today. Although France and Spain were not in danger of a default recently, there is one famous case within the sample covered in this paper. Greece, who was struggling with the consequences of the U.S. subprime crisis, had to admit in October 2009 that it has been manipulating national accounting by understating deficit figures for years. This cumulated in the loss of confidence among international investors and the country was cut-off from borrowing at financial markets. In the spring of 2010 a default seemed unavoidable, which would have possibly triggered bigger financial turbulences than the collapse of Lehman Brothers did. Several last-minute interventions from the EU, eventually summing up to a total amount of over €240 billion, saved Greece from declaring bankruptcy (The New York Times, 2016).

Banking risk covers disruptions in the banking sector due to banks either declaring bankruptcy or having severe financing difficulties. The risk mainly arises from the leveraged position of financial institutions. Banks borrow from the public in form of short-term deposits that can be redeemed at any time while on the other side of the balance sheets loans are given out with a long-run repayment schedule. When the public for any reason loses confidence in the ability of the bank to repay its obligations, the people rush to the counters in order to get their money as they fear to be left out if the bank goes bankrupt. Because the majority of the

bank assets are in long-term securities, the bank even in the case of having enough funds is not able to meet the wishes of the panicking depositors and therefore has to declare bankruptcy. In the end the fear among the depositors results in a self-fulfilling prophecy. In September 2007 worried depositors formed long lines in front of the bank branches of Northern Rock, as they were not satisfied with the British government's partial insurance plan and wanted to empty their banking accounts (Reinhart and Rogoff, 2009). The troubles intensified and the British government had no other choice than to bail out the bank and completely back its liabilities. Although traditional bank runs do not happen often anymore due to deposit insurances, lost confidence in the banks ability to repay obligations is still an issue as the interbank lending dropped drastically during the global financial crisis. Other potential sources for banking risk are sharply falling asset prices or the default of an important debtor like a big company or an entire country.

The category *currency risk* is set up to capture events of speculators challenging the fixed exchange rate of a country in belief that the government lacks enough resources to back the peg. Krugman (2007) pointed out that currency crises usually have their origins in a governments disability to implement fiscal and monetary policies aligned with protecting the fixed exchange rate. This was one of the criticisms of the 1979 introduced Exchange Rate Mechanism (ERM) and partly caused the increasing attacks on the weak currencies within the ERM. On 16 September 1992, what was later named the events of the "Black Wednesday", the British government was forced to exit the ERM and give up the fixed exchange rate of the pound. One day later Italy followed by giving up the peg on the lira. The connected currency crisis is believed to have intensified the recession in both countries in the early 90s (Fratianni & Artis, 1996).

Crises categorized within *asset price correction* suffered under the sudden fall of prices in one asset class. Usually there was an external cause that had an impact on the domestic stock market. For instance, the burst of the dot-com bubble in 2001 caused the All Share Index in

Finland to decrease by over 70% within 2 years (ECB, 2017). Oil price shocks in the 70s and 80s are another example for asset price corrections.

5. Methodology

Following previous work in this field, a panel analysis will be conducted that tests contemporaneous output versus a crisis dummy that takes the value 0 or 1. A set of control variables influencing economic growth is included in order to single out the true effect of a systemic crisis and to mitigate the omitted variable bias of time variant effects. The specification of the empirical model for the panel analysis is,

$$y_{it} = \alpha_i + \beta C_{it} + \theta' X_{it} + \varepsilon_{i,t} \qquad (1)$$

where y_{it} is the annual growth of real GDP for country i in year t. Country-specific effects are captured in α_i. Economic growth can be influenced by weather conditions, like severe winters in Finland or dry summers in Spain. Influences like these, who are different from country to country, but do not change much over time, can be controlled with the country-specific effects. C_{it} is a dummy variable and indicates if country i was in a systemic crisis in year t. X_{it} represents the control variables described in section 3.

