Larger crises cost more: impact of banking sector instability on output growth

Dobromił Serwa*

National Bank of Poland
Financial System Department
and
Warsaw School of Economics
Institute of Econometrics

Abstract:

We propose a method for calculating the macroeconomic costs of banking crises that controls for the downward impact of recessions on banking activity. This method uses an event-study approach and a multiple-equation identification and estimation technique. In contrast to earlier research, we estimate the cost of crises based on the size of banking crises. The extent of a crisis is measured using banking sector aggregates. The results, based on our method and data from over 100 banking crises, suggest that it is the size of the crisis that matters for economic growth. Lower credit and money growth during crises cause GDP growth to decline.

JEL Classification: C32, E51, G21, G15
Keywords: banking crises, costs, output growth, event-study

---

* Address: National Bank of Poland, Financial System Department, ul. Świętokrzyska 11/21, 00-919 Warszawa, Poland; e-mail: dobromil.serwa@nbp.pl; tel. ++48 22 653 2412, fax. ++48 22 620 8491

Introduction

Considerable attention has been paid in recent years by a number of interested parties to analyzing the damaging impact of banking crises on the economy. Economists, for example, are concerned about the causal relationship between recessions and banking crises. International investors seek to predict output growth more accurately, given a banking crisis in the country in which they are investing.

The recent global financial turmoil and the resulting actions of international authorities responsible for limiting the effects of such economic instability also provoke the question of the macroeconomic costs of banking crises. Policymakers want to assess the extent to which the recessions accompanying crises are worsened by the decline in credit supply and by the reduction in other banking activities. Are the policy measures of central banks to sustain credit and money supply effective? To what extent the magnitude of a crisis matters for economic growth remains the fundamental question for market participants.

The relationship between banking crises and economic growth has been investigated extensively in the literature. Two main areas of specific interest are fiscal costs and output losses suffered by economies during crises (Dell'Ariccia, Detragiache, and Rajan, 2005; Gupta, 2005). Some research has analyzed the fiscal costs associated with crisis resolutions and found them to be extremely high in many cases, although they are difficult to calculate and compare across countries (e.g. the database of Caprio, Klingebiel, Laeven and Noguer, 2005). Alternatively, declines in output growth during banking crises have often been investigated. Output growth is both an important measure of economic activity, and is also comparable across countries, and should reveal the effects of fiscal costs on the economy.

The average estimated output losses associated with banking crises have varied considerably in different studies, depending on the sample and the estimation method, from less than 1 to up to 8 percentage points of output growth for each year of a crisis (Barro, 2001; Hutchison and Noy, 2005), and from 4 to 20 percent of cumulative GDP loss or more during a crisis (Barro, 2001; Demirgüç-Kunt, Detragiache, and Gupta, 2006; Hoggarth, Reis, and Saporta, 2002; Boyd, Kwak, and Smith, 2005; Hutchison and Noy, 2005). However, these studies have been generally unable to identify whether output losses were caused by banking crises, or vice versa. In the latter case, it could be a recession and not a banking crisis that caused lower GDP growth.

This paper analyses the impact of banking crises on GDP growth. It extends earlier research in four ways. First, it empirically analyses the costs of banking crises after controlling for the downward impact of recessions on banking activity. To do so, we use a multiple-equation identification and estimation technique which is novel to studies of the costs of banking crises.

Second, it proposes several variables to control for the macroeconomic significance of crises, with the aim of analyzing how the specific size of a crisis, measured in macroeconomic terms, affects economic growth.[1] This fills a clear gap in the literature, as earlier studies purely distinguish between systemic and non-systemic crises or identify policies used to resolve the crises to calculate their costs, rather than account for the actual size of the crisis.

Third, our study uses macroeconomic measures of the extent of crises in order to analyze the two main paths whereby banking crises may affect output growth, i.e. the credit and monetary channels. In this way our paper bridges the gap between research on the credit–output relationship and the monetary transmission mechanism, and studies on the costs of banking crises (e.g. Loayza, Rancière, 2005; Psaradakis, Ravn and Sola, 2005).

Finally, this study applies the event-study approach, which draws on a large database of banking crises in developed and emerging markets from the late 1970s to the first years of the new century, as developed by Caprio, Klingebiel, Laeven and Noguer (2005). We construct a set of variables calculated with a yearly frequency preceding and following the

[1] Ranciere, Tornell and Westermann (2005) use variables related to credit growth to compare long-run economic growth in countries with stable financial systems, and countries suffering from systemic financial crises.

crisis dates by zero up to seven years. In this way we are able to compare the properties of macroeconomic variables before and after the crises.

The paper is organized as follows. The method of calculating the impact of banking crises on output growth is presented in Section 2. Section 3 contains empirical results. Finally, Section 4 concludes.

2. Methodology

In this section we describe the method used to measure the impact of banking crises on the economy. We propose macroeconomic measures to determine the magnitude of banking crises, examine the relationship between such crises and output growth, and then explain our econometric method used to estimate how these measures affect output growth.

2.1 Measures to determine the size of a banking crisis

In this paper we follow Caprio and Klingebiel (2003) and define banking crises as "much or all of bank capital being exhausted". Such crises typically comprise large-scale bank failures, depositor runs, the high level of non-performing loans, or certain emergency actions of the government (deposit freezes, nationalizations, recapitalization plans etc.) (e.g. Demirgüç-Kunt, Detragiache and Gupta, 2006).

It is true that previous studies have estimated the average impact of banking crises on GDP growth or production growth in selected sectors of the economy, taking into account crisis length, resolution policies, evidence of twin crises, i.e. joint currency and banking crises, and triple crises when sovereign debt is also involved (e.g. IMF, 1998; Frydl, 1999; Honohan and Klingebiel, 2000; Bordo, Eichengreen, Klingebiel and Soledad Martinez-Peria, 2001; Hoggarth, Reis and Saporta, 2002). However, although these studies usually distinguish between systemic and non-systemic crises, and measure the fiscal costs of some crises, but none have attempted to measure the size of individual crises in terms of macroeconomic variables such as the fall in domestic credit, deposits, or the monetary base.

We propose four measures of the extent of a banking crisis.[2] First, the change in real credit in relation to GDP is used to account for a drop in credit supply due to multiple bank failures, more restrictive credit rationing policies of commercial banks, losses and increased capital provisions lowering capital base and limiting the credit supply in line with regulatory capital requirements (e.g., Ranciere, Tornell, and Westermann, 2005):

$$l_t = \frac{L_t(1-\pi_t) - L_{t-1}}{GDP_{t-1}}. \tag{1}$$

The variable L_t denotes the nominal value of credit at time t, π_t is the percentage change in consumer prices between periods $t-1$ and t, and GDP_{t-1} is the gross domestic product at time $t-1$. The choice of this variable is based on the literature on a credit channel in the monetary transmission mechanism and the existence of a financial accelerator amplifying real economic fluctuations (e.g., threshold effects in the US - Balke, 2000, in the UK – Atanasova, 2003, and in the EU – Calza and Sousa, 2005). The GDP_{t-1} is used to control for the size of a credit market in relation to the whole economy.

We also experimented with the spread between the lending interest rate and the policy rate as our measure of credit rationing during crises. This variable increases two years before the crisis and then falls during the crisis to its pre-crisis level. Therefore, the spread appears to be a superior predictor of banking crises, but is less useful as a measure of crisis extent.[3]

Second, we use changes in aggregate deposits after controlling for the impact of interest paid on these deposits to measure the extent of banking crises. Let r_t denote the deposit interest rate at time t and d_t be the net deposit inflows as percentage of old deposits, i.e. the difference between new deposit inflows and deposit withdrawals at time t, divided by the value of deposits at time t-1 (e.g., Willis, 1960). The aggregate deposits D_t at time t

[2] Our measures of the extent of banking crises are in fact bank activity indicators. These variables take on lower values during crisis periods than during calm periods. In this way they indicate how banking sectors behaved during crises and provide information about the extent of crises in those banking sectors.

[3] Other measures of credit rationing are also available (e.g., Bernanke, Gertler and Gilchrist, 1996; Balke, 2000). However, data for such variables are not available in many developing countries from our dataset.

depend on the value of deposits from time t-1, new deposit inflows, old deposit outflows, and the interest paid on old deposits:

$$D_t = D_{t-1} + D_{t-1} \cdot d_t + D_{t-1} \cdot r_{t-1} \qquad (2)$$

From equation (1) we find the net deposit inflows as a percentage of old deposits to equal:

$$d_t = \frac{D_t - D_{t-1}}{D_{t-1}} - r_{t-1}. \qquad (3)$$

Lower values of d_t during banking crises describe investors' flight to liquidity (e.g., Gupta, 2005). The more severe the crisis, the higher the probability of bank runs and the lower propensity to keep deposits in banks. In extreme cases the value of d_t could become negative if there were less new deposits than deposit withdrawals or the percentage increase in aggregate deposits was lower than the deposit interest rate.[4]

The third measure of banking crises, b_t, is the difference between changes in the money supply and changes in the amount of cash in circulation. Here, we also take into account the increase in the money supply due to the interest paid on demand, time, savings, and foreign currency deposits. The percentage growth of money supply is given by:

$$h_t = \frac{M_t - M_{t-1}}{M_{t-1}} - k \cdot r_{t-1}, \qquad (4)$$

where M_t is the money supply at time t. Since the money aggregate contains cash in circulation G, interest is paid only to the part of the money supply. Thus, we use the parameter k that belongs to the interval (0, 1) to proxy an average interest rate $k \cdot r_t$ of the money aggregate.[5] Then the third variable is calculated using the following expression:

$$b_t = h_t - \frac{G_t - G_{t-1}}{G_{t-1}}. \qquad (5)$$

[4] Changes in real deposits in relation to GDP were also considered, but they are low only during the second year of a crisis and in other years they are higher than before the crisis.

