The Consequences of Banking Crises for Public Debt

Abstract

The aim of this paper is to assess the consequences of banking crises for public debt. Using an unbalanced panel of 154 countries from 1980 to 2006, the paper shows that banking crises are associated with a significant and long-lasting increase in government debt. The effect is a function of the severity of the crisis. In particular, for severe crises, comparable to the most recent one in terms of output losses, banking crises are followed by a medium-term increase of about 37 percentage points in the government gross debt-to-GDP ratio. In addition, the debt ratio increased more in countries with higher initial gross debt-to-GDP ratio, with a higher share of foreign debt, and with a lower quality of institutions (in terms of political stability and democracy). The increase in government debt is also a function of the size of the fiscal stimulus to counter the economic downturns and varies with the type of banking intervention policy used.

Keywords: Public Debt, Financial Crises.

JEL: G1, E6

1. Introduction

Financial crises are not only typically associated with sharp economic downturns[1] but also with a substantial deterioration of fiscal positions. Declining revenues due to weaker economic conditions, higher expenditures associated with bailout costs and demand stimuli have historically led to a rapid deterioration of fiscal balances and increase of public debt.[2]

Analyzing a panel of developed and developing economies, Reinhart and Rogoff (2009) estimate that in the 3 years after the occurrence of a banking crisis the real value of government debt rose on average by 86 *percent*. However, arguably measuring the change in debt this way can be misleading because it depends on the initial level of debt. Alternatively, if the rise in debt is measured in terms of the change in the ratio of debt to GDP the figures becomes considerably smaller; using similar episodes to those chosen by Reinhart and Rogoff (2009), but focusing on the *percentage point* increase of the debt-to-GDP ratio, the historical average cumulative increase in the debt-GDP ratio 3 years after the occurrence of banking crises is about 9 *percentage points* of GDP (Figure 1). The effect varies considerably across the episodes presented in the figure, ranging from an almost insignificant increase in the case of Thailand in 1997 to an increase of more than 35 percentage points for Finland in 1991. In addition, countries differ not only in terms of the magnitude of the impact in the 3 years following the crisis, but also in terms of the dynamic of the response and in terms of medium-term effects. For example, three years after financial crises in Japan and Finland the effect on debt is very similar, however the medium-term evolution beyond three- years is very different (Figure 2).

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[1] See, for example, Aziz et al. (2000), Barro (2001), Hutchinson and Ilan (2005), Boyd et al. (2005), Cerra and Saxena (2008), Furceri and Mourougane (2009a,b) Furceri and Zdzienicka (2010a,b).

[2] See, for example, Caprio and Klingebiel (1997), Honohan and Klingebiel (2000), Laeven and Valencia (2008), Reinhart and Rogoff (2008), Furceri and Mourougane (2009a), OECD (2009).

The current financial crisis is exceptional not only for its severity and its synchronicity across countries, but also for the policy response: monetary policy rates have been slashed, central bank balance sheets expanded, and most governments have taken expansive fiscal measures to counter the economic downturn. For many countries debt levels are projected to increase substantially. For example, in OECD countries gross government debt-to-GDP ratios are projected to increase by more than 20 percentage points by 2011 (Figure 3), and in some cases (Iceland, Ireland, Japan, and the United Kingdom) by more than 30 percentage points (OECD, 2010). Focusing on a longer time horizon, debt levels are projected to increase even more (OECD, 2010). Based on the assumption that consolidation measures are only gradual but sufficient to stabilize the government debt-to-GDP over the long-term, debt-GDP ratios may still increase by about 30 percentage points by 2025 compared to pre-crisis levels, with the largest increase being projected for Ireland (about 100 percentage points) and the United Kingdom (about 80 percentage points).[3]

In the context of the aftermath of the recent financial crisis this paper considers past historical episodes to examine what has happened to public debt over the medium and long-term. The paper provides estimates of the dynamic impact that banking crises episodes have typically had on the gross debt-to-GDP ratio, and of the role that structural and policy variables have had in shaping this response. The analysis complements previous work analyzing the fiscal costs associated with banking crises in several respects by:

- Focusing on gross public debt as a dependent variable. Several papers in the literature have instead focused on trying to estimate only the bailout costs

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[3] In particular, it is assumed that the underlying primary fiscal balance improves by ½ per cent of GDP until it is sufficient to ensure that the debt-to-GDP ratio is stable. See Chapter 4 of the the OECD Economic Outlook 87 (2010) for more details.

associated with banking crises.[4] However, there are two main problems with this approach. First, estimates of fiscal bailouts depend markedly on the methodology used. As a result, the difference in the estimates across studies focusing on the same episodes is large (Frydl, 1999 and Vale, 2006). Second, bailout costs are only a part of the fiscal cost associated with banking crises. In fact, the fiscal consequences of banking crises also result from the reduced revenues associated with output losses, the increase in spending due to automatic stabilizers and from discretionary increases in the public deficit.

▪ The focus is on the debt-to-GDP ratio rather than the percentage change in debt levels. This is important for two reasons. First, the debt-to-GDP ratio is a better measure to assess fiscal sustainability. Second, analyzing the *percent* increase of debt levels in the aftermath of banking crises could lead to possible mis-interpretations since the *percent* increase crucially depends on the initial level of the debt before the occurrence of the crisis. For example, consider two crises episodes: Sweden (1991) and Colombia (1998). Following Reinhart and Rogoff (2009) the cumulative increase in the gross public debt in the three years following the banking crisis in Colombia implies that public debt increased by about 175 *percent* while in Sweden it increased by about 60 *percent*. However, when the *percentage point* increase in the debt-to-GDP ratio is considered, as in Figure 1 the result leads to a spectacular reversal of this ranking: fiscal positions deteriorated significantly more in Sweden (27 *percentage points* of GDP) than in Colombia (13 *percentage points* of GDP).

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[4] See, among others, Caprio et al. (2005), and Sanhueza (2001).

- Presenting *inferential* empirical evidence on the increase of the debt-to-GDP ratio in the aftermath of banking crises. The only work, to our knowledge, that tries to assess the increase in public debt (not as ratio to GDP, as discussed previously) is Reinhart and Rogoff (2009). However, in their paper, the authors present only *descriptive* evidence of the increase in the gross government debt 3 years after the occurrence of banking crises, without controlling for countries' characteristics and other factors that could explain the increase in public debt in the short term and different responses across countries.

- Estimating the effect of banking crises on the debt-to-GDP ratio both in the short and in the long-run,[5] to assess whether fiscal costs associated with crises have been permanent or if they have tended to dissipate in the long-run.

- Analyzing the heterogeneity of responses among different countries by assessing the role of countries structural and policy variables.

- Analyzing the heterogeneity of responses across episodes.

Using an unbalanced panel of 154 countries from 1970 to 2006, the main finding of the paper is that banking crises are associated with a significant and long-lasting increase in the government debt-to-GDP ratio. The magnitude of the effect is a function of the severity of the crisis. In particular, we find that for severe crises, comparable to the most recent one in terms of output loss, banking crises are on average followed by a medium-term increase of about 37 percentage points in the government gross debt-to-GDP ratio. In addition, the debt ratio increased more in countries with higher initial gross debt-to-GDP ratio, with a higher share of foreign debt, and with a lower quality of institutions (in terms of political stability and

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[5] Previous works generally focus on a time horizon of 3 years.

democracy). The increase in government debt is also a function of the size of the fiscal stimulus to counter the economic downturns and varies with the type of banking intervention policy used.

The rest of the paper is organized as follows. The next section describes the data and the empirical methodology used to examine the effects of a financial crisis on debt. Section three describes the results. Finally, section four concludes with the main findings.

2. Empirical Methodology

In order to estimate the dynamic impact of banking crises episodes on the debt-to-GDP ratio the paper follows the approach proposed by Jorda (2005) and Teulings and Zubanov (2009) which consists of estimating impulse response functions (IRFs) directly from local projections. In detail, for each future period k the following equation has been estimated on annual data:

$$b_{i,t+k} - b_{i,t} = \alpha_i^k + \sum_{j=1}^{l} \gamma_j^k \Delta b_{i,t-j} + \beta_k D_{i,t} + \varepsilon_{i,t}^k \tag{1}$$

with $k=1,..8$. Where b indicates the government gross debt-to-GDP ratio, D is a dummy that takes the value equal to 1 in correspondence of the occurrence of a banking crisis, α_i represent country fixed effects, γ_j captures the persistence in changes of the debt ratio, and β_k measures the impact of banking crises on the change of the debt ratio for each future period k. The number of lags (l) has been tested, and the results suggest that inclusion of two lags produce the best specification.[6] Correction for heteroskedasticity, when appropriate, are applied using White robust standard errors, while the problem of autocorrelation in the errors is solved using the two

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[6] The results are extremely robust to the number of lags included in the specification.

lags of the increase in the public debt-to GDP ratio as control variables.[7]   Impulse response

functions (IRFs) are then obtained by plotting the estimated coefficients β_k for $k= 1,..8$.

An alternative way of estimating the dynamic impact of banking crises on output is to

estimate an ARDL equation of debt-to-GDP ratio and crises dummies and to compute IRFs from

the estimated coefficients.[8] However, the IRFs derived using this approach are sensitive to the

choice of the number of lags, and the inclusion of interaction terms in the equation often leads to

problem of multicollinearity, thus making the IRFs unstable. In addition, the significance of

long–lasting effects on the debt ratio with ARDL models can be simply driven by the use of *one-

type-of- shock* models (Cai and Den Haan, 2009).

In contrast, the approach used in this paper does not suffer from these problems because

the lags of the change in the debt ratio enter only as control variables and are not used to derive

the IRFs, and since the structure of the equation do not impose permanent effects. Finally, the

confidence bands associated with the estimated IRFs are easily computed using the standard

deviations of the estimated coefficients β_k, and Monte-Carlo simulations are not required.