The decision to use a fixed effects model specification was made after a series of tests. First an F-Test confirmed that fixed effects can be found in the panel dataset and therefore a pooled OLS specification would be less accurate. The Breusch-Pagan LM test also confirmed the existence of heterogeneity in the considered data. As is common in panel analysis, a Hausman test was performed to choose between fixed and random effects. A p-value of <0.01 strongly suggests the use of a model with fixed effects. To check for non-constant variance in the country population, the modified Wald test for groupwise heteroskedasticity is performed which clearly indicates heteroskedastic disturbances. Furthermore, the Wooldridge test for autocorrelation revealed evidence for first-order autocorrelation in the data and the Breusch-Pagan LM test for independence pointed out the problem of cross-sectional dependence. Because the present data show evidence of heteroskedasticity, serial correlation and cross-sectional dependence,

Driscoll-Kraay standard errors were used to account for these features and therefore reduce the risk to obtain biased results. All variables used are (trend) stationary at a 10% significance level according to the Im–Pesaran–Shin unit root test who allows to deal with heterogenous and serial correlated data. The trend option was used for government consumption, as a time trend is visible when looking at the corresponding graphs of all countries. Further information on the model diagnostic tests can be found in Appendix B.

In a second step it will be evaluated if there are different effects by the various crisis types defined in the dataset. The marginal effect of a crisis type will be estimated by looking at all crises where the risk type materialised either alone or as part of a twin crisis, together with all the other crisis types. Equation 2 shows the altered specification

$$y_{i,t} = \alpha_i + \beta_1 C_{i,t}^B + \beta_2 C_{i,t}^B C_{i,t}^A + \beta_3 C_{i,t}^B C_{i,t}^C + \beta_4 C_{i,t}^B C_{i,t}^D + \beta_5 C_{i,t}^A + \beta_6 C_{i,t}^A C_{i,t}^C \quad (2)$$

$$+\beta_7 C_{i,t}^A C_{i,t}^D + \beta_8 C_{i,t}^C + \beta_9 C_{i,t}^C C_{i,t}^D + \beta_{10} C_{i,t}^D + \beta_{11} C_{i,t}^M + \theta' X_{it} + \varepsilon_{i,t}$$

where β_1 reflects the effect of a crisis where only banking risk materialised, β_2 to β_4 reflect the effects of a twin crises where banking risk (B) was one component together with either asset price correction (A), currency risk (C) or sovereign debt risk (D). β_{11} captures the effects of all multiple crises with 3 or more risk components. If β_3 turns out to be significant, the interpretation is that a banking-currency twin crisis has an additional amplifying effect, that is different from the effects of a sole banking crisis and currency crisis taken together. In this second part, data from both systemic crises and residual events were used, as a big majority of the systemic crises fall under the category of multiple crises. Therefore, an analysis only of the systemic crises would most likely not render any results regarding the different crisis origins.

6. Results

The baseline model shows that a systemic crisis has a highly significant negative effect on GDP. If a country suffered from a systemic crisis the GDP will be on average 1.8% lower in this year compared to the expected trend without any crises (Table 1 Column I). This has substantial consequences for a country since the considered crises in the dataset lasted on

average 4.6 years. A reduction of growth by 1.8% per crisis year usually has far-reaching consequences since crucial elements of the domestic economy can be affected by the crisis.

If the banking sector predominantly is affected by the crisis, the core intermediation function of the banks is disrupted as the financial institutions have to cut back in lending temporarily until calmer waters are reached. This specially harms households and small and medium enterprises as banks are usually the only source to obtain funding. Big corporations are more flexible due to the broader set of options like the issue of corporate bonds. Nevertheless, big firms obviously also suffer under the unfavourable macroeconomic conditions. When the crisis roots are found in sovereign debt and currency disruptions, one of the damage factors is the loss of international confidence. The access to external capital markets is denied and foreign investment drops drastically. Furthermore, external saviours like the IMF or the EU often force harsh restructuring plans upon the domestic economy resulting in a structural change that can cause decades of economic contraction until the remedies start to show benefits. Domestic savers see the real value of their savings decline, as they usually are not able to convert their funds fast enough before the currency devaluates. Another important consequence is the cost for future generations as they suffer under lower debt-to-GDP thresholds that trigger a sovereign debt crisis and also need to deal with long repayment schedules. For instance, Greece not only has to deal with rigid austerity measures but also will be repaying bailout loans up to the year of 2060 (Baynes, 2018). All these dynamics are potential factors that eventually lead to the observed drop of 1.8% in GDP growth connected to the occurrence of a systemic crisis.