[5] k is lower than 1, because the market interest rate r is higher than the interest rates of deposits and other components from the money aggregate.

Like the second measure, this third measure may be used to proxy the propensity to save during calm and crisis periods. This is analogous to the change in a cash-deposit ratio used by Gupta (2005), who notes that this ratio increases during banking crises. As a result, the deposit and money aggregates grow slower in comparison to cash during crises.

The fourth measure used in our investigation is the change in real money in relation to GDP:

$$m_t = \frac{M_t(1-\pi_t) - M_{t-1}}{GDP_{t-1}}. \qquad (6)$$

The rate of money growth decreases during crises because of credit rationing and investor flight from the banking system. This measure is especially notable, because it allows for a comparison with other studies of the money – output relationship. Empirical research has found that such a relationship is usually significant in both directions. Output growth causes changes in the money supply, and increases in money have an impact on output growth (Bernanke, 1986; Christiano, Ljungquist, 1988; Stock, Watson, 1996; Psaradakis, Ravn and Sola, 2005; and others).[6]

2.2 Relationship between banking crises and output growth

Economic theory enables us to distinguish several channels through which banking crises affect output growth (e.g., Hoggarth, Reis and Saporta, 2002). First, a number of bank failures reduces credit and money supply and may lead to a recession. In a version of the IS/LM model developed by Bernanke and Blinder (1988), where the credit market is explicitly distinguished from the bond market, downward credit supply shocks limit both investment and consumption and lead to lower output. Similarly, a negative shock to the money supply causes an adjustment of output at a new reduced level.

Second, this mechanism can be magnified, when preventive policies of banks (caused

[6] The percentage change in real credit and the percentage change in real money are analogous to the first and fourth measure discussed here, respectively. Another candidate measure, the change in real deposit in relation to GDP, is similar to variables defined in equations (1) and (6). However, it is negative only during the second year of a crisis and it is positive or close to zero in other years.

by increased uncertainty about future financial stability among other factors) restrict credit solely to firms that are in a relatively good shape and cause weaker firms to go bankrupt (e.g., Stiglitz, 1989). More restrictive credit limits may also force companies to cut trade credits to their customers and subsequently to reduce output (e.g., Love, Preve and Sarria-Allende, 2007). In a credit rationing regime, the financial accelerator mechanism, where borrowers with relatively worse financial positions borrow and invest less, plays a significant role (e.g., Bernanke, Gertler and Gilchrist, 1996).

Third, bank failures and credit rationing policies of banks can generate the loss of information about customers, hinder obtaining credit elsewhere, and as a result increase the costs of economic activity. Fourth, depositors may lose confidence in banks, or banks may lose confidence in other banks, causing the payment system to malfunction, and severely damage any trade. Finally, banking crises may also be accompanied by debt and currency crises. Such “twin” or “triple” crises will lead to even stronger contractions in economic activity, e.g. via balance sheet effects (e.g., Hutchison and Noy, 2005).

There is also another side to the relationship: falling output growth has an impact on different banking crisis measures, such as credit growth or deposit growth. Recessions bring about more restrictive credit policies of banks (e.g. expecting an increase in non-performing loans). Declining asset prices during recessions also reduce the value of firms and their collateral, both of which are (ceteris paribus) essential in order to obtain credit. Additionally, companies with balance sheet problems may reduce their demand for bank loans during recessions.

A recession or economic slowdown also affects money and deposits. For example, households may save less during recessions due to declining earnings and greater unemployment. The empirical literature confirms that the fall in output among other factors is a good predictor of banking crises (e.g., Demirgüç-Kunt and Detragiache, 1998; Kaminsky and Reinhart, 1999).

It is notable that the bank activity indicators, approximating the size of banking crises, are strongly interrelated. For example, deposit growth may decelerate during banking crises due to the limited confidence of depositors in some banks, bank runs or bank failures. Since deposits are an important element of money aggregates (e.g. M2), money growth will also be affected.

Money and credit growth are directly linked through the process of money creation, since new loans provided to customers eventually return to banks as new deposits and enable banks to make further loans (credit multiplier effect). The credit multiplier effect may change during crises, as it depends, among other factors, on the ability of banks to provide new loans (e.g. due to capital and liquidity constraints), credit policies of banks, customers' demand for credit, and the propensity of depositors to keep deposits. However, theoretically, credit and money do not always have to move in the same direction. In the Bernanke and Blinder's model (1988), exogenous upward shifts in credit demand increase aggregate credit (and the interest rate on loans), but reduce output and money. In turn, exogenous increases in money demand cause a contraction of output and credit.

2.3 Econometric approach

To estimate the relationship between the extent of the crisis and output growth, we employ an event-study method. A typical event-study employs one-equation models to check for the dependence of a selected variable on a specific event. However, in the case of a banking crisis, the variables to measure the crisis and output growth affect each other in the sample. In such circumstances the standard event-study that uses one-equation estimation methods would give biased results due to omitted bidirectional dependence (e.g., Rigobon and Sack, 2004).

A straightforward solution to this problem is to employ a system of equations, where both output growth and the banking crisis variable affect each other in separate equations. We build the following two-equation model describing the link between crisis measure and output growth:

$$\begin{aligned} c_{it} &= \alpha y_{it} + A x_{it} + \varepsilon_{it} \\ y_{it} &= \beta c_{it} + B x_{it} + \eta_{it} \end{aligned}, \tag{7}$$

where c_{it} denotes the crisis size variable (e.g., credit growth) in country *i* at time *t*, and y_{it} represents output growth. x_{it} is a column vector of exogenous factors including a constant term that influences both endogenous variables (e.g. indicator variables for currency, debt and systemic banking crises, changes in the real effective exchange rate, the real interest rate, variables classifying the foreign exchange rate regime, measures of economic, financial and political development), *A* and *B* are row vectors of structural parameters, and ε_{it} and η_{it} are independent disturbance shocks. The parameter α describes the impact of output on the size of the crisis. A 1 percentage point fall in output growth increases the size of a crisis (e.g., decreases the credit growth) by α percentage points.

Similarly, parameter β denotes a fall in output growth (in percentage points) after the 1 percentage point fall in credit growth or another measure of the extent of the crisis. Thus, the parameter β measures the average effect of banking crises on output growth after controlling for the impact of changes in output growth on crisis measures. The null hypothesis that we test is $\beta = 0$, which means that the fall in output growth does not depend on the extent of a banking crisis. The alternative hypothesis is $\beta > 0$. If banking crises matter for output growth, the parameter β should be significantly greater than zero.

To assess how banking crises reduce output growth, it is necessary to identify and estimate the parameters of an output growth equation. However, the output equation is not identifiable, unless an exogenous variable that influences directly credit growth, but not output growth is proposed. This task is difficult due to the lack of such variables that are available for approximately 100 countries in our sample. Indeed, when the ordinary least squares method (OLS) is applied to the output growth equation, i.e. when the identification problem is ignored, the estimate of β will be biased.

This identification problem is an important issue for studies analyzing costs of banking crises. Some researchers argue that their calculations estimate output losses during the crisis rather than the loss in output "caused" by the crisis (e.g., Boyd, Kwak, Smith, 2005). Others attempt to identify the costs of banking crises by comparing the behavior of crisis countries with neighboring countries that did not face the crisis (Hoggarth, Reis and Saporta, 2002) or by comparing the performance of firms more dependent on external finance with those less dependent (Dell'Ariccia, Detragiache and Rajan, 2005, Kroszner, Leaven and Klingebiel, 2007). In a different context, Levine, Loayza and Beck (2000) use lagged values of credit and deposits as instruments and estimate the impact of financial development on economic growth.

We deal with the identification problem by defining a set of the econometric instruments that are correlated with our banking crisis measures but not correlated with the disturbance shock η_{it} in the output growth equation in model (7). We use the "identification through heteroscedasticity" (IH) method, proposed by Rigobon (2003) and Rigobon and Sack (2004) and the analogous "identification through changes in mean" (ICM) technique to estimate the impact of banking crises on output growth.

Let the variance of the disturbance shock ε_{it} to the crisis measure change between the two sub-samples T_1 and T_2. There are N_1 observations of ε_{it} in the sub-sample T_1 and N_2 observations in the sub-sample T_2. The whole sample consists of $N = N_1+N_2$ observations of analyzed variables. The variances of the disturbance shock η_{it} and the exogenous variables x_{it} remain constant in these sub-samples. The valid instruments for the crisis variable c_{it} in model (7) are:

$$vc_{it} = \begin{cases} \dfrac{c_{it}}{N_1} & when \quad it \in T_1 \\ -\dfrac{c_{it}}{N_2} & when \quad it \in T_2 \end{cases} \qquad (8)$$

and

$$vy_{it} = \begin{cases} \frac{y_{it}}{N_1} & when \quad it \in T_1 \\ -\frac{y_{it}}{N_2} & when \quad it \in T_2 \end{cases}. \tag{9}$$

Additionally, when there is a negative or positive shock to the crisis equation that changes the mean of our crisis measure c_{it} in one of the sub-samples T_1 and T_2 without affecting the disturbance shock η_{it} or exogenous variables x_{it}, then another instrument may be used:

$$m_{it} = \begin{cases} \frac{1}{N_1} & when \quad it \in T_1 \\ -\frac{1}{N_2} & when \quad it \in T_2 \end{cases}. \tag{10}$$

This instrument is analogous to the dummy variable indicating crisis periods, used by Demirgüç-Kunt, Detragiache and Gupta (2006) in the regressions explaining output growth. However, they use the OLS method to estimate output growth during crises.