To assess the impact of structural and policy variables on shaping the effect of banking

crises on the government debt-to GDP ratio, equation (1) is augmented by including these

variables as control and as interaction term with the crises dummy. In detail, the following

equation has been estimated:

$$b_{i,t+k} - b_{i,t} = \alpha_i^k + \sum_{j=1}^{l} \gamma_j^k \, by_{i,t-j} + \beta_k D_{i,t} + \vartheta^k X_{i,t} + \delta^k (X_{i,t} - \bar{X}) D_{i,t} + \varepsilon_{i,t}^k \qquad (2)$$

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[7] Tests for autocorrelation of the residuals have been carried out and have rejected the hypothesis of serial correlation.
[8] This approach was initially proposed by Romer and Romer (1989) and then recently applied by Cerra and Saxena (2008), Furceri and Mourougane (2009) and Furceri and Zdzienicka (2011b) to assess the impact of financial crises on economic activity.

where *X is* a set of structural and policy including: i) Country size (both in terms of population and GDP), ii) Trade openness (measured as the share of total exports and imports over GDP); iii) Real GDP per capita in PPPs; iv) Initial Debt-to-GDP ratio; v) Initial Foreign Debt-to-GDP ratio vi) Quality of institutions (in terms of political stability and democracy); vii) A measure of discretionary fiscal policy.

The interaction terms $(X_{i,t} - \bar{X})D_{i,t}$ are centered to the (over-time and cross-country) mean to make easier the interpretation of unconditional effects. Based on equation (2), for each period *k,* the impact of banking crises on the debt-to-GDP ratio is measured by: $\beta_k + \delta^k(X_{i,t} - \bar{X})$. This implies that, assuming $\beta_k > 0$, the effect in absolute value increases with δ^k.

Data for the real gross debt-to-GDP ratio are taken from the IMF World Economic Outlook (2009). Data for the share of gross foreign public debt over total public debt are taken from Panizza (2008), where public foreign debt is defined as debt issued in foreign countries and under the jurisdiction of a foreign court. Data for banking crises episodes are taken from Laeven and Valencia (2008a). In their paper the authors provide detailed information on the starting date of several banking, currency and debt crises. The dataset is constructed by combining quantitative indicators measuring banking sector distress, such as a sharp increase in non-performing loans and bank runs, with a subjective assessment of the situation. In particular, the database extends and builds on the Caprio, et al. (2005) banking crisis and covers 124 episodes of systemic banking crises over the period 1970-2007. Data for crises response strategies is based on the database built by Laeven and Valencia (2008b). The database documents many features of banking crises episodes from 1980 to present, including details on the resolution policy interventions put in place to attenuate the distress of the banking sector. Data for

institutional quality are taken from Kauffman et al. (2007) and the Polity IV database. All the other data are taken from the IMF International Financial Statistics and authors calculation.[9]

3. Results

3.1 Baseline

The results from estimating the impact of banking crises on the gross government debt-to-GDP ratio using equation (1) imply a significant and long-lasting increase in public debt (Figure 5).[10] In particular, banking crises have typically increased the government gross debt-to-GDP ratio by about 12 percentage points in the very short term (1 year after the occurrence of the crisis), and by about 10 percentage points in the medium term (8 years after). In addition, the largest increase in the debt ratio (17 percentage points) has typically occurred around 3 years following the occurrence of a banking crisis.

To check the robustness of the results, equation (1) is re-estimated by alternatively including 1) time fixed effects, 2) a common time trend, 3) a country-specific time trend. Time fixed effects are included to control for specific time shocks, such as those affecting world interest rates. Time trend is used to control for common trends in the developments of debt-to-GDP ratios. Finally, a country-specific time trend is included to allow trends in the debt-to-GDP ratio to differ across countries. The results using these different controls remain statistically significant and broadly unchanged (Figure 6a-6c).

Finally as additional robustness test we restrict our estimation sample to those countries for which data for $b_{i,t+k}$ are available for each period k. The reason to do so is to control for a possible composition bias deriving from estimating $b_{i,t+k}$ over an unbalanced set of countries.

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[9] See Tables A1 and A2 for a detailed description of crises episodes.
[10] See Table A3 for more detailed information regarding the estimated parameters in equation (1).

The results for the restricted sample (displayed in Figure 6d) suggest that while the short and the medium term are the almost identical to those estimated for the baseline sample, the dynamic of the response changes slightly.

Severity of the crises

The results presented so far have shown that on *average* banking crises have had significant and persistent effects on the government debt-to-GDP ratio. However, it is reasonable to think that fiscal policy responses, both in terms of size of fiscal stimulus packages to counter the crisis and in terms of the increase in the deficit due to automatic stabilizers, may be a function of the output losses and therefore vary with the severity of the crisis. This would imply that our estimates tend to overestimate the impact on government debt for "moderate" banking crises and to under estimate the impact for "severe" crises.

To test for this hypothesis equation (1) is re-estimated distinguishing between "severe" and other crises, where severity is judged according to output loss. Specifically the cumulative output loss is computed as the deviation of the annual growth rate from the average trend and if this exceeds 4% the crisis is considered to be severe.[11] The results suggest a clear distinction between moderate and severe crises on the debt-to-GDP ratio (Figure 7), both in the short and in the medium term. In particular, for moderate crises (Panel A) the maximum effect is about 15 percentage points after 4 years and it becomes insignificant in the medium term (after 8 years). For severe crises (Panel B-C), the peak effect is about 50 percentage points (three times bigger than the average effect presented in the baseline scenario) and the medium-term effect (eight years after) is about 37 percentage points.

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[11] Output losses are computed as the deviation of the annual growth rate compared to the trend (approximated by the average of annual growth rates over time). The results are qualitatively unchanged for reasonable changes in the threshold value.

The results for severe crises are in line with the recent IMF World Economic Outlook (2010) and OECD Economic Outlook (2010) medium term projections for the debt-to-GDP ratio following the most recent financial crisis. In particular, according to the IMF (2010), the average gross general government debt-to-GDP ratio for the G-20 advanced economies is projected to rise by 37 percentage points from pre-crisis levels. According to the OECD Economic Outlook (2010) the increase in the gross debt-to-GDP ratio for OECD economies during the period 2007-2014 is estimated to be around 35 percentage points.

3.2 Structural and policy variables

Subsequently, the paper assesses whether the effect of banking crisis on public debt depends on countries' structural and policy variables: size, openness and economic development, the initial level of debt, the share of foreign debt, discretionary deficits and banking intervention policies.

Size, openness and economic development

Since the impact of crises is generally more important in smaller, more open and less developed economies (Cerra and Saxena, 2008; Cerra et al., 2009; Furceri and Zdzienicka, 2011), it is reasonable to think that following banking crises the debt-to-GDP may have increase more in those countries.

To test whether openness (in terms of the share of exporters and imports over GDP), country size (in terms of population and real GDP) and economic development (in terms of real GDP per capita in PPPs) affect the response of the debt-to-GDP ratio to banking crises, equation (2) is re-estimated using these variables as control and interaction term with the banking crises dummy. The results tend to suggest that the effect of these variables is insignificant, with the

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exception of economic size in the very short term (Figure 8). Figure 8 presents the average response and the responses obtained considering the first and third quartile of the distribution of the GDP. In order to highlight the significance of the results, the dotted lines for the first and third quartile differ from the average response only when the interaction term is found to be statistically significant.[12] Looking at the figure, it emerges that the short term increase in the debt-to-GDP ratio is larger in smaller economy, which tend to be less resilient to shocks. However, the effect in the medium term is estimated to be not statistically different between larger and smaller economies.

The level of development seems to not directly affect the response of public debt to banking crises. Alternatively, to test whether the effect is similar between advanced and less developed economies, equation (1) is augmented by including a dummy for OECD countries as a control and as interaction term with the crisis dummy, as follows:

$$b_{i,t+k} - b_{i,t} = \alpha_i^k + \sum_{j=1}^{l} \gamma_j^k \, by_{i,t-j} + \beta_k D_{i,t} + \vartheta^k OECD_{i,t} + \delta^k OECD_{it} D_{i,t} + \varepsilon_{i,t}^k \qquad (2)$$

The coefficient associated with the interaction term is statistically significant, suggesting that the effect of banking crises on public debt is not statistically difference between the two groups of countries. The unconditional effect is still positive, statistically significant and of the same order of magnitude as the one estimated in the baseline specification (Table A4).

Quality of institutions

The literature on fiscal policy has generally pointed out that one key factor in explaining differences across countries in the conduct of fiscal policy is the quality of political institutions. The results suggest that countries characterized by a lower quality of institutions generally tend

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[12] See Table A4 for detailed information regarding the significant of the average (unconditional) effects.

to be characterized by worse fiscal outcomes both in terms of debt levels, government size, spending volatility, and cyclicality of fiscal deficits.[13] To test whether the response of public debt to banking crises is affected by the quality of institutions equation (2) is re-estimated including as control and interaction terms two measures of institutional quality: a) political stability; b) an index of democracy (Polity). The results are reported in Figure 9 and 10, respectively. The figures present the average response and the responses obtained considering the first and third quartile of the distribution of the variables. In order to highlight the significance of the results, the dotted lines for the first and third quartile differ from the average response only when the interaction term is found to be statistically significant. Looking at the figures, the results suggest that while in the short term the effect is not statistically different between countries with lower and higher quality of institutions, in the medium term public debt has typically increased in countries with a lower quality of institutions (first quartile), which may reflect difficulties in implementing effective and credible consolidation measures in these countries.

Initial Debt

The rise in public debt in the aftermath of a banking crisis may be more important for countries that had at the time of the crisis a higher initial debt-to-GDP ratio. This hypothesis can be explained by the fact that a higher initial level of debt affects the debt accumulation through debt service.[14] In times of crisis debt service burdens increase due to reduced government

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[13] See for a more detailed discussion, Persson (2001), Persson and Tabellini (2001), Alesina and Tabellini (2005) Alesina et al (2008).

[14] See Figure A1 and A2 for the estimated impact of banking crises on government debt service.

revenues and increased risk premia. This last factor tends to be generally more important for countries with a higher initial level of public debt.[15]

To test for this hypothesis equation (2) is re-estimated using the initial level of the debt-to GDP ratio as control and interaction term with the banking crises dummy. The results reported in Figure 11 suggest that in countries with a higher initial level of debt-to-GDP ratio (corresponding to the third quartile of the distribution, i.e. above 76 percent) the increase in the debt-to-GDP ratio, both in the short (1 and 2 years after) and in the medium term (8 years after), is about 15 percentage points higher than in countries with a lower initial debt ratio (corresponding to the first quartile, i.e. below 20%).