When having a closer look at the control variables, it stands out that government consumption is significant at a 10% level but shows to have a negative effect on GDP, which is counterintuitive to economic theory. It usually is predicted that higher government consumption results in higher GDP. One possible explanation is that many countries covered in the dataset have extraordinarily high debt-to-GDP ratios and higher government consumption leads to a further deterioration of this figure. Caner, Grennes and Koehler-Geib (2010) showed

that above the threshold of 77% debt-to-GDP each additional percentage point has negative effects on economic growth. In the year 2011 more than half of the countries were above this threshold, which could contribute to explain the negative coefficient. The effect for private consumption is negative too, but at a lower significance level and with a smaller size. The reasons might be similar, as higher consumption results in less savings or higher private debt, which can have negative effects on growth.

Table 1. Financial Crises and GDP Growth

	(I)	(II)	(III)	(IV)[a]	(V)[b]	(VI)	(VII)
Systemic Crisis	-0.0177 (-4.30)***	-0.0164 (-3.98)***		-0.0118 (-2.60)**	-0.0240 (-5.48)***	-0.0225 (-5.50)***	-0.0206 (-5.60)***
Systemic Crisis + Residual Event			-0.0178 (-6.16)***				
Systemic Crisis T-1						0.0073 (1.67)	-0.0042 (-0.96)
Systemic Crisis T-2							0.0151 (3.48)***
Government Consumption	-0.0049 (-5.89)***	-0.0244 (-2.05)**	-0.0049 (-6.55)***	-0.0038 (-5.26)***	-0.0049 (-2.56)**	-0.0048 (-6.09)***	-0.0049 (-5.71)***
Domestic Investment	0.0006 (1.34)	0.0006 (1.17)	0.0007 (1.61)	0.0006 (1.95)*	0.0026 (4.43)***	0.0007 (1.60)	0.0009 (2.27)**
Household Consumption	-0.0007 (-2.04)**	-0.0019 (-1.69)*	-0.0006 (-1.67)	-0.0012 (-2.26)**	-0.0002 (-0.42)	-0.0006 (-1.94)*	-0.0005 (-1.39)
Imports		-0.0001 (-0.14)					
Exports		0.0001 (0.19)					
Consumption of Fixed Capital		-0.0013 (-1.40)					
Education Expenditure		0.0031 (1.43)					
Domestic Savings		-0.0189 (-1.65)					
N	752	752	752	576	638	752	736
within R^2	0.32	0.34	0.35	0.23	0.32	0.33	0.34

Note: Driscoll-Kraay standard errors in brackets; * p < 0.1, ** p < 0.05, *** p < 0.01. Sample: 1970 – 2017, 16 Countries. (IV)[a]: 1970 – 2006, 16 Countries. (IV)[b]: 1995 – 2017, 29 Countries. All regressions include country fixed effects.

6.1 Robustness Checks

The core model showed a negative effect of a systemic crisis on GDP growth. To examine the robustness of the results, several checks have been carried out. First, to control for different influences on growth and a potential variable omission bias, the set of control variables is enlarged. Total imports and exports are included, as different trade conditions influence the economic output. Consumption of fixed capital (depreciation) and education expenditure are used as an attempt to capture changes in capital and labour force, the two essential components of production. Domestic savings is connected to economic growth, as it enables higher levels of investment. None of these added control variables prove to be significant in our model specification (Table 1 Column II). The negative effect of the systemic crisis remains highly significant and of similar size. The second robustness check tests whether a different definition of a financial crisis alters the impact on growth. The ECB crisis database also lists residual events. These are periods when a country faced extensive troubles on the financial markets, but which were not severe enough to be flagged as a systemic crisis by the National Authorities. The coefficient of the crisis dummy in column III of Table 1 including all systemic crises and residual events is of the same significance and size compared to the one from the baseline model. Therefore, the result holds robust when the criteria for a crisis are broadened. On a side note, it is interesting to state that in a separate regression with residual events taken alone, the effect is negative and significant at a 1% level as well. But as expected, the effect of a residual event is smaller, as growth only decreases by 1.3% on average compared to the 1.8% decrease for a systemic crisis (Appendix B). The Global Financial Crisis (GFC) starting in 2007 proved to be extraordinarily intense and disturbed the financial markets to a considerable larger extent than the previous crises in the dataset. To ensure that the results are not solely based on this incident, the sample period was changed to 1970 – 2006. When the GFC is excluded, systemic crises still have a negative impact on economies (Table 1 Column IV). However, the coefficient is of smaller size and less significant (only at a 5% level instead of 1%), which could be