All instruments vc_{it}, vy_{it} and m_{it} enable us to identify the output equation and to estimate the parameter β in model (7) consistently using the generalized method of moments (GMM).[7] Although the instruments have a clear interpretation in our investigation, the validity of overidentification restrictions imposed by these instruments can be tested using the Sargan-Hansen *J*-statistic. We employ this statistic and the moment selection procedure of Andrews (1999) to select the optimal group of instruments.

We justify the use of the identification method in a specific way. We note that means and variances of the crisis measures may change during the calm and banking crisis periods or may depend on the given country's economic and financial development.

First, the banking aggregates are not only affected by macroeconomic variables and

[7] The crisis measure equation in (7) remains unidentifiable, i.e. it cannot be estimated. We explain the derivation of instruments in the IH and ICM methods in Appendix 1.

recession during crises, but also by idiosyncratic shocks that are specific to the banking sector and independent from real business cycles. Such shocks include financial problems and failures of banking institutions caused by poor management, insufficient supervisory regulations, frauds, and contagion from other institutions or other events not related to the economic slowdown. All of these shocks reduce credit, deposit and money growth even further than the real business cycle does.

Second, the levels of financial and economic development also determine the pace of credit, deposit, and money growth. This pace may be higher and more volatile in countries with less developed financial sectors due to the low initial level of credit and deposits, immature supervisory regulations, foreign investments (large in relation to the size of the local financial sectors), and other factors related to the catching-up process. Developing countries often conduct less reliable economic policies resulting in high inflation rates that decrease credit and deposit growth, measured in real terms.

3. Data and empirical results

3.1 Data

The first important area of the investigation is the identification of banking crisis episodes. We utilize the most comprehensive database of systemic and borderline banking crises constructed by Caprio, Klingebiel, Laeven and Noguer (2005), which includes 166 crisis events from over 100 countries. Caprio et al. argue that some judgment has gone into compilation of their list; however, systemic crises are generally defined as "much or all of bank capital being exhausted" (see also Caprio and Klingebiel, 2003). The starting dates of crises are also taken from this database.

All variables in our investigation are observed in a 14-year window from seven years before the crisis to seven years after. In this way we can compare the behavior of macroeconomic variables before and during the crisis. For example, the difference between the rate of credit growth during the crisis and before the crisis may indicate how significant the banking crisis was (Demirgüç-Kunt, Detragiache and Gupta, 2006).

The ending dates of banking crises are usually more difficult to identify. In order to overcome this problem, we measure the effects of crises over different time horizons. Our idea is to analyze data with different frequencies. Changes in output, credit and other variables are analyzed and compared from one year up to seven years. For each crisis the variables are measured twice: during the pre-crisis period and during the crisis period.

Since the somewhat imprecise definition of a crisis used by Caprio, Klingebiel, Laeven and Noguer (2005) makes the choice of certain crises rather problematic, the choice of crisis-extent measures becomes a major issue. As reported in the previous section, we use changes in real credit in relation to GDP, net deposit inflows (as percentage of old deposits), differences between money supply changes and changes of cash in circulation, and increases of real money in relation to GDP.

The data for output growth and crisis instruments were gathered from the International Financial Statistics (IFS) database of the International Monetary Fund. Some observations come from the ECOWIN database, when IFS data were unavailable. In addition we exclude a few crises for which data could not be obtained, and we have removed data for some countries that changed their definitions in the sample.

The output growth is calculated as an increase in the log-value of real GDP. In rare cases, when the GDP deflator was not available for some observations, nominal GDP was deflated with the consumption price index (CPI). Deposits are demand deposits, money aggregate is M2 (money plus quasi-money) in the IFS database, credit is domestic credit and cash is defined as the currency outside banks in the IFS database.

Changes in the real effective exchange rate and the real interest rate are used as the main explanatory variables for output growth and banking aggregate changes. These data also come from the IFS database. An appreciating exchange rate may decrease the value of credit and deposits denominated in foreign currencies and worsen the balance of foreign trade and GDP growth. Higher interest rates reduce investment and output growth, increase deposits, decrease demand for credit and increase the interest paid on loans.

The values of deposit interest rates, which are used in two crisis measures described by formulas (3) and (5), were not available for all countries in the dataset. Therefore we employed a fraction of a short-term market interest rate as a proxy for the deposit rate in all countries.[8] We also experimented with the inflation rate and different fractions of a short-term market interest rate and received similar results.

We construct indicators of the level of democracy for each country using the POLITY IV database.[9] Such a variable could possibly have an impact on output growth and credit growth as a proxy for the political impact on financial markets and the real economy. As many examples of communist and other authoritarian regimes suggest, autocracy and dictatorship hinder economic activity, so the level of democracy may point to the level of economic development in a country. Similarly, Gross National Income (GNI) per capita for each country is used as another proxy for the long-term level of economic development.[10]

The following distinct binary variables are employed to denote periods of currency crises in some countries and to identify cases of systemic crises, respectively. The variable $currcrisis_{it}$ takes on value 1 in the periods (crisis or calm), where the real effective exchange rate falls by more than 25% during at least one year, and 0 in other periods. As Kaminsky and Reinhart (1999) note, banking crises that are accompanied by currency crises (twin crises) have a more significant impact on economic growth than individual banking crises. The variable $systemic_{it}$ equals 1 in both calm and crisis periods related to the crises that are

---

[8] The deposit rate is calibrated to equal one-half of the market rate, with the parameter *k* equal 0.3 in formula (4). The general results do not change when we use other values of these parameters.

[9] The POLITY IV database is maintained through a partnership between the University of Maryland's Center for International Development and Conflict Management and the George Mason University Center for Global Policy.

[10] We obtained GNI per capita for the year 1975 from the World Bank database. Since the analysis focuses on the short-term (up to seven years) costs of banking crises, the year of an observation for the long-term development indicator should have a limited impact on our results.

systemic according to Caprio, Klingebiel, Laeven and Noguer (2005). This variable equals 0 for borderline crises. Similarly, the variable $debtcrisis_{it}$ equals 1 when there is a debt crisis in a country and 0 otherwise. The periods of sovereign debt crises are taken from Manasse, Roubini and Schimmelpfennig (2003).

The effect of currency and debt crises on economy may depend on the foreign exchange regime, therefore we also define the binary variables fx_fix_{it}, fx_peg_{it}, fx_crawl_{it}, fx_float_{it}, that identify mutually exclusive foreign exchange regimes. The variable fx_fix_{it} takes on value 1 in the fixed exchange rate regime and 0 otherwise. Similarly, fx_peg_{it} equals 1 in the regime with a fixed peg or pegged within a horizontal band, fx_crawl_{it} takes on value 1 in the regimes with crawling peg, crawling band, and dirty float, and fx_float_{it} equals 1 in the floating exchange rate regime. We use data on currency regimes from Levy-Yeyati, Sturzenegger (2005) and Babula and Ötker-Robe (2002).

3.2 Empirical results

Our analysis focuses on the impact of banking crises on output growth after controlling for the influence of recessions and other macroeconomic shocks. We start by presenting differences between the values of crisis instruments in pre-crisis and crisis periods, and then show key estimates from the event study method.

We calculate values of the four crisis measures and output growth in different time horizons, and investigate from one-year up to seven-year changes in real credit (in relation to GDP) for the pre-crisis and crisis periods, averaged over all banking crises. Similar calculations are conducted for changes in deposits, for differences between changes of money and changes in cash, and for real money increases (in relation to GDP). In order to compare the behavior of banking crisis measures and output growth, we also analyze the accumulated GDP growth over the same time horizons.

We utilize the IH and ICM methods and estimate different specifications of the output equation in model (7) to measure how the size of a crisis impacts on economic growth. The identification methods used in our investigation require sub-samples T_1 and T_2 to be constructed. There are three different ways in which the estimation sample is divided into sub-samples in our investigation. We distinguish between calm and crisis periods, developed and developing economies, and developed and developing financial sectors. For each crisis event we select a period t_{calm} before the crisis and a period t_{crisis} after the start of the crisis. The whole sample consists of calm and crisis periods for each of N_{crisis} crisis events. Therefore we have N=2N_{crisis} observations in the estimation sample.

The measure of economic development is Gross National Income per capita in each country in the year 1975 and the measure of financial development is the ratio of credit to GDP in each country (averaged over the pre-crisis and crisis period).[11] In order to obtain sub-samples with the same number of observations we use the median of the development measures to divide the sample into two sub-samples. Detailed formulas are presented in Table 1.[12]

[Table 1 around here]

Table 1 reports means and variances of the output growth and crisis measures in each sub-sample. The analyzed variables often exhibit significant differences both in mean and in variance across sub-samples, which allows us to construct 18 distinct instruments in line with formulas (6), (7) and (8). The values of the respective banking crisis measures are utilized to build these instruments, as explained in subsection 2.3. The names of the constructed instruments (in the fourth and seventh column) are presented in the same rows as their corresponding banking crisis measures in Table 1.

Ideal instruments should be correlated with our crisis measures, but uncorrelated with the error term η_{it}. We use the moment selection procedure of Andrews (1999) and the Sargan-

11 We also experimented with GNI per capita in the year 2000 and seven years before the crisis as measures of economic development and cash in circulation to money supply as a measure of financial development. The results were very similar.

12 The number of observations is usually less than N and the sub-samples have approximately the same number of observations due to missing values of variables in some periods.

Hansen test of overidentifying restrictions and eliminate some instruments if the test rejects the restrictions imposed by these instruments. In most specifications all instruments are selected for each banking crisis measure. Table 2 presents correlations between econometric instruments and analyzed variables. Our measures of banking crises are generally positively but not perfectly correlated with each other, only deposit growth shows weak dependence with other variables. As discussed in subsection 2.2, the variables may point to different channels through which crises affect economic activity.