Foreign Debt

Another factor that may affect the pattern of the public debt-to-GDP ratio in the aftermath of banking crises is the foreign debt. First, countries with an high share of foreign debt may face higher interest payments on debt coming due as capital markets become unwilling to continue rolling debt over. Second, when foreign exposure is heavy, expectations that debt service and repayment mat be made difficult by currency depreciation may lead to a self-fulfilling liquidity crunch, and eventually to public debt default. Third, in countries with high foreign debt ratio currency depreciation may lead to a substantial increase in the debt burden because of the *original sin* and lead to debt crises (Calvo Flandreau, 2003; Bordo, 2006; Bordo and Meisser,

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[15] See for example Haugh et al. (2009), Schuknecht et al. (2009), Codogno et al. (2003), Gale and Orzag (2003), Gomez-Puig (2006), Manganelli and Wolswijk (2007).

2006). Fourth, a high level of foreign debt may lead to significant output losses, especially in emerging economies, since sudden stops or reversals in capital inflows are more likely.[16]

An approach to test whether countries with a higher foreign debt ratio have been characterized by an higher rise in the debt-to-GDP ratio in the aftermath of banking crises is to re-estimate equation (2) using the initial level of the foreign debt ratio as control and interaction term with the banking crises dummy. However, a problem with this approach in this case is that the probability of banking crises is endogenous to the share of foreign debt.[17]

A way to mitigate this problem is to estimate our baseline equation in correspondence of different levels of the foreign debt ratio. For simplicity, and homogeneity with the rest of the results presented, equation (1) is estimated for three groups of countries: i) those with a foreign debt ratio lower than the first quartile of the distribution, i.e. below 13 percent of GDP (*low foreign debt ratio*); ii) those with a foreign debt ration higher than the third quartile of the distribution, i.e. above 57 percent of GDP (*high foreign debt ratio*); iii) those with a foreign debt between the first and the third quartile (*average foreign debt ratio*). The IRFs corresponding to the three groups are displayed in Figure 9. The results suggest that the public debt-to-GDP ratio increased more in those countries with a higher share of foreign debt to GDP. In particular, in countries with a low foreign debt ratio the increase in the debt ratio is not statistically significant different from zero, or negative (decrease in public debt). In countries with average foreign debt ratio, the results point to a long-term increase of the debt ratio of about 8 percentage points (which is similar to the baseline effect presented in Figure 5). Finally, in countries with high

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[16] See, for example, Calvo et al. (2004), Bordo et al. (2008).
[17] Bordo and Meisser (2006) find that, especially if mis-managed, foreign debt can significantly increase the probability of financial crises.

foreign debt ratio the peak effect is close to 30 percentage points, while the long-term effect is about 23 percentage points.[18]

Discretionary deficits

In addition to the severity of the crises, another key factor in shaping the response of public debt is the fiscal reaction in the aftermath of financial crises occurrence. In particular, it is plausible to expect that the debt-to-GDP ratio has increase more in those countries where government deficit increased more in the years following the crises.

From an estimation point of view a problem with the use of government deficit in a specification as equation (2) is that changes in government deficits are clearly endogenous to banking crises, via automatic stabilizers. To control for this problem we use a measure of discretionary fiscal deficit. In particular, following Fátas and Mihov (2003, 2006) and Afonso et al. (2010), discretionary changes in fiscal deficit are estimated using the following regression:

$$\Delta d_{i,t} = \alpha_i + \beta \Delta d_{i,t-1} + \gamma \Delta y_{i,t} + \delta Z_{i,t} + \varepsilon_{i,t} \tag{3}$$

where *d* represent government deficit, *y* the (log of) real output and the estimated residuals $e_{i,t}$ will represent respectively our measures discretionary fiscal policy. In order to get these estimates, we include as control variables (i.e. the vector *Z*) the current and the lagged value of real oil prices, the current inflation rate and a linear time trend. Oil prices are included since they affect the state of the economy and more importantly because they contribute significantly to total revenue for some of the countries in the sample. Inflation is included to ensure that the results are not driven by high inflation episodes. Time trend is added because government spending and revenue may have a deterministic time trend in addition to the stochastic one.

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[18] The results obtained by estimating equation (2), using the initial level of the foreign debt ratio as control and interaction term with the banking crises dummy, broadly confirm these results.

Finally, in order to control for possible endogeneity past values of real GDP growth are used as instruments.

To test whether discretionary fiscal policy during crises have significantly increased the debt-to-GDP ratio, equation (2) is re-estimated using the estimated measure of discretionary changes in fiscal deficits as control and interaction term with the banking crises dummy. The results reported in Figure 13 confirm the hypothesis that public debt has increased more in countries with larger discretionary changes in fiscal deficit.

Banking Intervention Policies

This section analyzes the role of three banking intervention policies which are generally argued to affect public finances: 1) Liquidity support; 2) Blanket guarantees; 3) Nationalization. These policies have been usually adopted to restore public confidence in the financial sector and the financial health of banking institutions. To test for the effectiveness of these variables we use the information collected in Laeven and Valencia (2008b), which describes the resolution policies adopted in a sample of 40 systemic banking crises episodes, to construct dummies for each resolution approach. The dummy takes a value equal to for the adoption of a given policy and zero otherwise.[19] Once these dummies variables are constructed, equation (1) is re-estimated for each of the three banking intervention policies. The results displayed in Figure 14 in four different panels, corresponding to: a) Episodes of banking crises in the restricted sample; b) Liquidity support; c) Blanket guarantees; d) Nationalization. Looking at the figure, it is evident that the evolution of debt-to-GDP ratio differs between the banking intervention policy adopted. More precisely, it seems that liquidity support measures are associated with the largest increase in public debt. In addition, while the impact of liquidity support and nationalization on debt

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[19] See Table A1-3 for detailed statistics.

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attenuates progressively, the impact of blanket guarantees remains large. However, in the medium term the results are not statistically significant, possibly due to the scarce number of episodes.

Overall, the results have to be treated with caution. First, the data on banking intervention policies contains only 40 episodes of banking crises and thus only 1/3 of full set of banking crises episodes. Second, intervention measures are categorized as binary variables and therefore do not contain any information regarding the size of the interventions. Nonetheless, we think that this analysis completes previous works in the literature (e.g. Detragiache and Ho, 2010) and provides some useful information.

4. Conclusions

Financial crises are not only typically associated with sharp economic downturns but also with a substantial deterioration of fiscal positions. Declining revenues due to weaker economic conditions, higher expenditures associated with bailout costs and demand stimuli have historically led to a rapid deterioration of fiscal balances and increase of public debt. Analyzing several episodes of banking crises from 1980 to 2006 this paper aims to quantify the evolution of the government gross debt-to-GDP ratio in the aftermath of banking crises. In particular, using a sample of 154 countries the paper estimates impulse response functions of public debt to banking crises, and the effect that policy and structural variables have in shaping this response.

The results suggest that banking crises have generally produced a significant and long-lasting increase in the government debt-to-GDP ratio.

The effect is a function of the severity of the crisis. In particular, for severe crises, comparable to the most recent one in terms of output losses, banking crises are followed by a medium-term increase of about 37 percentage points in the government gross debt-to-GDP ratio. In addition, the debt ratio increased more in countries with higher initial gross debt-to-GDP ratio, with a higher share of foreign debt, and with a lower quality of institutions (in terms of political stability and democracy). The increase in government debt is also a function of the size of the fiscal stimulus to counter the economic downturns and varies with the type of banking intervention policy used. In particular, analyzing three types of intervention policies (nationalization, blanket guarantees and liquidity support) the results suggest that liquidity support measures are associated with a larger increase in the debt-to-GDP ratio. This result, however, has to be treated with caution. First, the data on banking intervention policies contains only 40 episodes of banking crises and thus only 1/3 of the full set of banking crises episodes. Second, intervention measures are categorized as binary variables and therefore do not contain any information regarding the size of the interventions. Nonetheless, we think that this analysis completes previous works in the literature and provides some useful information.

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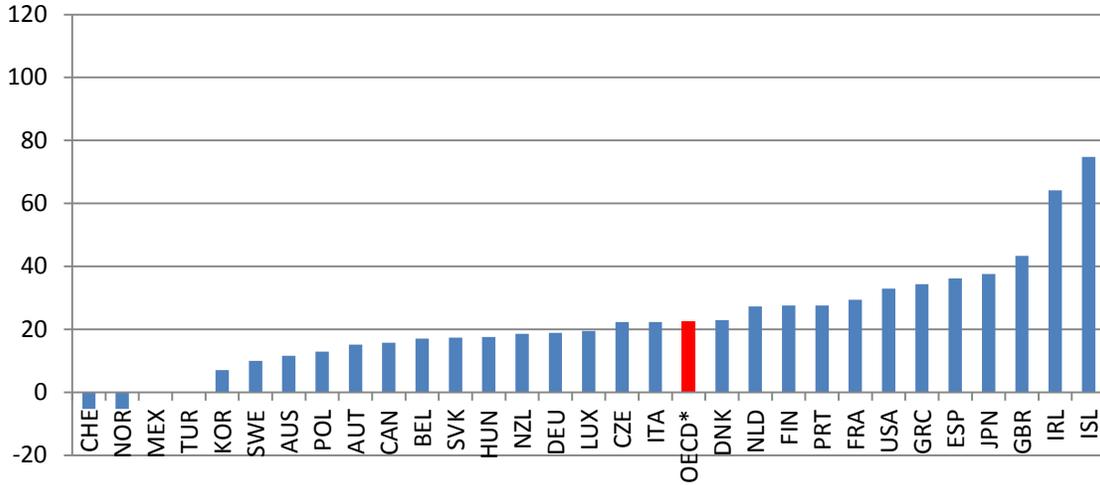**Figure 1. Cumulative increase in the debt-to-GDP ratio in the three years following the banking crises**