expected taking into account the vast size of the GFC. In order to keep a balanced panel model specification, 13 countries from the ECB crises database were initially excluded in the baseline model as they lacked GDP data for the considered time period. For all EU countries and Norway GDP data exists from 1995 to 2017. This period is analysed in the last robustness check where it is tested if the results hold when the number of countries is extended to 29. GDP growth is again negatively influenced by systemic crises. The effect is of same significance and larger size compared to the initial model (Table 1 Column V). All EU countries and Norway experienced on average a 2.4% lower growth rate if the country experienced a systemic crisis in a specific year. The GFC can only partly explain the bigger size of the coefficient. When a regression is run on all 29 countries over the period 1995 – 2006, the effect of the crisis dummy is still at 2.2% (Appendix B). One possible explanation can be found in the information that the majority of the added countries were only recently founded as a result of the fall of the iron curtain. These young states might have been more fragile and vulnerable to disturbances in financial markets and suffered more under systemic crises than the older nations in the core model.

The results from the baseline model proved robust against alterations in the explanatory variables, the crisis definition, the time span and the sample of countries. It can be concluded that the negative effect of a systemic crisis is highly robust. The coefficients range from 1.2% to 2.4% of GDP growth loss in the different model specifications. The results indicate that systemic financial disturbances eliminate more than half of the expected growth since the average growth rate in our 1970 – 2017 sample was 2.4%. Regarding that countries usually stay multiple years in a crisis it becomes evident that the whole economy suffers substantially. How a country recovers once the crisis has ended will be covered in the next section.

7. Impact of Different Crisis Types

It is of interest to examine whether the listed crisis types in the ECB database differ in their effects on GDP growth, as this offers a more in-depth insight to the dynamics of crises.

Through altering the model specification, explained in detail in section 5, the effect of different crisis origins is estimated. The risk categories are non-exclusive meaning that a systemic crisis can have multiple origins. For the present analysis, all crises with three or more materialised risk factors were taken together in the dummy multiple crisis. Twin crisis are events with exactly two causes and single crisis were labelled with only one risk category. The vast majority of the systemic crises in the ECB database fall under the criteria of multiple crisis, what makes it harder to single out the effects of certain risk categories. Therefore, the residual events were included as well in the following regressions. Table 2 Column I lists the coefficients for the regression with all possible crisis combinations together with the usual set of control variables. In our core sample, consisting of data from 16 countries for 1970 – 2017, there were no twin crises with the specification sovereign-asset and sovereign-banking and no single sovereign crisis. Except for the currency-banking twin crisis, all coefficients have a significant negative effect on growth. The coefficient for Twin Crisis Currency-Asset shows the marginal effect of this particular crisis type taking into account the effects of the single crises of the two types. The corresponding interpretation is that a twin crisis, which suffers under currency risk and asset price correction risk at the same time, is worse than the impacts of two single crises in currency and asset price correction taken together. Therefore, amplifying dynamics must take place when a country is in a twin crisis which go beyond the pure effects of the risk factors when they occur alone. The crisis where currency and sovereign risk are materialised at the same time seems to have the largest negative impact on GDP growth with a reduction of 2.7% on average compared to 1.5% for a Currency-Asset Twin Crisis and 2.0% for a Banking-Asset Crisis. Incidents where countries have to deal with both aggressive speculators in the foreign exchange markets and losing confidence among international investors seem to specially impede economic growth. A suitable explanation is that lenders are even more cautious when they observe an ongoing struggle to maintain a fixed exchange rate and vice-versa the

speculators smell more blood when the country is forced to pay higher and higher interests to roll-over its debt which results in a vicious cycle.

A further result is that multiple crises have a marginal effect over twin and single crises. The financial distress in the multiple areas seem to intensify each other when they happen simultaneously and therefore creating a marginal effect worse than if the risk factors materialised as part of a twin or single crisis. One possible chain of events is that a sudden price fall in one asset category causes troubles among banks with high exposure in this category. The government is forced to bail out these banks, resulting in higher debt. Investors start to question the ability of the government to repay its high debt level and start to charge higher risk premia, increasing the vulnerability of the country and facilitating speculative attacks on the currency peg. The interconnectedness in the banking sector as well as the access to bailout programmes by the government and existing vulnerabilities due to high levels of debt-to-GDP create a fertile soil for multiple crisis to unfold with severe consequences for economies.