[Table 2 around here]

For each of the crisis variables we employ four different specifications of the model (7). In the first specification, S1, the vector of exogenous variables, x_{it}, contains only the constant term. In the second version of the model, S2, the vector x_{it} also contains changes in the real effective exchange rate and the real interest rate. Specification S3 includes additional binary exogenous variables: $currcrisis_{it}$, $debtcrisis_{it}$ and $systemic_{it}$, which identify currency crises, debt crises and systemic banking crises, respectively. The variable $fxregime_{it}$ classifying the foreign exchange rate regime in each country is also included in the specification S3. Finally, in the final and most general version of our model (7), S4, the vector x_{it} includes three measures of economic, political, and financial development in addition to the already mentioned variables. Respectively, these are GNI per capita in a country in 1975, the level of autocracy in a country at time t, and the ratio of cash in circulation to money supply. The first measure is a long-term variable that does not change over time; the latter two variables are allowed to change due to new political regimes and financial development.

Estimates from different specifications may be treated as a robustness check of our analysis. Horizons from one-year up to seven-year-long are investigated for all specifications and instruments to observe the reaction of output growth in different time horizons. We also consider horizons equal to the length of the crises.

[Table 3 around here]

Table 3 presents results from these specifications of the model, where the real credit growth is a measure of the extent of the crisis. Estimates of the β parameter in different specifications are displayed in rows, and the results for different time horizons are given in columns. The values in parentheses denote the t-statistics of the parameter estimates.

The parameter β indicates how much output growth will change on average after a 1 percentage point increase in the value of a crisis measure (e.g., credit growth). For example, the value 0.182 in the second column, corresponding to the specification S2, denotes that a drop in the rate of real credit growth in relation to GDP by 1 percentage point causes the real GDP growth rate to decline on average by 0.182 percentage points over a two-year period.

The change in credit growth usually has a significant impact on the real output growth regardless of the investigated specification and the time horizon. All significant estimates of the parameter β are greater than zero, and range between 0.080 (for the specification S4 and a time horizon dependent on the length of each crisis) and 0.311 (for the specification S2 and a time horizon of three years).

According to Frydl (1999), an average banking crisis does not typically last longer than four years. In our sample, accumulated credit growth (in relation to GDP) was lower on average by 9.4 percentage points during the four years of a crisis than in the four-year period preceding a crisis. From estimates in Table 3, it is possible to calculate that this declining credit growth reduced real GDP growth by 2.0 percentage points during the four years of a typical crisis.

[Table 4 around here]

In Table 4 the estimated parameters indicate reactions of the real GDP growth to changes in net deposit inflows in an analogous way to Table 3. The values of β parameters are generally not significantly greater than zero for any time horizons, which suggests that the declining deposits do not have a significant effect on economic growth during crises. Indeed, only the results for specifications S3 and S4 and the time horizons between 3 and 5 years show some impact: up to 1.0 percentage point of GDP growth during a four-year crisis.

[Table 5 around here]

Table 5 provides information about the impact of changes in the third crisis measure on real economic growth. The third measure is the difference between percentage changes in money supply and percentage changes of cash in circulation, as described by formula (4). The slower the increase of money relative to the growth rate of cash, the more significant the impact of a banking crisis on output growth should be.

Here, the parameters are generally significantly greater than zero for the time horizons between 3 and 4 years. The impact on output decline after a four-year crisis is estimated 0.8 percentage points.[13] For longer time horizons, the third measure is usually negative and cannot be treated as an indicator of a banking crisis. As discussed earlier, this variable indicates that crises last up to four years on average, and that in the fifth year their effect vanishes.

[Table 6 around here]

The last instrument employed in our analysis is a change in real money measured as a percentage of GDP. The impact of this measure on output growth is statistically significant for most specifications and time horizons. The β parameter is insignificant for the two-year horizon. The significant values of the parameter range between 0.149 and 0.600. For example, selecting a four-year horizon leads to the conclusion that the money growth in relation to GDP was on average 1.9 percentage points lower during crisis periods than before crises. The declining money growth reduced real GDP growth by 0.6 to 1.1 percentage points, depending on the model specification.

Generally, these results suggest that at least two out of four banking aggregates have a significant impact on output growth during banking crises. Although the values of the β

[13] The significant result (0.255) for the specification S3 and the six-year horizon is not an outlier. The sample was reduced in this specification due to missing data for some explanatory variables and the actual value of the third measure was negative.

parameters in models depend on time-horizons and model specifications, the significant parameters are always greater than zero.

The change in parameter values depending on the time horizon can be attributed to two aspects. One is the possibility that output effects last longer than crises. Some measures of the extent of banking crises may affect output growth with a lag. Therefore, even when the crisis fades, output growth will still fall. Thus, the parameters β for longer periods will have higher values, because the accumulated impact of the already terminated crisis on the falling GDP growth will be stronger. A second reason is the fact that the number of crises for which longer time series are available is limited. The longer the time horizon, the less data are available.

The change in parameter values depending on the specification (S1, S2, S3, and S4) can be explained by the fact that certain significant variables could be omitted in some more restricted specifications (like S1) and some insignificant variables could be included in more general specifications (like S4). Nevertheless, the impact of banking crises on output growth is significant in most specifications.

The results obtained also suggest that the average macroeconomic effects of banking crises are less severe than earlier research, based on smaller samples of crises, suggested (e.g., Hutchinson and Noy, 2005; Demirgüç-Kunt, Detragiache, and Gupta, 2006). Controlling for the downward impact of recessions on banking activity could be one important explanation of this outcome. Empirical studies show that some banking crises were not always associated with a decline in output growth (e.g., Hoggarth, Reis and Saporta, 2002). Possible causes are suitable economic policies and macroeconomic factors (e.g., increased government spending, growing foreign trade), which alleviate the effects of crises. During less significant (non-systemic) crises important functions of affected banks may be taken over by other institutions. Indeed, in some less developed countries local banking sectors play a relatively minor role in financing the economic activity. Also, even in developed markets the impact of a banking crisis may be imperceptible when the crisis follows an economic depression with some delay and the output returns into an upward trend at the outbreak of the crisis.

Another explanation for the small average declines of output growth in our sample is the fact that the average changes in bank activity indicators were not excessive during crises. The estimated models indicate that the costs were serious in countries with more developed banking sectors and during more severe crises, where changes in bank aggregates were large in relation to GDP.

As a robustness check to our event-study method, we also considered the dynamic panel data models similar to those considered by Levine, Loayza, and Beck (2000) and found that two main bank activity indicators, i.e. changes in real credit and changes in real money, significantly affect output growth during banking crises. We also experimented with individual time-series models for each country separately and found the average effect of these variables to be significant as well, although the problem of endogenous explanatory variables could not be resolved in this case. More details are presented in Appendix 2.

Finally, it is worth noting that all four crisis measures are correlated with each other (see Table 2 and discussion in section 2.2). Therefore the overall effect on output growth cannot be calculated by accumulating the individual effects of the respective measures. We purely seek to show how individual banking sector variables influence economic growth. However, future analyses could construct a cumulative measure of the extent of a crisis and measure its impact on GDP growth.

Conclusions

In answer to the main questions whether banking crises cause economic slowdown and to what extent the size of a crisis affects GDP growth, we conclude that even after controlling for the impact of recessions on the size of crises, banking crises cause output growth to slow down.

We obtain our results by proposing a technique that is novel in the area of banking crisis research. Our method uses an event-study approach and multi-equation models, and applies measures of banking crises constructed from banking sector aggregates, employing a large dataset of over 100 banking crises.

Although the precise impact of some crisis measures is difficult to assess, the typical decelerations in growth of credit cause a reduction in accumulated four-year GDP growth by around 2 percentage points. A significant relationship between credit and money dynamics, and output growth suggests that the credit and monetary transmission channels are responsible for transferring banking crises to the real economy.

Some economists argue that countries experiencing occasional crises grow faster than countries with stable financial systems (e.g., Ranciere, Tornell, and Westermann, 2005), but others point to significant slow down of economies during crises. Our findings support the view that crises are costly for economies, at least in the short-term. The results related to banking crises are also similar to those obtained for other types of crises, e.g. currency and political crises (Cerra, Saxena, 2005; Hutchison, Noy, 2005).

Acknowledgements

The paper has benefited from very helpful comments from two anonymous referees, Martin Bohl, Bartosz Gębka, Glenn Hoggarth, Paulina Sotomska-Krzysztofik, Olga Szczepańska, Dobiesław Tymoczko, and participants of the seminars at the Warsaw School of Economics, Westfälische Wilhelms-Universität Münster and the National Bank of Poland. Dario D'Onofrio provided interesting comments and excellent research assistance. Author acknowledges financial support from the Foundation for Polish Science.