Period 2007-2011, % points of GDP
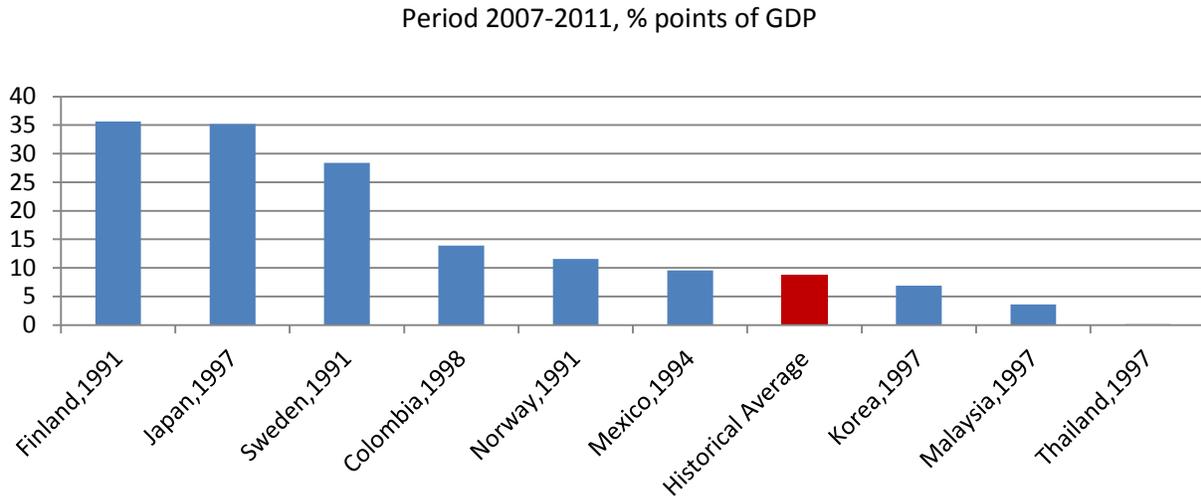
Figure 2. Evolution of the debt-to-GDP ratio following banking crises in Finland and Japan

Period 2007-2011, % points of GDP

23
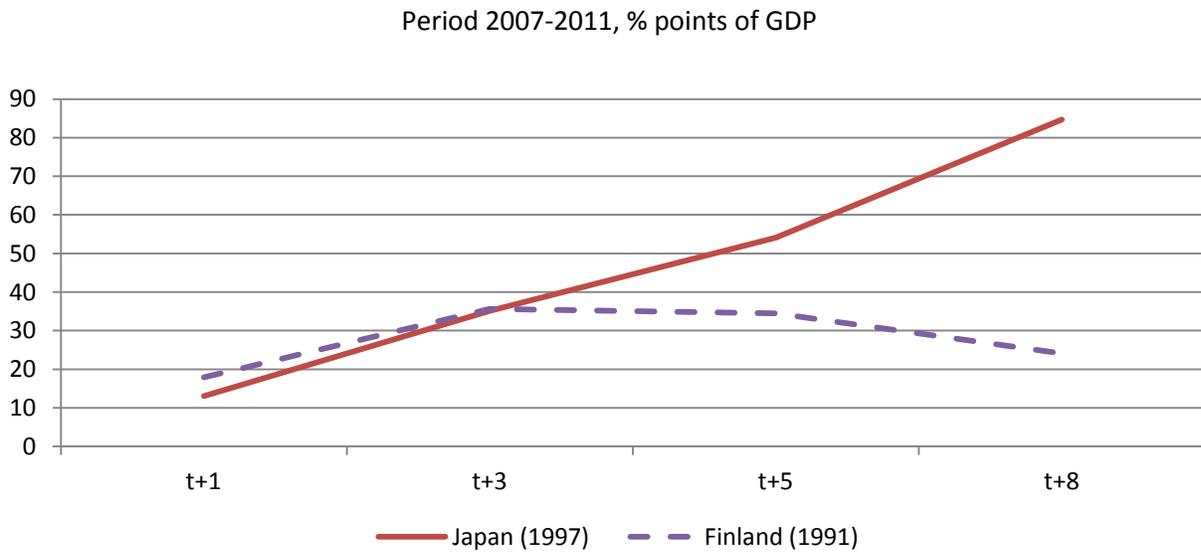
Figure 3. Projected increase in the government debt-to-GDP ratio
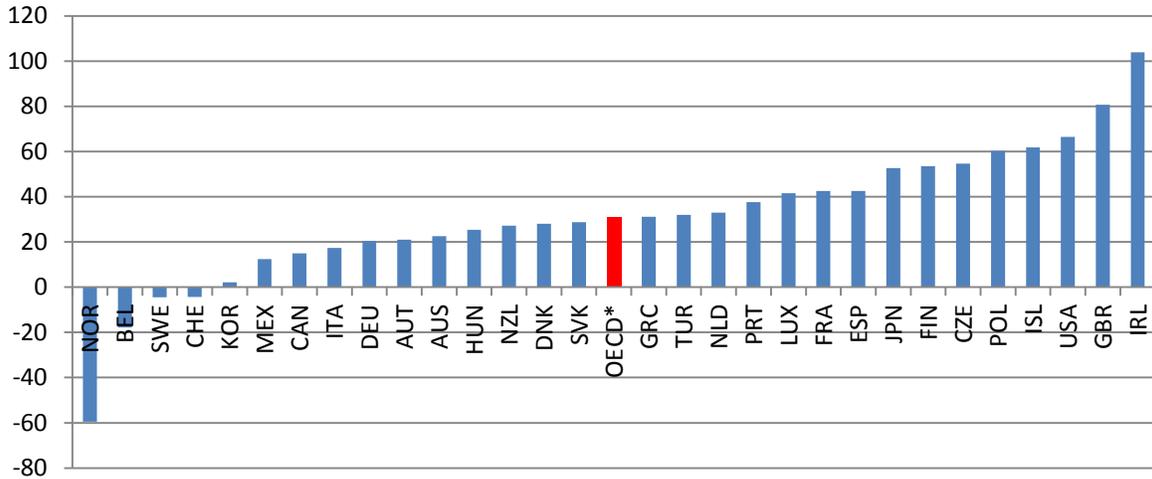
Period 2007-2011, % points of GDP

Source: OECD Economic Outlook 87 Database (2010).
Note: * unweighted average of OECD countries excluding Mexico and Turkey.

**Figure 4. Projected increase in the government debt-to-GDP ratio**

Period 2008- 2025, % points of GDP

Source: OECD Economic Outlook 87 Database (2010).
Note: * unweighted average of OECD countries excluding Mexico and Turkey. Projections are based on the assumption that government debt-to-GDP will stabilize by 2025 as a result of gradual consolidation measures. See the OECD Economic Outlook 87 (2010) for more details.
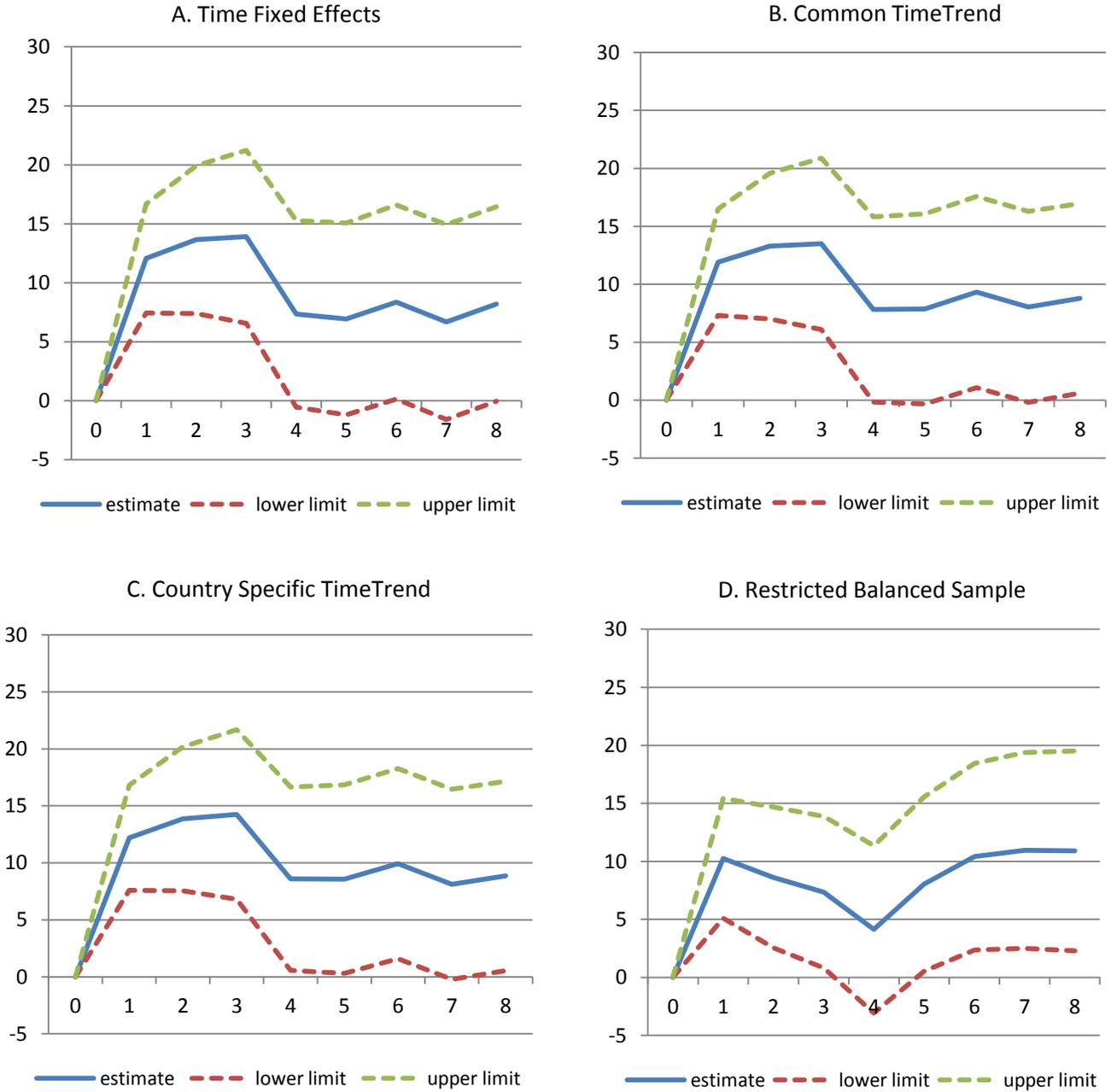
Figure 5. The effect of banking crises on the debt-to-GDP ratio
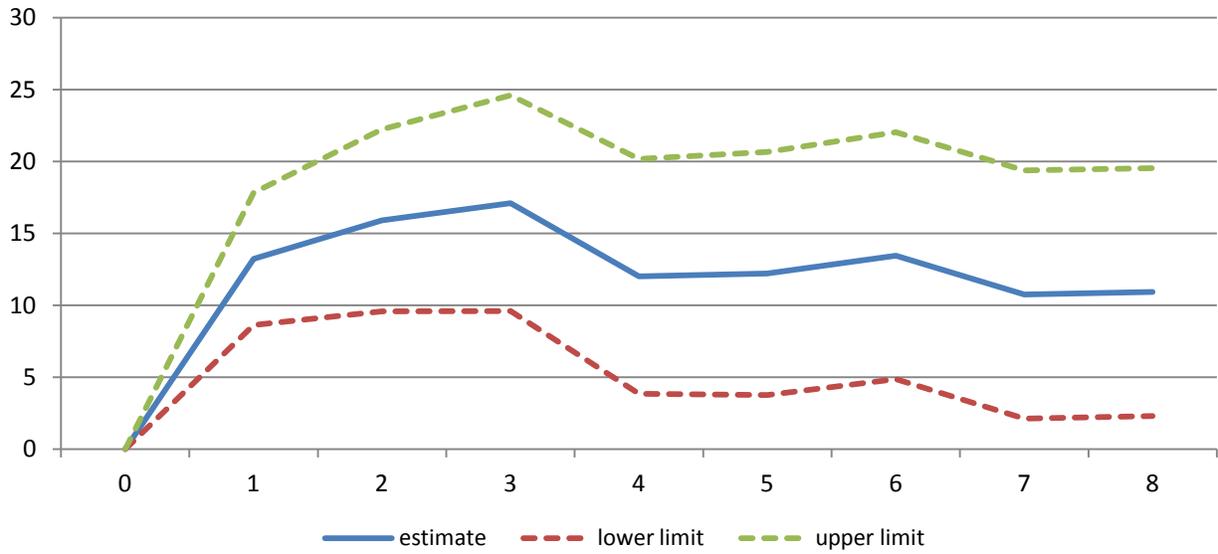
(% points of GDP)