To analyse if the results are robust to changes in the model parameters, the same robustness checks as in section 6.1 have been carried out. A bigger set of explanatory variables does not change the observed effects. Excluding the financial crisis from the sample does not change the marginal effects of Twin and Single Crises but lowers the impact of multiple crises on growth, which is to be expected since GFC appears as a specially negative event with numerous risk factors materialised. Nevertheless, multiple crises still have a significant marginal negative impact on growth, which shows that the effect was not solely based on GFC. Lastly the analysis of the shorter time period from 1995 – 2017, but with all EU countries plus Norway renders different results. Fewer events of Twin and Single Crises happened as can be seen by the many categories with 0 observations. Nevertheless, the significant marginal effects of the observed crisis types could be confirmed with one exception for single banking crisis. In general, the results are highly robust as they were confirmed in all different scenarios.

Table 2. Different Crisis Types and GDP Growth

	(I)	(II)	(III)	(IV)
Twin Crisis Currency-Sovereign	-0.0268 (-2.43)**	-0.0241 (-1.93)*	-0.0248 (-2.23)**	0 *omitted*
Twin Crisis Currency-Asset	-0.0151 (-3.48)***	-0.0167 (-3.31)***	-0.0140 (-3.75)***	-0.0550 (-2.20)**
Twin Crisis Currency-Banking	-0.130 (-1.20)			0 *omitted*
Twin Crisis Sovereign-Asset	0 *omitted*			0 *omitted*
Twin-Crisis Sovereign-Banking	0 *omitted*			0 *omitted*
Twin Crisis Banking-Asset	-0.0197 (-3.44)***	-0.0183 (-3.10)***	-0.0212 (-5.59)***	-0.0251 (-2.14)**
Single Crisis Currency	-0.0143 (-3.15)***	-0.0150 (-2.82)***	-0.0144 (-3.04)***	0 *omitted*
Single Crisis Asset	-0.0170 (-3.58)***	-0.0166 (-3.48)***	-0.0130 (-4.08)***	-0.0206 (-2.74)**
Single Crisis Banking	-0.0123 (-2.84)***	-0.0149 (-2.96)***	-0.0159 (-4.74)***	-0.0154 (-0.83)
Single Crisis Sovereign	0 *omitted*			0 *omitted*
Multiple Crisis 3+ Origins and Transition	-0.0170 (-2.93)***	-0.0159 (-2.72)***	-0.0085 (-2.02)*	-0.0297 (-7.10)***
N	752	752	576	638
within R^2	0.36	0.37	0.27	0.35

Note: Driscoll-Kraay standard errors in brackets; * p < 0.1, ** p < 0.05, *** p < 0.01. Control variables included but not listed. Sample: 1970 – 2016, 16 Countries. (II): bigger set of control variables included. (III): 1970 – 2006, 16 countries. (IV): 1995 – 2017, 29 Countries. All regressions include country fixed effects. Sovereign = Sovereign Debt Risk. Asset = Asset Price Correction Risk.

8. Impulse Response Function

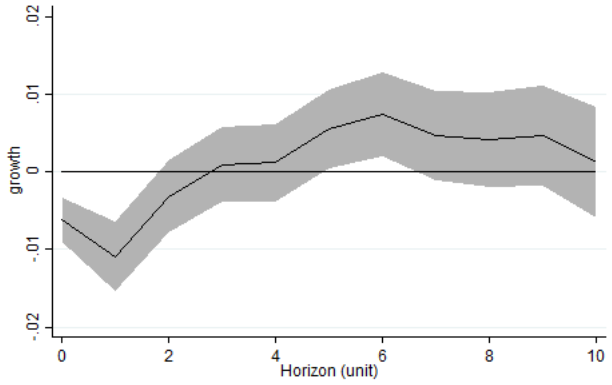
After a crisis has ended the system does not switch back to normal mode immediately. There are medium-term effects and the impact of a crisis is believed to persist for some time after the crisis ends. Confidence in the stability of the financial sector or the government's budget planning takes time. Also, companies hit by the crisis might need to restructure and thus will not perform at full strength right after the crisis. This section attempts to estimate the recovery time of a country. A first approach is to simply add lagged crisis dummies in the baseline model specification explained in section 5. As visible in Table 1 Column VI, an additional crisis dummy was included, indicating whether there is an effect on growth if the

country was in a crisis in the previous year. There is no statistical evidence that this is the case, as the coefficient is insignificant. However, it is remarkable to point out that a crisis dummy, indicating that a country was in a crisis two years ago, has a highly significant positive effect on growth (Table 1 Column VII). On average a country has a higher than normal GDP growth if two years ago it was caught up in a systemic crisis. The conclusion can be drawn that two years after the crisis ended, the economy seems to perform at pre-crisis level or even above, what may be explained by crisis management programmes and government interventions that now start to be fully effective.