Appendix 1

In this Appendix, we explain the derivation of instruments (8), (9) and (10) in the "identification through heteroscedasticity" method developed by Rigobon and Sack (2004) and the analogous "identification through changes in mean" method. The model describing the link between the crisis measure c_{it} and output growth y_{it} is given by:

$$\begin{aligned} c_{it} &= \alpha y_{it} + Ax_{it} + \varepsilon_{it} \\ y_{it} &= \beta c_{it} + Bx_{it} + \eta_{it} \end{aligned}, \tag{A1}$$

From the reduced form of the model (A1):

$$\begin{aligned} c_{it} &= \frac{1}{1-\alpha\beta}[Gx_{it} + \varepsilon_{it} + \alpha\eta_{it}] \\ y_{it} &= \frac{1}{1-\alpha\beta}[Hx_{it} + \beta\varepsilon_{it} + \eta_{it}] \end{aligned} \tag{A2}$$

we can derive the covariance matrices of the variables c_{it} and y_{it}, in the subsamples T_1 and T_2, $\Omega^{T_1} = E\left([c_{it} \quad y_{it}]'[c_{it} \quad y_{it}] \mid it \in T_1\right)$ and $\Omega^{T_2} = E\left([c_{it} \quad y_{it}]'[c_{it} \quad y_{it}] \mid it \in T_2\right)$:

$$\Omega^{T_1} = \frac{1}{(1-\alpha\beta)^2}\begin{bmatrix} G\Omega_x^{T_1}G' + \sigma_\varepsilon^{T_1} + \alpha^2\sigma_\eta^{T_1} & G\Omega_x^{T_1}H' + \beta\sigma_\varepsilon^{T_1} + \alpha\sigma_\eta^{T_1} \\ \cdot & H\Omega_x^{T_1}H' + \beta^2\sigma_\varepsilon^{T_1} + \sigma_\eta^{T_1} \end{bmatrix},$$

$$\Omega^{T_2} = \frac{1}{(1-\alpha\beta)^2}\begin{bmatrix} G\Omega_x^{T_2}G' + \sigma_\varepsilon^{T_2} + \alpha^2\sigma_\eta^{T_2} & G\Omega_x^{T_2}H' + \beta\sigma_\varepsilon^{T_2} + \alpha\sigma_\eta^{T_2} \\ \cdot & H\Omega_x^{T_2}H' + \beta^2\sigma_\varepsilon^{T_2} + \sigma_\eta^{T_2} \end{bmatrix},$$

where $\Omega_x^{T_i}$ is the covariance matrix of the control variables x_{it} in the subsample T_i, $\sigma_\varepsilon^{T_i}$ is the variance of ε_{it} in the subsample T_i, $\sigma_\eta^{T_i}$ is the variance of η_{it} in the subsample T_i. We note that $\Omega_x^{T_1} = \Omega_x^{T_2}$ and $\sigma_\eta^{T_1} = \sigma_\eta^{T_2}$, but $\sigma_\varepsilon^{T_1} \neq \sigma_\varepsilon^{T_2}$. Rigobon and Sack (2004) propose to calculate the difference between the two covariance matrices to identify the parameter β:

$$\Delta\Omega = \Omega^{T_2} - \Omega^{T_1} = \frac{(\sigma_\varepsilon^{T_2} - \sigma_\varepsilon^{T_1})}{(1-\alpha\beta)^2}\begin{bmatrix} 1 & \beta \\ \beta & \beta^2 \end{bmatrix}. \tag{A3}$$

Let $\Delta\Omega_{ij}$ be the (*i*, *j*) element of the matrix $\Delta\Omega$. We obtain the value of the parameter β by dividing the respective elements of the matrix $\Delta\Omega$:

$$\beta = \frac{\Delta\Omega_{12}}{\Delta\Omega_{11}} \tag{A4}$$

or

$$\beta = \frac{\Delta\Omega_{22}}{\Delta\Omega_{12}}. \tag{A5}$$

Rigobon and Sack show that two alternative estimates of the parameter β , analogous to expressions (A4) and (A5), are given by:

$$\hat{\beta} = \frac{\frac{1}{N_2}(\mathbf{c}_{T_2})'\mathbf{y}_{T_2} - \frac{1}{N_1}(\mathbf{c}_{T_1})'\mathbf{y}_{T_1}}{\frac{1}{N_2}(\mathbf{c}_{T_2})'\mathbf{c}_{T_2} - \frac{1}{N_1}(\mathbf{c}_{T_1})'\mathbf{c}_{T_1}}, \tag{A6}$$

$$\hat{\beta} = \frac{\frac{1}{N_2}(\mathbf{y}_{T_2})'\mathbf{y}_{T_2} - \frac{1}{N_1}(\mathbf{y}_{T_1})'\mathbf{y}_{T_1}}{\frac{1}{N_2}(\mathbf{c}_{T_2})'\mathbf{y}_{T_2} - \frac{1}{N_1}(\mathbf{c}_{T_1})'\mathbf{y}_{T_1}}, \tag{A7}$$

where $\mathbf{c}_{T_i} = [c_{it}]_{N_i}$ and $\mathbf{y}_{T_i} = [y_{it}]_{N_i}$ are vectors containing observations of the respective variables from the subsample T_i. N_i is the number of observation in the subsample T_i. The formulas (A6) and (A7) are equivalent to estimating β with the use of instrumental variables vc_{it} and vy_{it}:

$$\hat{\beta} = (\mathbf{vc}'\mathbf{c})^{-1}(\mathbf{vc}'\mathbf{y}), \tag{A8}$$

$$\hat{\beta} = (\mathbf{vy}'\mathbf{c})^{-1}(\mathbf{vy}'\mathbf{y}), \tag{A9}$$

where $\mathbf{vc} = [vc_{it}]_N$, $\mathbf{vy} = [vy_{it}]_N$, $\mathbf{c} = [c_{it}]_N$ and $\mathbf{y} = [y_{it}]_N$ are vectors containing all observations of the respective variables from our sample.

Similarly, if we assume that the means of the variables x_{it} and η_{it} do not change between the subsamples T_1 and T_2 and only the disturbance shock ε_{it} changes its mean, we can derive the difference between the expected values of the variables c_{it} and y_{it}, in each subsample as:

$$\Delta E\begin{pmatrix} c_{it} \\ y_{it} \end{pmatrix} = \frac{E^{T_2}(\varepsilon_{it}) - E^{T_1}(\varepsilon_{it})}{1-\alpha\beta}\begin{bmatrix} 1 \\ \beta \end{bmatrix} , \tag{A10}$$

where $E^{T_i}(\varepsilon_{it})$ is the expected value of the disturbance shock ε_{it} in the subsample T_i. Now, the appropriate formula to estimate β is:

$$\hat{\beta} = \frac{\frac{1}{N_2}\mathbf{e}'\mathbf{y}_{T_2} - \frac{1}{N_1}\mathbf{e}'\mathbf{y}_{T_1}}{\frac{1}{N_2}\mathbf{e}'\mathbf{c}_{T_2} - \frac{1}{N_1}\mathbf{e}'\mathbf{c}_{T_1}}, \tag{A11}$$

where $\mathbf{e}$ is the vector of ones. This is equivalent to using the instrument m_{it} defined by (8) in the instrumental variable estimation formula:

$$\hat{\beta} = (\mathbf{m}'\mathbf{c})^{-1}(\mathbf{m}'\mathbf{y}), \tag{A12}$$

where $\mathbf{m} = [m_{it}]_N$ is the vector containing all observations of m_{it}. In the generalized method of moments all instruments vc_{it}, vy_{it} and m_{it} are used simultaneously to estimate β.

Appendix 2

As a robustness check to the event study method, we also consider the following dynamic panel data model and use the general method of moments (GMM) to estimate its parameters:

$$y_{it} = \delta y_{it-1} + \beta c_{it} + Bx_{it} + \eta_{it}. \tag{A13}$$

A transformation is applied to the specification of this model to remove cross-section fixed effects. We use both "first differences" and "orthogonal deviations" transformations (Arellano and Bond, 1991; Arellano and Bover, 1995). The GMM estimator is the Arellano-Bond 2-step estimator with White serial-correlation robust standard errors. We employ lagged values of the variables y_{it} and c_{it} as dynamic panel instruments for y_{it} and c_{it}, as proposed by Arellano and Bond (1991). In this case we use 14 yearly observations of the respective variables from the calm and crisis periods for each of *N* crisis events.

The estimates presented in Table A2 suggest that two main crisis indicators, i.e. changes in real credit and changes in real money, significantly affect output growth. In most cases the values of the parameter β are significantly larger than zero, regardless of the specification and the estimation method. The Sargan-Hansen tests (*J*-statistic) of over-identifying restrictions also indicate that the over-identifying restrictions are valid in our specifications.

These results are in line with those obtained by Levine, Loayza and Beck (2000), who use the same methodology, but different measures of changes in credit and liabilities, as well as a different set of countries and a different sample period. In contrast to their study, we check if the causation effects from credit and liabilities to output growth are present during banking crises.

Additionally, we experimented with individual time-series models for each country separately and found the average effect of these variables to be significant as well, although the problem of endogenous explanatory variables could not be resolved in this case.

Finally, we estimated our original models using only those instrumental variables (defined in equations 8, 9 and 10) that changed their values before and during the crisis (m_{it}^{crisis}, vy_{it}^{crisis}, $vc1_{it}^{crisis}$, $vc2_{it}^{crisis}$, $vc3_{it}^{crisis}$, $vc4_{it}^{crisis}$ in Table 1). The results confirm that slowing credit and money growth affect output growth during crises. Detailed results are available upon request.

References

Andrews, D. W. K., 1999. Consistent Moment Selection Procedures for Generalized Method of Moments Estimation. Econometrica 67, 543 - 564.

Arellano, M., Bond, S., 1991. Some Tests of Specification for Panel Data: Monte Carlo Evidence and an Application to Employment Equations. Review of Economic Studies 58, 277 - 297.

Arellano, M., Bover, O., 1995. Another look at the instrumental variable estimation of error-components models. Journal of Econometrics 68, 29 - 51.

Atanasova, Ch., 2003. Credit Market Imperfections and Business Cycle Dynamics: A Nonlinear Approach, Studies in Nonlinear Dynamics & Econometrics 7 (Issue 4, Article 5).

Babula, A., Ötker-Robe, İ., 2002. The Evolution of Exchange Rate Regimes Since 1990: Evidence from De Facto Policies. IMF Working Paper 02/155.

Balke, N. S., 2000. Credit and Economic Activity: Credit Regimes and Nonlinear Propagation of Shocks. Review of Economics and Statistics 82, 344 - 349.