Note: dotted lines represent 90% confidence bands.

Figure 6. Robustness tests

(% points of GDP)

A. Time Fixed Effects

B. Common TimeTrend

C. Country Specific TimeTrend

## D. Restricted Balanced Sample

Note: dotted lines represent 90% confidence bands.

Figure 7. The effect of moderate and severe banking crises on the debt-to-GDP ratio

(% points of GDP)

A. Moderate Crises

B. Severe Crises-Full unbalanced sample

C. Severe Crises-Restricted Unbalanced Sample
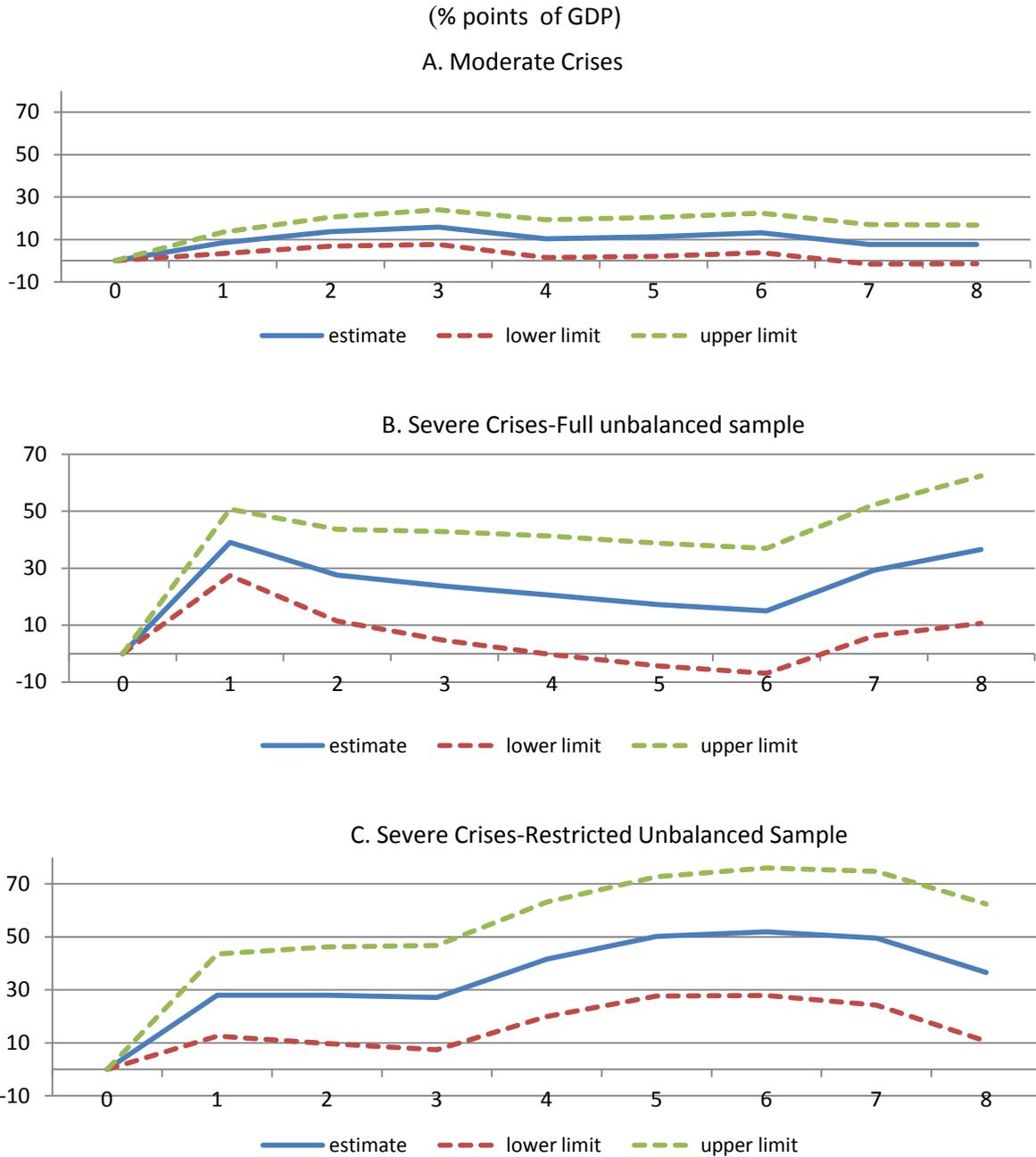
Note: dotted lines represent 90% confidence bands.

Figure 8. The effect of banking crises on debt-to-GDP ratio controlling for size

(% points of GDP)
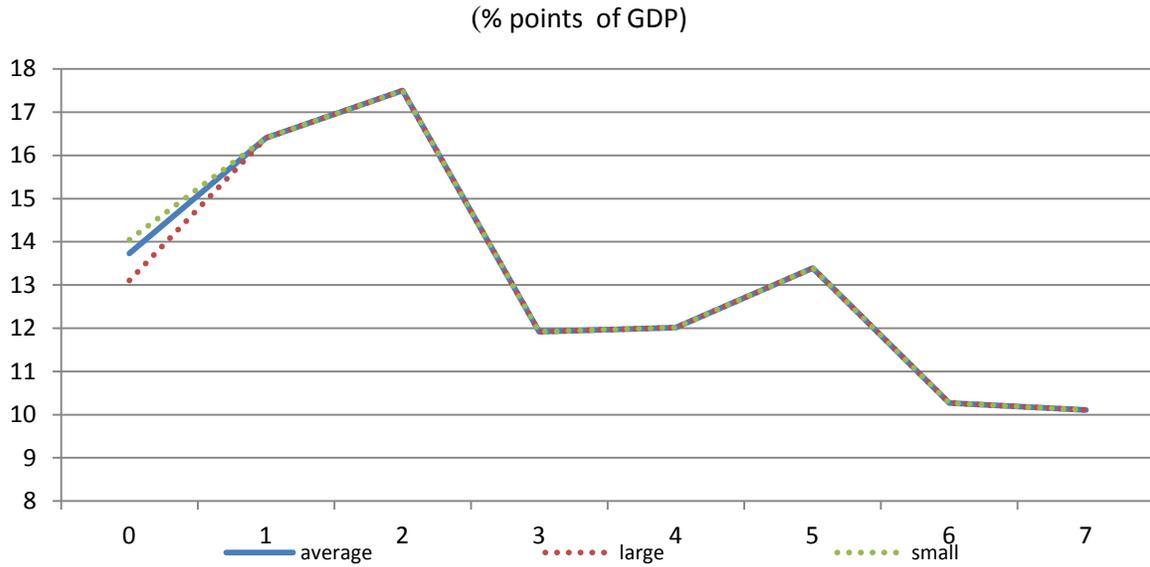
Note: Large and small identify the first and the third quartile of the GDP size distribution. Dotted lines differ from the average response only when the interaction term is statistically significant.

Figure 9. The effect of banking crises on debt-to-GDP ratio controlling for political stability

(% points of GDP)
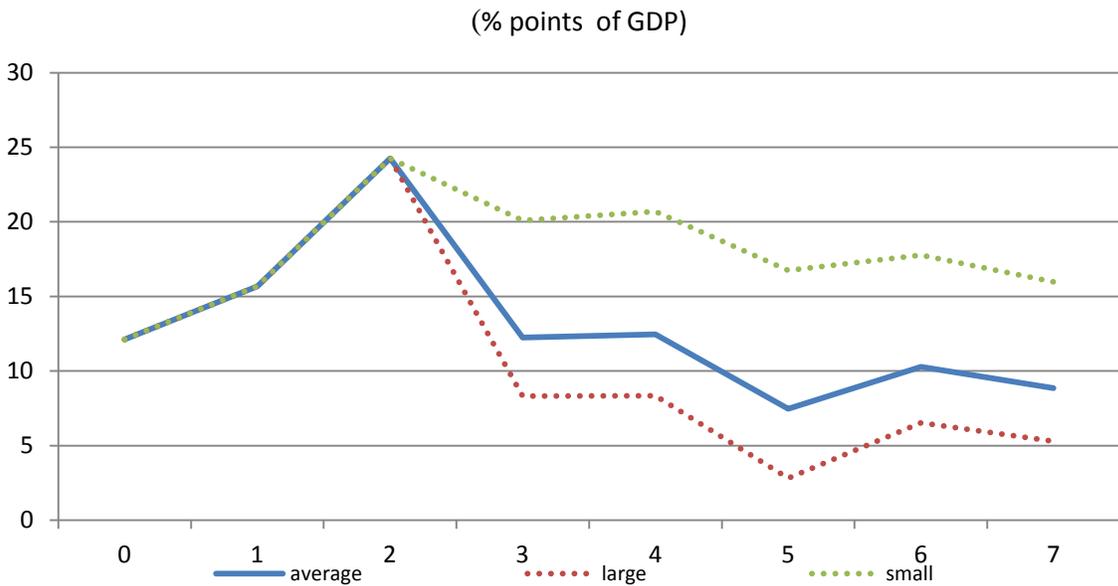
Note: Large and small identify the first and the third quartile of the political stability distribution. Dotted lines differ from the average response only when the interaction term is statistically significant.