To gain a more profound understanding of the dynamics after a crisis has ended, an impulse response function (IRF) is computed using the Local Projection Method proposed by Jordá (2005). The method is robust to misspecifications as the estimation of the IRF works without a specification of the underlying multivariate model. The core concept is to estimate local projections at each period and not extrapolate into the far future from a given model, as is done with IRFs obtained from vector autoregressions (VAR). The cost for this advantage is a lower efficiency of Jordà's IRF estimates as shown by Teulings and Zubanov (2014). For the analysis in this paper the previously used set of three control variables is incorporated and robust standard errors are used for the IRF to account for heteroskedasticity in the dataset. The IRF suggests that the shock in the crisis dummy has an immediate negative effect on GDP growth. In the year one after the crisis has ended the negative impact persists and reduces the normal growth trend by around 1%. Two years after the crisis the effect has vanished and is now insignificant, indicating that the economy of the country has recovered and is back on its normal growth path. The IRF can not confirm the above average performance after two years found when using the lagged crisis variable. After six years there is a slight positive significant effect, but it is questionable if this is a consequence of the crisis event as many other factors could be responsible for the effect. The result of an average recovery time of two years is robust in the IRF as well as in the analysis with the lagged crisis variable. It can be concluded that a

rather long time of 12 months pass until the economic engine of a country is at normal speed again. A country suffers substantially under a systemic crisis as the recovery time together with the average duration of a crisis sum up to more than half a decade of negative impact on GDP growth.

Figure 1. The Response of GDP Growth to a Crisis



Note: IRF from Local Projection Method, response of GDP growth to shock in systemic crisis dummy. Black line represents the estimate, grey-shaded area is 95% confidence interval using robust standard errors.

9. Conclusion and Future Research Suggestions

The memorable images of long queues in front of British banks or Greek workers burning down cars in outrage are not an exception. Analysing systemic crises among European countries during almost 50 years reveals that financial crises have severe consequences for the average citizen in the involved economies. A systemic crisis is connected to a growth decline of 1.8% for each year that a country is caught up in the crisis. The impact proved to be robust even when tested against a large set of control variables or different time frames. Previous research has reported similar findings and a negative relation between crises and economic output is undisputed. However, the reported size of the effect varies widely among different studies. The here presented result is positioned on the lower end of the range of estimates. For comparison Furceri and Zdzienicka (2011) reported that a debt crisis reduces output by around 6% per year. The authors analysed a similar time span but included many more countries with a total of 154 observed economies. A large share of them are low developed countries or in the phase of

emerging towards an advanced economy. Emerging markets being more vulnerable to external shocks is thus a reasonable explanation for the large difference. Furthermore, the study worked with the crisis definition of Laeven and Valencia who use a stricter definition for a crisis as shown in section 3. This might influence the results as well but to a rather small extend as the databases only differ slightly. A future research recommendation is to extend the presented analysis in this paper to a broader set of countries including developing states as at the moment only advanced countries are represented in the dataset used. This step would involve expanding the ECB database to more countries.

Every crisis on its own has its special dynamics but there are repeating patterns which can be categorized. The four main sources for crises were explained in section 4 and formed part of a more detailed analysis of the impact on GDP of different crisis types. The Twin crises Currency-Sovereign Debt, Currency-Asset Price Correction and Banking-Asset Price Correction all showed to have a large significant negative impact on GDP growth. The panel analysis showed that the interplay of both crises harms a country more than the case of just suffering under the two components separately, which is a pure theoretical consideration. Multiple crises where three or more risk factors materialised also prove to be especially harmful for a country as the disruptions in one sector probably intensify the troubles in other areas. A suggestion for further research is to closely analyse the channels through which the different risk factors interact with each other and how such amplifying dynamics are created, in order to find ways to mitigate the negative impacts of complex crises.