Bernanke, B. S., 1986. Alternative Explanations of the Money–Income Correlation. Carnegie–Rochester Conference Series on Public Policy 25, 49 - 99.

Bernanke, B., Gertler, M., Gilchrist, S., 1996. The Financial Accelerator and the Flight to Quality. Review of Economics and Statistics 78, 1 - 15.

Barro, R. J., 2001. Economic Growth in East Asia Before and After the Financial Crisis. NBER Working Paper 8330, New York.

Bordo, M., Eichengreen, B., Klingebiel, D., Soledad Martinez-Peria, M., 2001. Is the Crisis Problem Growing More Severe? Economic Policy 16, 51 - 82.

Boyd, J. H., Kwak, S., Smith, B., 2005. The Real Output Losses Associated with Modern Banking Crises. Journal of Money, Credit, and Banking 37, 977 - 999.

Calza, A., Sousa, J., 2005. Output and Inflation Responses to Credit Shocks: Are There Threshold Effects in the Euro Area? Studies in Nonlinear Dynamics & Econometrics 10 (Issue 2, Article 3).

Caprio, G., Klingebiel, D., 2003. Episodes of Systemic and Borderline Financial Crises, World Bank Dataset, Washington.

Caprio, G., Klingebiel, D., Laeven, L., Noguera, G., 2005. Appendix: Banking Crisis Database, in Honohan, P., Laeven, L., (eds.), Systemic Financial Crises: Containment and Resolution. Cambridge, U.K., Cambridge University Press.

Cerra, V., Saxena, S. Ch., 2005. Growth Dynamics: The Myth of Economic Recovery. IMF Working Paper 05/147, Washington.

Christiano, L. J., Ljungqvist, L., 1988. Money does Granger–Cause Output in the Bivariate Money–Output Relation. Journal of Monetary Economics 22, 217 - 235.

Dell'Ariccia, G., Detragiache, E., Rajan, R., 2005. The real effect of banking crises. IMF Working Paper 05/63, Washington.

Demirgüç-Kunt, A., Detragiache, E., 1998. The determinants of banking crises: evidence from developing and developed countries. IMF Staff Papers 45, 81 - 109.

Demirgüç-Kunt, A., Detragiache, E., Gupta, P., 2006. Inside the Crisis: An empirical analysis of banking systems in distress. Journal of International Money and Finance 25, 702 - 718.
Frydl, E. J., 1999. The Length and Cost of Banking Crises. IMF Working Paper 99/30, Washington.
Gupta, P., 2005. Aftermath of banking crises: Effects on real and monetary variables. Journal of International Money and Finance 24, 675 - 691.
Hoggarth, G., Reis, R., Saporta, V., 2002. Costs of banking system instability: some empirical evidence. Journal of Banking and Finance 26, 825 - 855.
Honohan, P., Klingebiel, D., 2000. Controlling Fiscal Costs of Banking Crises, Proceedings (Federal Reserve Bank of Chicago), 284 - 319.
Hutchison, M. M., Noy, I., 2005, How Bad Are Twins? Output Costs of Currency and Banking Crises. Journal of Money, Credit and Banking 37, 725 - 752.
International Monetary Fund, 1998. World Economic Outlook (May), Washington.
Kaminsky, G. L., Reinhart, C. M., 1999. The Twin Crises: The Causes of Banking and Balance of Payments Problems. American Economic Review 89, 473 - 500.
Kroszner, R. S., Leaven, L., Klingebiel, D., 2007. Banking crises, financial dependence, and growth. Journal of Financial Economics 84, 187 - 228.
Levine, R., Loayza, N., Beck, T., 2000. Financial intermediation and growth: Causality and causes, Journal of Monetary Economics 46, 31 - 77.
Levy-Yeyati, Sturzenegger, F., 2005. Classifying Exchange Rate Regimes: Deeds vs. Words. European Economic Review 49, 1603 - 1635.
Loayza, N., Rancière, R., 2005. Financial Development, Financial Fragility, and Growth, IMF Working Paper 05/170, Washington.
Love, I., Preve, L. A., Sarria-Allende, V., 2007. Trade Credit and Bank Credit: Evidence from Recent Financial Crises. Journal of Financial Economics 83, 453 - 469.
Manasse, P., Roubini, N., Schimmelpfennig, A., 2003. Predicting Sovereign Debt Crises, IMF Working Paper 03/221, Washington.
Psaradakis, Z., Ravn, M. O., Sola, M., 2005. Markov switching causality and the money-output relationship. Journal of Applied Econometrics 20, 665 - 683.
Ranciere, R., Tornell, A., Westermann, F., 2005. Systemic Crises and Growth. NBER Working Paper 11076, Cambridge, MA.
Rigobon, R., 2003. Identification Through Heteroskedasticity. Review of Economics and Statistics 85, 777 - 792.
Rigobon, R., Sack, B., 2004. The Impact of Monetary Policy on Asset Prices. Journal of Monetary Economics 51, 1553 - 1575.
Stiglitz, J. E., 1989. Money, Credit, and Business Fluctuations. NBER Working Paper 2823.
Stock, J. H., Watson, M. W., 1996. Evidence on Structural Instability in Macroeconomic Time Series Relations. Journal of Business and Economic Statistics 14, 11 - 30.
Willis, J. B., 1960. Gross Flows of Funds Through Mutual Savings Banks. Journal of Finance 15, 170 - 190.

Table 1: Means and standard deviations of the output growth and crisis measures in different sub-samples (three-year calm and crisis periods)

	Mean		Name of the constructed instrument	Variance		Name of the constructed instrument
	Sub-sample T_1	Sub-sample T_2		Sub-sample T_1	Sub-sample T_2	
	Sub-sample T_1 when $d_i \le median(d_i)$, sub-sample T_2 when $d_i > median(d_i)$					
real GDP	0.07	0.07	m_{it}^{d}	0.13	0.10	vy_{it}^{d}
real credit	0.00	0.11	m_{it}^{d}	0.12	0.23	$vc1_{it}^{d}$
new deposits	0.25	0.13	m_{it}^{d}	0.52	0.35	$vc2_{it}^{d}$
money-cash	-0.06	0.03	m_{it}^{d}	0.25	0.22	$vc3_{it}^{d}$
real money	0.02	0.08	m_{it}^{d}	0.08	0.14	$vc4_{it}^{d}$
	Sub-sample T_1 when $GNI_i \le median(GNI_i)$, sub-sample T_2 when $GNI_i > median(GNI_i)$					
real GDP	0.07	0.07	m_{it}^{GNI}	0.10	0.11	vy_{it}^{GNI}
real credit	0.02	0.12	m_{it}^{GNI}	0.13	0.19	$vc1_{it}^{GNI}$
new deposits	0.08	0.27	m_{it}^{GNI}	0.40	0.46	$vc2_{it}^{GNI}$
money-cash	-0.02	0.03	m_{it}^{GNI}	0.20	0.24	$vc3_{it}^{GNI}$
real money	0.03	0.08	m_{it}^{GNI}	0.08	0.15	$vc4_{it}^{GNI}$
	Sub-sample T_1 when calm period, sub-sample T_2 when crisis period					
real GDP	0.09	0.05	m_{it}^{crisis}	0.14	0.12	vy_{it}^{crisis}
real credit	0.10	0.02	m_{it}^{crisis}	0.18	0.19	$vc1_{it}^{crisis}$
new deposits	0.21	0.17	m_{it}^{crisis}	0.40	0.50	$vc2_{it}^{crisis}$
money-cash	0.03	-0.05	m_{it}^{crisis}	0.19	0.28	$vc3_{it}^{crisis}$
real money	0.06	0.04	m_{it}^{crisis}	0.11	0.14	$vc4_{it}^{crisis}$

Note: The variable "real GDP" is the growth rate of real GDP, "real credit" is the growth rate of real credit in relation to GDP, "new deposits" are net deposit inflows as percentage of old deposits, "money-cash" is the difference between the growth rates of money and cash, and "real money" is the growth rate of real money in relation to GDP. The variable d_i is a measure of financial development (ratio of credit to GDP) in country i, GNI_i is a measure of economic development (GNI per capita in 1975). Observations from hyperinflationary economies are excluded from this analysis.

Table 2: Pairwise correlations between instruments and crisis measures and output growth (three-year calm and crisis periods)

Instrument	real GDP	real credit	new deposits	money-cash	real money
m_{it}^{d}	-0.02	-0.41	0.17	-0.18	-0.33
vy_{it}^{d}	0.16	-0.43	0.00	-0.26	-0.40
$vc1_{it}^{d}$	-0.22	-0.66	0.05	-0.19	-0.27
$vc2_{it}^{d}$	-0.13	-0.20	0.44	-0.20	-0.06
$vc3_{it}^{d}$	-0.19	-0.12	-0.13	-0.05	-0.22
$vc4_{it}^{d}$	-0.23	-0.32	0.16	-0.28	-0.58
m_{it}^{GNI}	0.09	-0.26	-0.15	-0.06	-0.20
vy_{it}^{GNI}	-0.07	-0.09	-0.07	0.04	-0.08
$vc1_{it}^{GNI}$	0.12	-0.27	-0.06	-0.02	-0.03
$vc2_{it}^{GNI}$	0.06	-0.08	0.05	-0.13	-0.10
$vc3_{it}^{GNI}$	0.09	0.00	-0.12	0.00	-0.14
$vc4_{it}^{GNI}$	0.09	-0.08	-0.10	-0.14	-0.39
m_{it}^{crisis}	0.28	0.16	0.11	0.18	0.06
vy_{it}^{crisis}	-0.15	0.28	0.07	0.09	0.13
$vc1_{it}^{crisis}$	0.33	0.28	0.06	0.11	0.31
$vc2_{it}^{crisis}$	0.11	0.07	-0.04	0.21	0.09
$vc3_{it}^{crisis}$	-0.02	0.03	0.15	-0.42	-0.16
$vc4_{it}^{crisis}$	0.24	0.35	0.11	-0.04	-0.14
real credit	0.26	1.00	0.03	0.33	0.54
new deposits	0.01	0.03	1.00	-0.11	0.10
money-cash	0.14	0.33	-0.11	1.00	0.48
real money	0.25	0.54	0.10	0.48	1.00

Note: All names of instruments and other variables are explained in Table 1. Observations from hyperinflationary economies are excluded from this analysis.