Figure 10. The effect of banking crises on debt-to-GDP ratio controlling for polity

(% points of GDP)

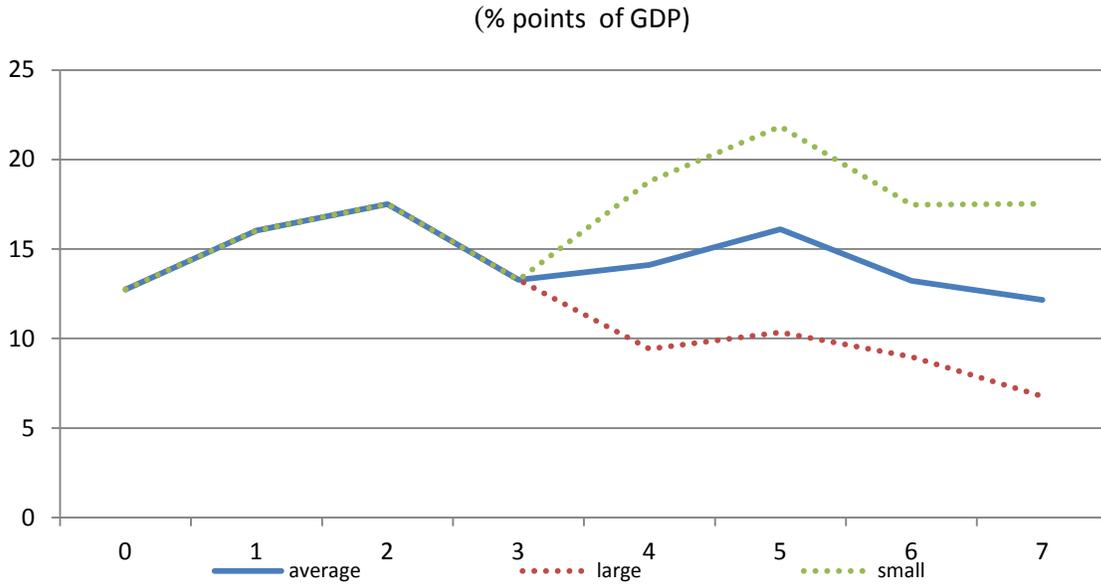Note: Large and small identify the first and the third quartile of the Polity distribution. Dotted lines differ from the average response only when the interaction term is statistically significant.

Figure 11. The effect of banking crises on debt-to-GDP ratio controlling for initial debt

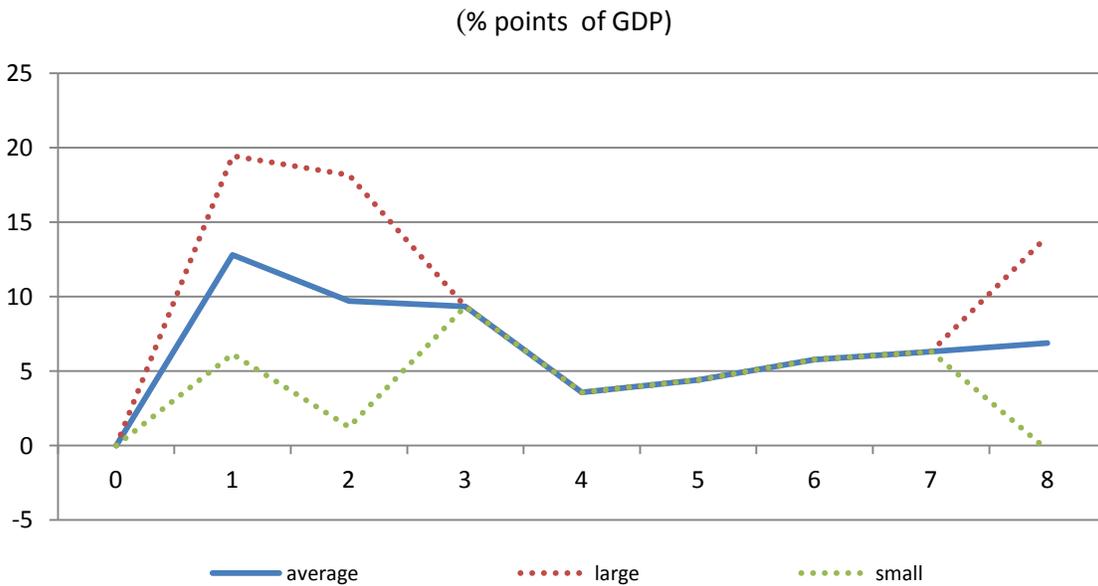(% points of GDP)

Note: Large and small identify the first and the third quartile of the initial debt-to-GDP ratio distribution. Dotted lines differ from the average response only when the interaction term is statistically significant.

Figure 12. The effect of banking crises on the debt-to-GDP ratio for different level of foreign debt ratio

(% points of GDP)

A.Low ratio

estimate — lower limit — upper limit

B.Average ratio

estimate — lower limit — upper limit

C.High ratio

estimate — lower limit — upper limit

Note: Dotted lines represent 90% confidence bands. Low ratio corresponds to a level of the foreign debt ratio lower than 13 pp (1st quartile of the distribution); Average ratio corresponds to a level of foreign debt ratio higher than 13 pp and lower than 57 pp; High ratio corresponds to a level of foreign debt ratio higher than 57 pp. (3rd quartile of the distribution).

Figure 13. The effect of banking crises on debt-to-GDP ratio controlling for discretionary deficits

(% points of GDP)

Note: Large and small identify the first and the third quartile of the discretionary deficit distribution. Dotted lines differ from the average response only when the interaction term is statistically significant.

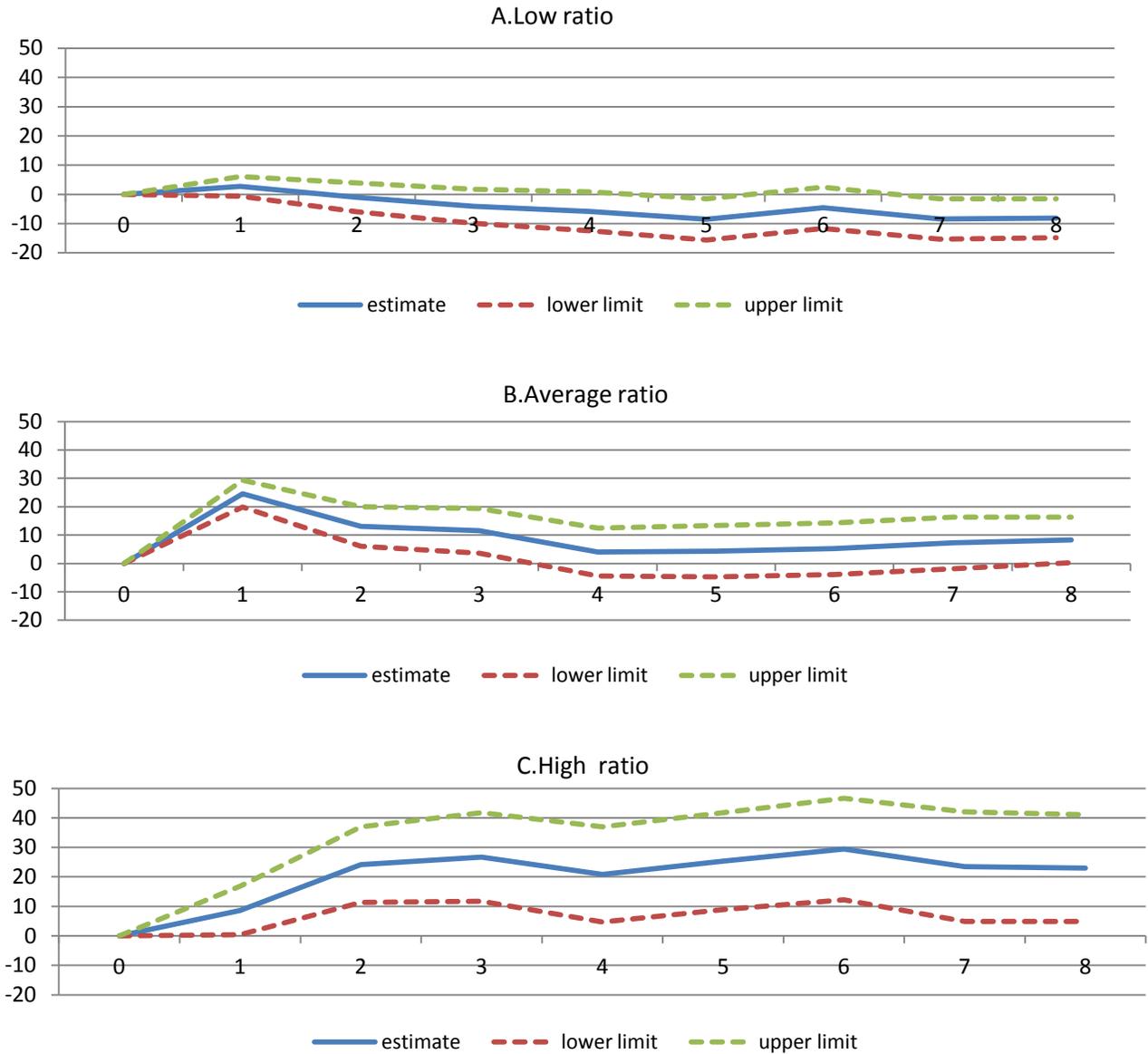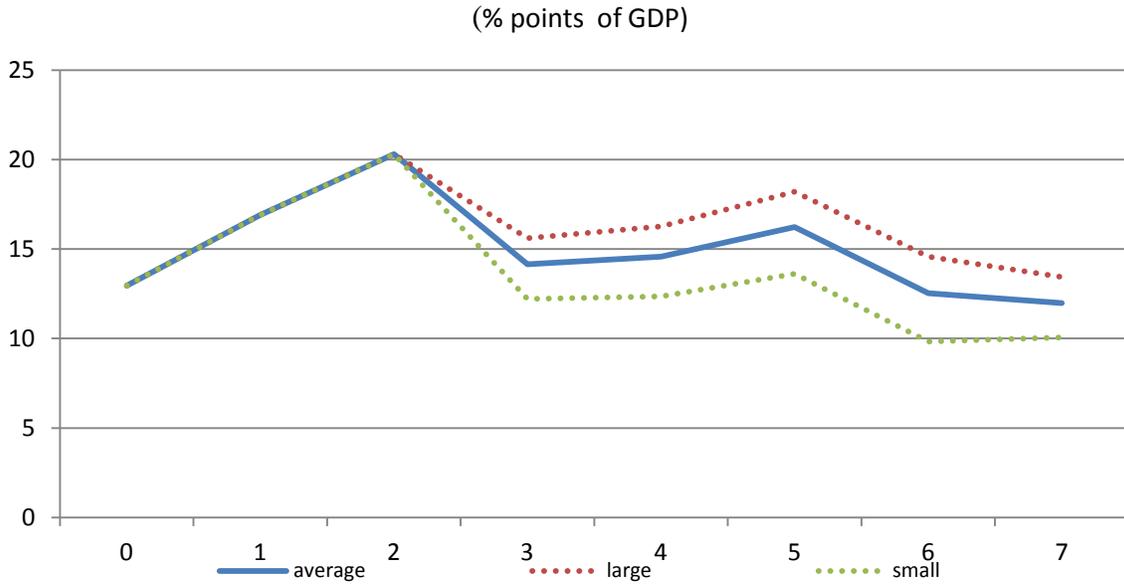## Figure 14. Banking interventions policies