After a crisis has ended usually the confidence in the financial sector or the trustworthiness of a government is shaken up. The involved actors often need to restructure as sometimes whole departments of their business collapsed during the crisis. All this causes a certain recovery time until the country's economy is back on track and can pick up the pre-crisis trend growth. Both the analysis of a lagged crisis variable as well as the response function of growth to a shock in the crisis variable indicate that the recovery time for a country is on average two years.

To conclude, this thesis presented evidence to confirm the hypothesis that systemic crises are harmful for economic output and delivered an estimate for the negative effect. Additionally, a highly significant marginal negative impact of Twin crises and complex crises is reported. The existence of a post-crisis recovery time could be confirmed with an estimated length of two years.

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Appendix B

Table 3. Data Description

Variable	Source	Description
Systemic Crises	ECB/ESRB EU crises database	Database for financial crises in European countries.
GDP	World Bank Constant 2010 US$	GDP at purchaser's prices is the sum of gross value added by all resident producers in the economy plus any product taxes and minus any subsidies not included in the value of the products..
Government Consumption	World Bank % of GDP	General government final consumption expenditure includes all government current expenditures for purchases of goods and services. It also includes most expenditures on national defense and security, but excludes government military expenditures that are part of government capital formation.
Domestic Investment	World Bank % of GDP	Gross capital formation (formerly gross domestic investment) consists of outlays on additions to the fixed assets of the economy plus net changes in the level of inventories.
Household Consumption	World Bank % of GDP	Household final consumption expenditure (formerly private consumption) is the market value of all goods and services, including durable products (such as cars, washing machines, and home computers), purchased by households.
Imports	World Bank % of GDP	Imports of goods and services represent the value of all goods and other market services received from the rest of the world.
Exports	World Bank % of GDP	Exports of goods and services represent the value of all goods and other market services provided to the rest of the world.
Consumption of Fixed Capital	World Bank % of GNI	Consumption of fixed capital represents the replacement value of capital used up in the process of production.
Education Expenditure	World Bank % of GNI	Education expenditure refers to the current operating expenditures in education, including wages and salaries and excluding capital investments in buildings and equipment.
Domestic Savings	World Bank % of GDP	Gross domestic savings are calculated as GDP less final consumption expenditure (total consumption).

Table 4. Diagnostic Tests

Diagnositc Tests mentioned in section 4 *Methodology*

Test	Test Statistic	p-value
F test that all u_i = 0	F(15,727) = 4.35	0.0000
Breusch and Pagan Lagrangian multiplier test for random effects	$\bar{\chi}_1^2$ = 17.23	0.0000
Hausman Test	χ_9^2 = 33.26	0.0001
Modified Wald test for groupwise heteroskedasticity	χ_{16}^2 = 187.86	0.0000
Wooldridge test for autocorrelation in panel data	F(1,15) = 71.322	0.0000
Breusch-Pagan LM test of cross sectional independence	χ_{120}^2 = 926.786	0.0000
Im-Pesaran-Shin unit-root test for GDP	$\bar{t}$ = -11.4056	0.0000
Im-Pesaran-Shin unit-root test for Systemic Crisis	$\bar{t}$ = -4.9751	0.0000
Im-Pesaran-Shin unit-root test for Government Consumption (Time trend included)	$\bar{t}$ = -1.4085	0.0795
Im-Pesaran-Shin unit-root test for Domestic Investment	$\bar{t}$ = -3.6772	0.0001
Im-Pesaran-Shin unit-root test for Household Consumption	$\bar{t}$ = -1.6307	0.0515

Table 5. Additional Regressions

	(I)	(II)
Residual Event	-0.0126 (-5.67)***	
Systemic Crisis		-0.0225 (-3.78)***
Government Consumption	-0.0050 (-5.76)***	-0.0028 (-1.48)*
Domestic Investment	0.0012 (2.57)**	0.0021 (4.90)***
Household Consumption	-0.0005 (-1.18)	0.000 (0.04)
N	752	319
within R^2	0.29	0.25

Note: Driscoll-Kraay standard errors in brackets; * p < 0.1, ** p < 0.05, *** p < 0.01. (I): 1970 – 2017, 16 Countries. (II): 1995 – 2006, 29 Countries. All regressions include country fixed effects.