Table 3: Output growth reactions to one percentage point increase of real credit at different time horizons

		1 year	2 years	3 years	4 years	5 years	6 years	7 years	Length of the crisis
S1	β	0.245***	0.147***	0.311***	0.251***	0.187***	0.145***	0.136*	-0.024
	$t(\beta)$	(4.952)	(2.937)	(5.867)	(5.058)	(3.320)	(2.568)	(1.914)	(0.472)
	N	170	168	162	146	136	118	90	144
	J(d.f.)	0.063	0.125	0.148	0.152	0.134	0.147	0.225	0.124
	d.f.	17	17	17	16	17	17	17	17
S2	β	0.239***	0.182***	0.278***	0.229***	0.204***	0.098**	0.180***	-0.022
	$t(\beta)$	(5.045)	(4.339)	(5.047)	(4.654)	(3.616)	(1.884)	(2.699)	(0.470)
	N	170	158	152	136	124	106	76	132
	J(d.f.)	0.063	0.122	0.132	0.179	0.136	0.159	0.261	0.135
	d.f.	17	17	17	17	17	17	17	17
S3	β	0.209***	0.189***	0.292***	0.220***	0.213***	0.063	0.250***	0.090**
	$t(\beta)$	(4.090)	(4.544)	(5.366)	(4.345)	(3.924)	(1.116)	(4.428)	(2.141)
	N	170	158	152	136	124	106	76	132
	J(d.f.)	0.070	0.116	0.132	0.176	0.137	0.175	0.259	0.121
	d.f.	17	17	17	17	17	17	17	17
S4	β	0.166***	0.141***	0.225***	0.214***	0.268***	0.172***	0.271***	0.080*
	$t(\beta)$	(3.847)	(3.620)	(4.648)	(5.544)	(5.987)	(4.289)	(6.462)	(1.737)
	N	164	152	146	132	120	104	74	128
	J(d.f.)	0.086	0.124	0.124	0.145	0.121	0.153	0.179	0.126
	d.f.	17	17	17	17	17	17	17	17

Note: $t(\beta)$ is the t-statistic testing the null hypothesis that $\beta = 0$, against the alternative $\beta \neq 0$. The symbols *, **, and *** denote significance of the statistics at the 10%, 5%, and 1% levels, respectively. N denotes the number of observations. J(d.f.) (multiplied by the number of observations) is the Sargan-Hansen statistic testing the null hypothesis that the GMM overidentifying restrictions are valid. Degrees of freedom, d.f., denote the number of instruments minus 1. If fewer instruments are used, as indicated by the degrees of freedom, then only those instruments not rejected by the Sargan-Hansen test are included.

Table 4: Output growth reactions to one percentage point increase of new deposits at different time horizons

		1 year	2 years	3 years	4 years	5 years	6 years	7 years	Length of the crisis
S1	β	-0.038	0.032	-0.012	-0.016	0.020	-0.010	-0.026	-0.009
	$t(\beta)$	(0.756)	(1.126)	(0.587)	(1.229)	(1.308)	(0.384)	(0.794)	(0.343)
	N	170	168	162	146	136	118	90	144
	J(d.f.)	0.078	0.113	0.137	0.149	0.147	0.155	0.211	0.125
	d.f.	17	17	16	16	17	17	17	17
S2	β	-0.062	-0.011	0.031	-0.002	0.007	-0.012	0.000	-0.003
	$t(\beta)$	(1.228)	(0.362)	(1.491)	(0.099)	(0.484)	(0.669)	(0.004)	(0.113)
	N	170	158	152	136	124	106	76	132
	J(d.f.)	0.080	0.109	0.157	0.165	0.158	0.168	0.239	0.137
	d.f.	17	17	17	16	17	17	17	17
S3	β	-0.055	-0.021	0.035*	0.007	0.008	-0.028	-0.007	0.006
	$t(\beta)$	(1.106)	(0.733)	(1.647)	(0.418)	(0.534)	(1.427)	(0.245)	(0.194)
	N	170	158	152	136	124	106	76	132
	J(d.f.)	0.074	0.126	0.144	0.163	0.166	0.173	0.238	0.126
	d.f.	17	17	17	16	17	17	17	17
S4	β	-0.054	0.001	0.053***	0.121***	0.077***	-0.015	0.002	-0.015
	$t(\beta)$	(1.426)	(0.056)	(2.662)	(4.282)	(4.515)	(0.688)	(0.083)	(0.820)
	N	164	152	146	132	120	104	74	128
	J(d.f.)	0.080	0.137	0.127	0.139	0.114	0.177	0.188	0.120
	d.f.	17	17	17	17	17	17	17	17

Note: $t(\beta)$ is the t-statistic testing the null hypothesis that $\beta = 0$, The symbols *, **, and *** denote significance of the statistics at the 10%, 5%, and 1% levels, respectively. N denotes the number of observations. J(d.f.) (multiplied by the number of observations) is the Sargan-Hansen statistic testing the null hypothesis that the GMM overidentifying restrictions are valid. Degrees of freedom, d.f., denote the number of instruments minus 1. If fewer instruments are used, as indicated by the degrees of freedom, then only those instruments not rejected by the Sargan-Hansen test are included.

Table 5: Output growth reactions to one percentage point increase of the difference between growth of money and growth of cash at different time horizons

		1 year	2 years	3 years	4 years	5 years	6 years	7 years	Length of the crisis
S1	β	0.123**	-0.006	0.400***	0.310***	-0.002	0.055	0.045	0.012
	$t(\beta)$	(2.039)	(0.120)	(5.817)	(3.593)	(0.063)	(1.240)	(0.918)	(0.858)
	N	170	168	162	146	136	118	90	144
	J(d.f.)	0.056	0.114	0.092	0.124	0.150	0.152	0.216	0.122
	d.f.	17	17	17	17	17	17	17	17
S2	β	0.107*	-0.006	0.148***	0.371***	0.007	-0.002	-0.026	0.013
	$t(\beta)$	(1.713)	(0.137)	(3.847)	(3.961)	(0.197)	(0.059)	(0.991)	(1.012)
	N	170	158	152	136	124	106	76	132
	J(d.f.)	0.064	0.110	0.147	0.120	0.159	0.166	0.241	0.130
	d.f.	17	17	17	17	17	17	17	17
S3	β	0.089	-0.014	0.137***	0.308***	0.044	0.255***	0.000	-0.009
	$t(\beta)$	(1.486)	(0.362)	(3.599)	(3.845)	(1.004)	(2.888)	(0.011)	(0.491)
	N	170	158	152	136	124	106	76	132
	J(d.f.)	0.071	0.126	0.136	0.136	0.165	0.163	0.239	0.123
	d.f.	17	17	17	17	17	17	17	17
S4	β	0.028	-0.004	0.054	0.276***	0.077	-0.010	-0.005	0.016
	$t(\beta)$	(0.445)	(0.120)	(1.229)	(3.381)	(1.277)	(0.632)	(0.282)	(1.199)
	N	164	152	146	132	120	104	74	128
	J(d.f.)	0.091	0.137	0.139	0.097	0.144	0.174	0.189	0.122
	d.f.	17	17	17	17	17	17	17	17

Note: $t(\beta)$ is the t-statistic testing the null hypothesis that $\beta = 0$, The symbols *, **, and *** denote significance of the statistics at the 10%, 5%, and 1% levels, respectively. N denotes the number of observations. J(d.f.) (multiplied by the number of observations) is the Sargan-Hansen statistic testing the null hypothesis that the GMM overidentifying restrictions are valid. Degrees of freedom, d.f., denote the number of instruments minus 1. If fewer instruments are used, as indicated by the degrees of freedom, then only those instruments not rejected by the Sargan-Hansen test are included.

Table 6: Output growth reactions to one percentage point increase of real money supply at different time horizons

		1 year	2 years	3 years	4 years	5 years	6 years	7 years	Length of the crisis
S1	β	0.250**	-0.041	0.617***	0.600***	0.262***	0.149*	0.164	0.540***
	$t(\beta)$	(2.187)	(0.346)	(6.438)	(7.800)	(3.056)	(1.702)	(1.436)	(7.026)
	N	170	168	162	146	136	118	90	144
	J(d.f.)	0.066	0.112	0.120	0.168	0.149	0.161	0.234	0.135
	d.f.	17	17	16	17	17	17	17	17
S2	β	0.273**	0.058	0.625***	0.590***	0.225***	0.147*	0.478***	-0.046
	$t(\beta)$	(2.538)	(0.507)	(7.222)	(7.033)	(2.685)	(1.816)	(7.394)	(0.677)
	N	170	158	152	136	124	106	76	132
	J(d.f.)	0.068	0.117	0.134	0.175	0.169	0.170	0.280	0.131
	d.f.	17	17	17	17	17	17	17	17
S3	β	0.244**	0.014	0.540***	0.529***	0.234***	0.067	0.483***	0.244***
	$t(\beta)$	(2.288)	(0.119)	(5.627)	(6.131)	(2.923)	(0.843)	(7.351)	(3.006)
	N	170	158	152	136	124	106	76	132
	J(d.f.)	0.072	0.129	0.128	0.172	0.167	0.182	0.259	0.125
	d.f.	17	17	17	17	17	17	17	17
S4	β	0.185*	0.143	0.479***	0.326***	0.354***	0.193***	0.458***	0.050
	$t(\beta)$	(1.767)	(1.496)	(5.963)	(3.232)	(4.687)	(3.178)	(5.433)	(0.608)
	N	164	152	146	132	120	104	74	128
	J(d.f.)	0.091	0.148	0.122	0.135	0.124	0.158	0.185	0.125
	d.f.	17	17	17	17	17	17	17	17

Note: $t(\beta)$ is the t-statistic testing the null hypothesis that $\beta = 0$, The symbols *, **, and *** denote significance of the statistics at the 10%, 5%, and 1% levels, respectively. N denotes the number of observations. J(d.f.) (multiplied by the number of observations) is the Sargan-Hansen statistic testing the null hypothesis that the GMM overidentifying restrictions are valid. Degrees of freedom, d.f., denote the number of instruments minus 1. If fewer instruments are used, as indicated by the degrees of freedom, then only those instruments not rejected by the Sargan-Hansen test are included.