(% points of GDP)

Baseline

Liquidity Support

Blanket Guarantees

Nationalization
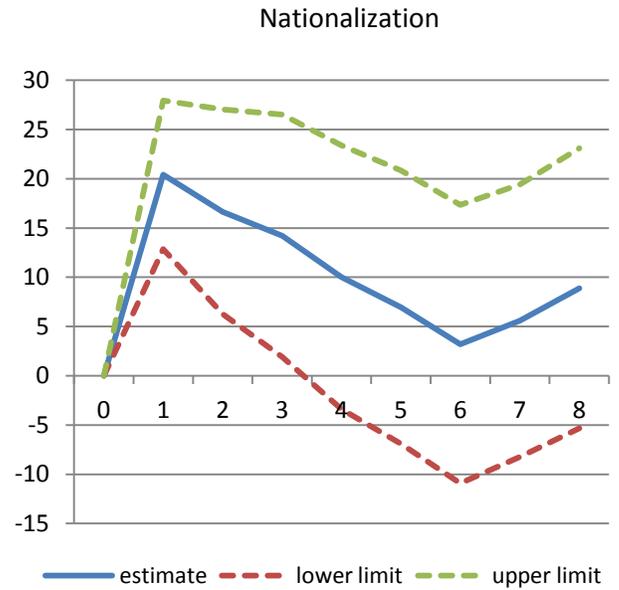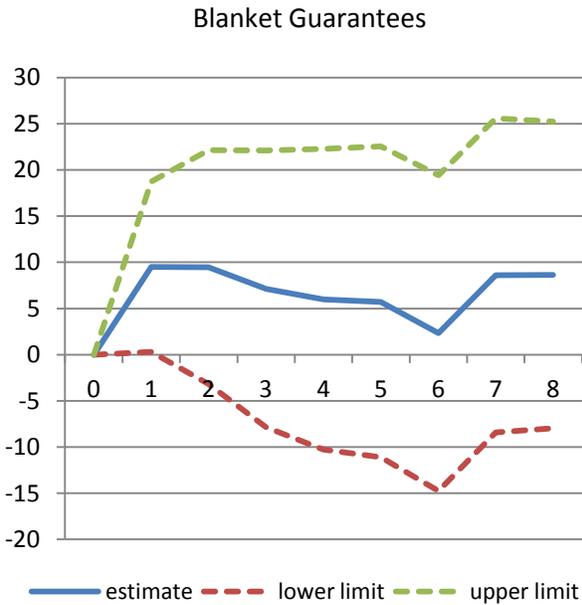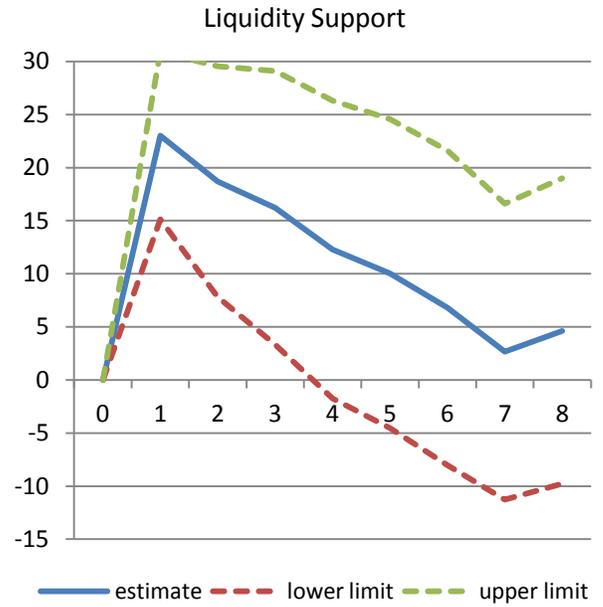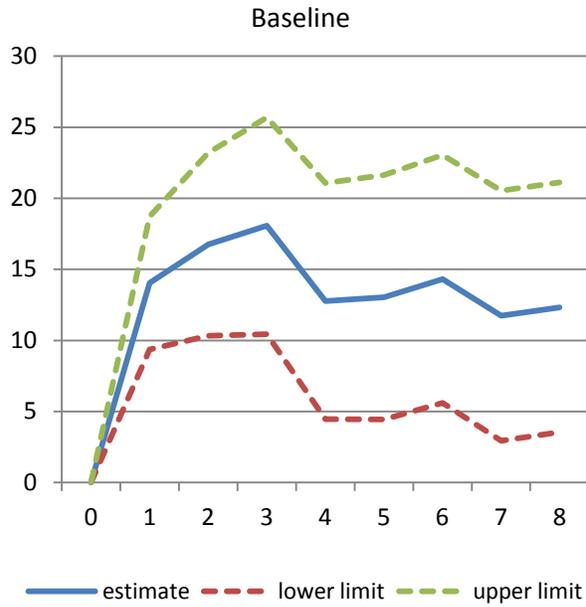
Note: dotted lines represent 90% confidence bands.

ANNEX

Figure A1. The effect of banking crises on debt service

Interest expenditure over Total Revenue(%)

Interest expenditure over GDP (%)

Note: dotted lines represent 90% confidence bands.

Table A1. Banking Crises Episodes

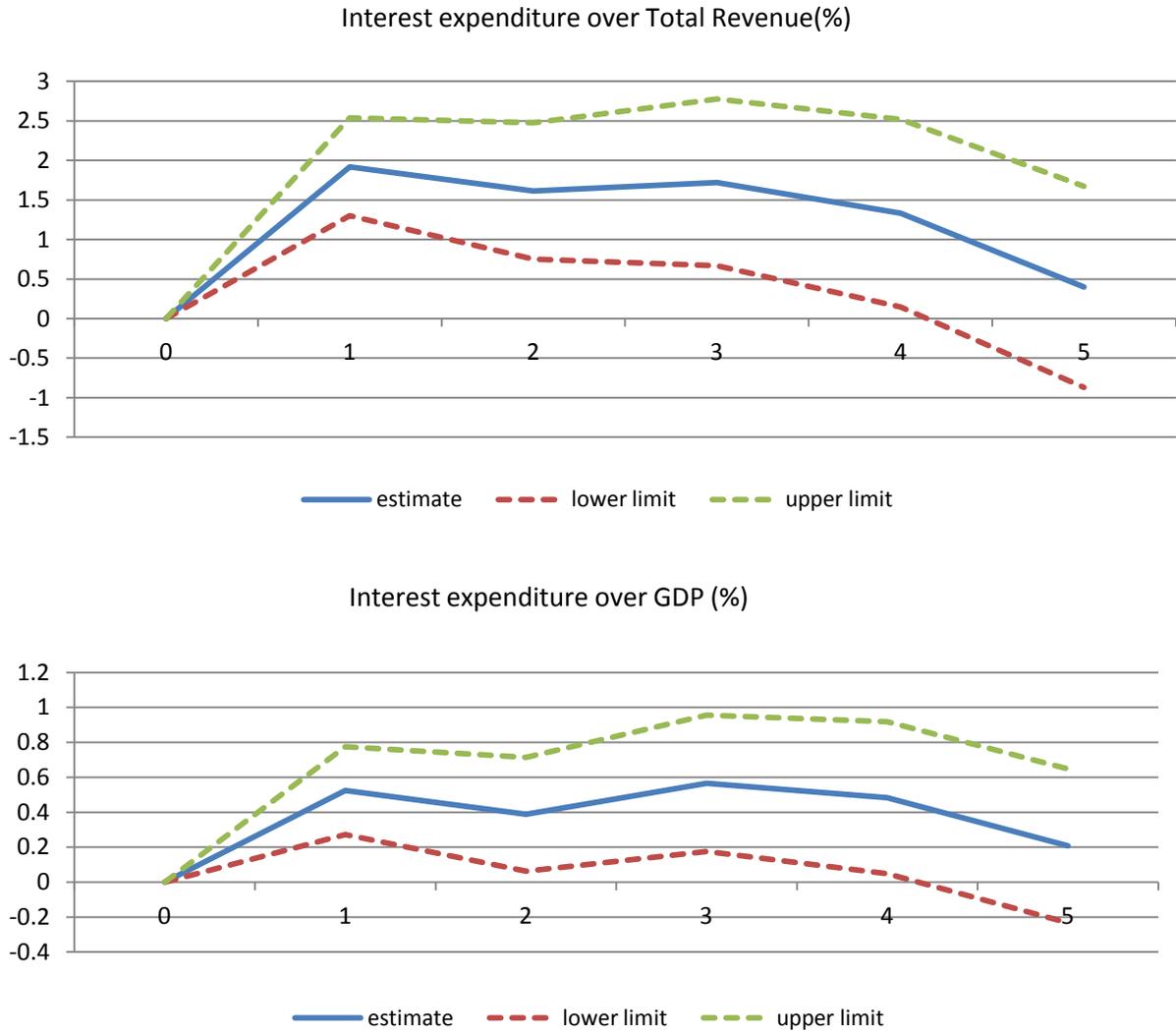| country	time	country	time	country	time
Albania	1994	Ecuador	1998	Norway	1991
Algeria	1990	Egypt,	1980	Panama	1988
Argentina	1980	El Salvador	1989	Paraguay	1995
Argentina	1989	Equatorial Guinea	1983	Peru	1983
Argentina	1995	Eritrea	1993	Philippines	1983
Argentina	2001	Estonia	1992	Philippines	1997
Armenia	1994	Finland	1991	Poland	1992
Azerbaijan	1995	Georgia	1991	Romania	1990
Bangladesh	1987	Ghana	1982	Russian Federation	1998
Belarus	1995	Guinea	1985	Sao Tome and Principe	1992
Benin	1988	Guinea	1993	Senegal	1988
Bolivia	1986	Guinea-Bissau	1995	Sierra Leone	1990
Bolivia	1994	Guyana	1993	Slovak Rep.	1998
Bosnia and Herzegovina	1992	Haiti	1994	Slovenia	1992
Brazil	1990	Hungary	1991	Spain	1977
Brazil	1994	India	1993	Sri Lanka	1989
Bulgaria	1996	Indonesia	1997	Swaziland	1995
Burkina Faso	1990	Israel	1977	Sweden	1991
Burundi	1994	Jamaica	1996	Tanzania	1987
Cameroon	1987	Japan	1997	Thailand	1983
Cameroon	1995	Jordan	1989	Thailand	1997
Cape Verde	1993	Kenya	1985	Togo	1993
Central African Rep.	1976	Kenya	1992	Tunisia	1991
Central African Rep.	1995	Korea, Rep.	1997	Turkey	1982
Chad	1983	Kuwait	1982	Turkey	2000
Chad	1992	Kyrgyz Rep.	1995	Uganda	1994
Chile	1976	Latvia	1995	Ukraine	1998
Chile	1981	Lebanon	1990	United Kingdom	2007
China	1998	Liberia	1991	United States	1988
Colombia	1982	Lithuania	1995	United States	2007
Colombia	1998	Macedonia, FYR	1993	Uruguay	1981
Congo, Dem. Rep.	1983	Madagascar	1988	Uruguay	2002
Congo, Dem. Rep.	1991	Malaysia	1997	Venezuela,	1994
Congo, Dem. Rep.	1994	Mali	1987	Vietnam	1997
Congo, Rep.	1992	Mauritania	1984	Yemen,	1996
Costa Rica	1987	Mexico	1981	Zambia	1995
Costa Rica	1994	Mexico	1994	Zimbabwe	1995
Cote d'Ivoire	1988	Morocco	1980		
Croatia	1998	Mozambique	1987		
Czech Rep.	1996	Nepal	1988		
Djibouti	1991	Nicaragua	1990		
Dominican, Rep.	2003	Nicaragua	2000		
Ecuador	1982	Niger	1983		
Ecuador	1998	Nigeria	1991		

Source: Laeven and Valencia (2008a)

Table A2. Banking intervention policies

Country	Time	Nationalization	Blanket guarantees	Liquidity support
Argentina	1980	1	0	1
Argentina	1989	0	0	1
Argentina	1995	0	0	0
Argentina	2001	1	0	1
Bolivia	1994	0	0	1
Brazil	1990	0	0	1
Brazil	1994	0	0	1
Bulgaria	1996	1	0	1
Chile	1981	0	0	1
Colombia	1982	1	0	1
Colombia	1998	1	0	1
Cote d'Ivoire	1988	0	0	1
Croatia	1998	1	0	0
Czech Rep	1996	0	0	0
Dominican Rep	2003	0	0	1
Ecuador	1998	1	1	1
Estonia	1992	1	0	1
Finland	1991	1	1	1
Ghana	1982	0	0	0
Indonesia	1997	1	1	1
Jamaica	1996	1	1	1
Japan	1997	1	1	0
Korea, Rep	1997	1	1	1
Latvia	1995	0	0	0
Lithuania	1995	1	0	0
Malaysia	1997	1	1	1
Mexico	1994	1	1	1
Nicaragua	1990	0	1	1
Norway	1991	1	0	1
Paraguay	1995	0	0	1
Philippines	1997	0	0	0
Russian Federation	1998	1	0	1
Sri Lanka	1989	0	0	0
Sweden	1991	1	1	1
Thailand	1997	1	1	1
Turkey	2000	1	1	1
Ukraine	1998	0	0	1
Uruguay	2002	1	1	0
Venezuela,	1994	1	0	1
Vietnam	1997	0	0	0

Note: "1" refers to the adoption of the policy.

Source: Laeven and Valencia (2008b).

Table A3. Estimates (1)

K	Baseline	Time FE	Time trend	Country time trend	OECD	Severe	Moderate
1	13.226	12.065	11.908	12.206	15.176	39.078	8.447
	(4.72)***	(4.30)***	(4.25)***	(4.35)***	(4.69)***	(5.51)***	(2.77)***
2	15.893	13.657	13.291	13.869	17.372	27.563	13.694
	(4.13)***	(3.58)***	(3.48)***	(3.61)***	(3.98)***	(2.81)***	(3.27)***
3	17.084	13.903	13.500	14.246	19.808	23.746	15.795
	(3.75)***	(3.12)***	(3.00)***	(3.15)***	(3.76)***	(2.04)**	(3.19)***
4	12.002	7.351	7.832	8.602	13.445	20.470	10.410
	(2.42)**	(1.53)	(1.61)*	(1.76)*	(2.34)**	(1.62)*	(1.93)**
5	12.206	6.937	7.872	8.581	13.706	17.220	11.246
	(2.37)**	(1.4)	(1.58)*	(1.71)*	(2.30)**	(1.31)	(2.02)**
6	13.441	8.365	9.331	9.928	16.109	15.012	13.102
	(2.57)**	(1.67)*	(1.86)*	(1.96)**	(2.66)***	(1.12)	(2.31)**
7	10.747	6.671	8.050	8.116	13.233	29.299	7.684
	(2.05)**	(1.33)	(1.61)*	(1.60)*	(2.12)**	(2.09)**	(1.36)
8	10.910	8.191	8.783	8.856	13.499	36.526	7.681
	(2.08)**	(1.63)*	(1.77)*	(1.75)*	(2.14)**	(2.32)**	(1.38)

Note: t-statistics in parenthesis. ***,**,* denote significance at 1%, 5%, and 10%, respectively.

Table A3. Estimates (2)

K	Small foreign debt	Average foreign debt	Large foreign Debt	Baseline restricted	Liquidity support	Blanket guarantees	National-ization
1	2.749 (1.35)	24.590 (8.59)***	8.618 (1.70)*	14.048 (4.94)***	23.021 (4.8)***	9.509 (1.7)*	20.406 (4.45)***
2	-1.022 (-0.34)	13.042 (3.09)***	24.161 (3.11)***	16.762 (4.29)***	18.684 (2.83)***	9.465 (1.23)	16.644 (2.64)**
3	-4.081 (-1.15)	11.504 (2.41)**	26.732 (2.92)***	18.068 (3.90)***	16.217 (2.07)**	7.119 (0.78)	14.219 (1.90)*
4	-5.847 (-1.44)	4.019 (0.78)	20.827 (2.13)**	12.768 (2.53)**	12.285 (1.44)	5.993 (0.61)	9.996 (1.23)
5	-8.570 (-2.01)**	4.377 (0.80)	25.323 (2.51)**	13.033 (2.49)**	10.021 (1.13)	5.724 (0.56)	6.953 (0.82)
6	-4.605 (-1.07)	5.223 (0.94)	29.401 (2.81)***	14.319 (2.70)***	6.786 (0.75)	2.334 (0.22)	3.207 (0.37)
7	-8.423** (-2.01)	7.232 (1.31)	23.499 (2.25)**	11.744 (2.20)**	2.665 (0.31)	8.589 (0.80)	5.599 (0.67)
8	-8.181 (-2.01)*	8.276 (1.70)*	23.016 (2.08)**	12.328 (2.31)**	4.617 (0.53)	8.631 (0.86)	8.875 (1.00)

Note: t-statistics in parenthesis. ***,**,* denote significance at 1%, 5%, and 10%, respectively.

Table A4. (Unconditional) Estimates with additional controls and interaction terms

K	GDP Size	Debt	Discretionary	Political stability	Polity
1	13.731	12.794	12.959	12.123	12.741
	(3.06)***	(4.84)***	(3.31)***	(2.53)**	(3.16)***
2	16.403	9.706	16.910	15.670	16.041
	(2.80)***	(2.99)***	(2.82)***	(2.06)**	(3.84)***
3	17.498	9.348	20.291	24.256	17.513
	(2.42)***	(2.60)***	(2.56)***	(2.03)***	(3.40)***
4	11.919	3.575	14.151	12.251	13.281
	(1.97)***	(0.96)	(2.16)**	(1.88)*	(2.29)**
5	12.018	4.407	14.583	12.455	14.107
	(1.97)**	(1.18)	(2.23)**	(1.48)	(2.25)**
6	13.390	5.765	16.233	7.462	16.100
	(2.04)**	(1.53)	(2.37)**	(0.79)	(2.46)**
7	10.270	6.309	12.539	10.277	13.223
	(1.88)*	(1.65)*	(2.33)**	(1.73)*	(1.82)*
8	10.109	6.883	11.987	8.858	12.152
	(1.78)*	(1.79)*	(2.11)**	(1.59)*	(1.63)*

Note: t-statistics in parenthesis. ***,**,* denote significance at 1%, 5%, and 10%, respectively. The coefficient reported in table and the associated t-statistics refer to the unconditional effect of banking crises on the debt-to-GDP ratio.