Table A1: Periods of banking crises

Developed countries:

Australia 1989-1992 (1989),Canada 1983-1985 (1983), Denmark 1987-1992 (1987), Finland 1991-1994 (1991), France 1994-1995 (1994), Germany late 1970s-late 1970s (1977), Greece 1991-1995 (1991), Hong Kong 1982-1983 (1982), Hong Kong 1998-1998 (1998), Iceland 1985-1986 (1985), Iceland 1993-1993 (1993), Italy 1990-1995 (1990), Japan 1992-2003+ (1992), Korea 1997-2000 (1997), New Zealand 1987-1990 (1987), Norway 1990-1993 (1990), Spain 1977-1985 (1977), Sweden 1991-1994 (1991), United Kingdom 1974-1976 (1974), United Kingdom 1980s-1990s (1990), United States 1988-1991 (1988),

Developing countries:

Algeria 1990-1992 (1990), Argentina 1980-1982 (1980), Argentina 1989-1990 (1989), Argentina 1995-1995 (1995), Argentina 2001-2003+ (2001), Azerbaijan 1995-1996 (1995), Bangladesh late 1980s-1996 (1989), Benin 1988-1990 (1988), Bolivia 1986-1988 (1986), Bolivia 1994-? (1994), Botswana 1994-1995 (1994), Brazil 1990-1990 (1990), Brazil 1994-1999 (1994), Bulgaria 1996-1997 (1996), Burkina Faso 1988-1994 (1988), Burundi 1994-? (1994), Cameroon 1987-1993 (1987), Cameroon 1995-1998 (1995), Central African Republic 1976-1992 (1976), Chad 1992-1992 (1992), Chile 1976-1976 (1976), Chile 1981-1986 (1981), Colombia 1982-1987 (1982), Congo, Democratic Republic of (former Zaire) 1991-1992 (1991), Congo, Republic of 1992-2003+ (1992), Costa Rica 1994-1996 (1994), Cote d'Ivoire 1988-1991 (1988), Croatia 1996-1996 (1996), Ecuador early 1980s-? (1982), Ecuador 1996-2001 (1996), Egypt 1991-1995 (1991), El Salvador 1989-1989 (1989), Ethiopia 1994-1995 (1994), Gabon 1995-? (1995), Gambia 1985-1992 (1985), Ghana 1982-1989 (1982), Guinea-Bissau 1995-? (1995), Hungary 1991-1995 (1991), India 1993-2003+ (1993), Indonesia 1994-1994 (1994), Indonesia 1997-2002 (1997), Israel 1977-1983 (1977), Jamaica 1994-1994 (1994), Jordan 1989-1990 (1989), Kenya 1985-1989 (1985), Kenya 1992-1992 (1992), Kenya 1996-? (1996), Kuwait 1980s-1980s (1980), Latvia 1995-1996 (1995), Lesotho 1988-? (1988), Lithuania 1995-1996 (1995), Madagascar 1988-1988 (1988), Mali 1987-1989 (1987), Malaysia 1985-1988 (1985), Malaysia 1997-2001 (1997), Mauritius 1996-1996 (1996), Mexico 1981-1991 (1981), Mexico 1994-2000 (1994), Morocco early 1980s-? (1981), Mozambique 1987-1995(?) (1987), Myanmar 1996-? (1996), Nepal 1988-1988 (1988), Niger 1983-1996 (1983), Nigeria 1997-1997 (1997), Panama 1988-1989 (1988), Papua New Guinea 1989-? (1988), Paraguay 1995-2000 (1995), Paraguay 2001-2003+ (2001), Peru 1983-1990 (1983), Philippines 1983-1987 (1983), Philippines 1998-2003+ (1998), Poland 1992-1995 (1992), Romania 1990-1996 (1990), Russia 1995-1995 (1995), Russia 1998-1999 (1998), Rwanda 1991-? (1991), Senegal 1988-1991 (1988), Sierra Leone 1990-1996 (1990), Singapore 1982-1982 (1982), Slovenia 1992-1994 (1992), South Africa 1977-1977 (1977), South Africa 1989-? (1989), Sri Lanka 1989-1993 (1989), Swaziland 1995-1995 (1995), Tanzania late 1980s-1990s (1989), Thailand 1983-1987 (1983), Thailand 1997-2002 (1997), Togo 1993-1995 (1993), Trinidad and Tobago 1982-1993 (1982), Tunisia 1991-1995 (1991), Turkey 1982-1985 (1982), Turkey 1994-1994 (1994), Turkey 2000-2003+ (2000), Uganda 1994-1996 (1994), Ukraine 1997-1998 (1997), Uruguay 1981-1984 (1981), Uruguay 2002-2003+ (2002), Venezuela late 1970s-1980s (1980), Venezuela 1994-1995 (1994), Vietnam 1997-2003+ (1997), Zambia 1995-1995 (1995), Zimbabwe 1995-1996 (1995).

Note: the symbol "?" denotes unknown date, "+" denotes that the crisis was not over in 2003. The starting dates of crisis used in our empirical analysis are presented in parentheses. Data from Caprio, Klingebiel, Laeven, Noguera (2005).

Table A2: Robustness check - the GMM estimation of the dynamic panel data model

Measure of crisis extent[(a)]	Specification of the instrumental variables[(b)]	Estimation method[(c)]	Period dummies	Model specification[(d)]	Parameter β [(e)]	Std. errors. of β [(f)]	Sargan J statistic [(g)]	p-value of the J statistic
credit	i=1	*difference*	yes	S4	0.008**	0.0010	95.52	0.495
credit	i=1	*difference*	no	S4	0.010**	0.0005	102.37	0.609
credit	i=1	*difference*	no	S2	0.007**	0.0002	112.43	0.418
credit	i=1	*difference*	no	S1	0.019**	0.0001	119.75	0.464
credit	i=1	*orthogonal*	yes	S4	0.009**	0.0011	94.99	0.510
credit	i=1	*orthogonal*	no	S4	0.011**	0.0003	109.89	0.405
credit	i=1	*orthogonal*	no	S2	0.010**	0.0003	110.56	0.467
credit	i=1	*orthogonal*	no	S1	0.016**	0.0001	119.67	0.466
credit	i=2	*difference*	yes	S4	0.004**	0.0012	93.27	0.560
credit	i=2	*difference*	no	S4	0.005**	0.0011	102.19	0.613
credit	i=2	*difference*	no	S2	-0.002**	0.0002	112.89	0.406
credit	i=2	*difference*	no	S1	0.008**	0.0002	118.77	0.489
money	i=1	*difference*	yes	S4	0.030**	0.0016	95.38	0.556
money	i=1	*difference*	no	S4	0.035**	0.0004	109.19	0.477
money	i=1	*difference*	no	S2	0.037**	0.0002	113.35	0.446
money	i=1	*difference*	no	S1	0.062**	0.0003	121.75	0.464
money	i=1	*orthogonal*	yes	S4	0.036**	0.0015	102.86	0.349
money	i=1	*orthogonal*	no	S4	0.041**	0.0005	109.94	0.457
money	i=1	*orthogonal*	no	S2	0.042**	0.0005	111.63	0.492
money	i=1	*orthogonal*	no	S1	0.059**	0.0001	120.24	0.502
money	i=2	*difference*	yes	S4	-0.006**	0.0022	94.33	0.586
money	i=2	*difference*	no	S4	-0.001	0.0009	108.32	0.500
money	i=2	*difference*	no	S2	-0.005**	0.0010	113.53	0.442
money	i=2	*difference*	no	S1	0.021**	0.0006	122.95	0.433

Note: Data from Caprio, Klingebiel (2003), similar to Caprio, Klingebiel, Laeven, Noguera (2005). (a) *credit* is defined as the log change in real credit, money is defined as the log change in real money; (b) i=1 and i=2 denote that all valid lags in the dynamic panel instruments up to $t-i$ for the observation t of the crisis variable are used in the Arellano-Bond method; (c) *difference* is the Arellano-Bond first-differences estimator, *orthogonal* is the orthogonal deviations estimator, as proposed by Arellano and Bover (1995); (d) model specifications are analogous to those in previous tables. However, the GNI per capita, $currcrisis_{it}$, $fxregime_{it}$, $debtcrisis_{it}$ and $systemic_{it}$ are not used in the specifications S2 and S4. Instead period dummy variables are used. (e) The β parameter measures impact of the crisis variable on GDP growth. Symbol * denotes significance of the parameter at the 5% level and ** denotes significance at the 1% level. (f) White period robust standard errors are computed; (g) The Sargan-Hansen test (J-statistic) of overidentifying restrictions.