Fiscal and Financial Crises*

April 5, 2015

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* Paper prepared for the Handbook of Macroeconomics Vol. 2 Conference, Stanford University April 9-11, 2015. We thank Sarah Quincy for invaluable research assistance.

1. Introduction

The recent financial crisis in the Eurozone involved both sovereign debt and the banking system. The circumstances of this crisis were unique but the combined incidence of debt and banking crises is not new. It goes back to the nineteenth century. Moreover debt and banking crises have on occasion been associated with currency crises.

In the recent Eurozone crisis a threatened sovereign default by Greece fed into a banking crisis because banks in Greece and the other financially integrated Eurozone countries held large amounts of Greek and other peripheral Eurozone sovereign debt. Also in that crisis, in the case of Ireland, a blanket guarantee of the Irish financial sector by the Irish government, following the bursting of a property price boom which made the Irish banks insolvent, led to a sovereign debt crisis because the Irish government could not service the large run up in its debt that followed. Thus the recent crisis is a fine example of the interconnection between fiscal and banking crises.

Such interconnections between types of financial crises have occurred before. In the Asian Crisis of 1997-98,, the guarantee provided to the banks of Thailand and Indonesia led both to a currency crisis,, a banking crisis and a debt crisis (a triple crisis) because the liabilities of the banks and other financial institutions which were in foreign currency were guaranteed by the government and ultimately by the international reserves of the central bank. The crises in Argentina and Russia at the turn of the twenty first century were also triple crises. Resonance to these recent triple crises can even be traced back to emerging market crisis in the 1890s (Bordo and Flandreau, 2003).

In this paper we examine the interconnections between financial and fiscal crises based on history, theory, and empirics. Section 2 presents a brief historical overview of financial crises. Banking crises can be traced back hundreds of years. Before the advent of deposit insurance and effective use of the lender of last resort, banking crises were banking panics. Since World War II, banking panics have evolved into fiscally resolved banking crises. Banking crises have often been global events as countries have been linked together by fixed exchange rates, capital flows and other sources of contagion. Debt crises—sovereign debt defaults-- have also been around for centuries, associated with over-borrowing and have been triggered by shocks. Today they occur primarily in emerging countries. Currency crises—speculative attacks on pegged exchange rates – often accompanied banking crises and sometimes debt crises.

Section 3 surveys theoretical perspectives on financial crises. Banking crises traditionally were analyzed using three approaches: the monetarist approach, the financial fragility approach and the business cycle approach. Modern perspectives build upon these earlier theories. The key approach is based on the Diamond and Dybvig (1983) notion of the inherent instability of banking because of a maturity mismatch. Also seminal are theories based on asymmetric information. The pioneering modern work to explain why countries issue sovereign debt and try to avoid debt crises traces back to Eaton and Gersovitz (1981) who emphasize reputation. By contrast Bulow and Rogoff(1989) focus on the deterrence effect of sanctions. Reinhart and Rogoff(2009) emphasize serial defaults, debt intolerance, and the distinction between domestic and foreign debt.

In the post-World War II period, especially since the 1970s, banking, currency and debt crises became linked because governments guaranteed the liabilities of the banking system. The seminal paper by Diaz Alejandro (1987) generated an enormous literature to explain the Latin American crises. The Asian crisis of 1997-98 led to new theories which explained triple crises based on guarantees and original sin (foreign currency denominated debt). Finally the recent Eurozone crisis has led to new work which emphasizes the feedback loop between bank guarantees and banks holding of member states sovereign debt which links financial to debt crises.

Section 4 provides empirical perspectives. We discuss the methodological issue of crisis measurement (the definition, dating and incidence) of financial crises. Different approaches to definition and dating in the literature lead to very different patterns of incidence and hence very different interpretations of the historical record. We also discuss the many and varied causes or determinants of financial crises, including bank credit driven asset booms which have resonance for the recent crisis.,. Our reading of the literature is that it is very difficult to predict crises with a high level of accuracy both because of Goodhart's law as well as because of the complex economic eco-system represented by the financial sector. We then review measures of the output costs of financial crises. Again different approaches in the literature lead to significantly different conclusions and hence different perspectives on the economic importance of crises.

Section 5 contains a preliminary examination of the empirical connection between financial and fiscal crises and identifies a potential new Trilemma. This three-pronged choice

argues that in the future countries will be able to have two of the following three: a large financial sector (with a high level of leverage in the economy), fiscal bailouts devoted to the inevitable crises that accompany leverage, and discretionary fiscal policy aimed at raising demand in the recessions occasioned by financial crises. This story is different from the argument that fiscal policy is pro-cyclical in less-developed countries. Moreover, as the recent crisis suggests, this trilemma may become more binding at higher initial levels of debt to GDP.

Section 6 to be done is the conclusion.

2. Historical Overview

Financial crises can be traced back hundreds of years (Kindleberger 1987). Historical narratives identify separate banking, currency and debt crises and combinations of them (Reinhart and Rogoff 2009, Bordo and Eichengreen 1999, Bordo and Meissner 2005,). While financial crises cum fiscal crises are certainly not a new phenomenon, it would be incorrect to say that the recent global financial crisis and the subsequent Eurozone crisis were no different than all of those that have come before. The nature and origins of fiscal crises and their relationship to financial crises has changed dramatically over the long-run in important ways.

Banking crises before the advent of deposit insurance were banking panics--attempts by the public en mass to convert their deposits into currency. Banking panics unless resolved by lender of last resort actions could seriously impact the real economy by reducing the money supply (Friedman and Schwartz 1963) and by reducing financial intermediation (Bernanke 1983). Banking panics would propagate through asset markets as banks under threat dumped their earning assets in fire sales . They could also propagate via interbank connections and other institutional arrangements to create a systemic collapse (Mitchener and Richardson 2014).

Banking panics could be caused by shocks leading to the failure of important financial firms, eg shadow banks (Rockoff 2014). They could also occur as a consequence of a bank credit driven asset price boom bust. Brunnermeir and Omke (2013), Taylor (2015)

and many others recently have argued that systemic banking crises are very likely to follow bank credit driven asset price booms.

Finally banking crises can also have an international dimension as for example during the Baring Crisis of 1890-91, the global instability of 1907, the Credit Anstalt Crisis of 1931, the Asian Financial Crisis and the subprime mortgage crisis of 2007-2009. Bordo and Landon Lane (2010a) identify 5 global financial crises(1890-91, 1914, 1929-30, 1980-81, 2007-2008) where the incidence of banking crises affected banks in multiple countries and in several continents in the same year. In all of these cases of contagion, cross-border claims and faltering foreign banks or counterparties led to insolvency or liquidity problems at home. In addition, interest rate shocks in leading financial centers (e.g., by the Bank of England in 1890, the Federal Reserve in 1929 and in 1980-81) could contribute directly or indirectly to starting or exacerbating financial stress, especially in emerging countries(Kaminsky and Vega Garcia 2014)

The incidence of banking panics was high in many advanced countries in the nineteenth century before monetary authorities learned to act as lenders of last resort. In the UK the last banking panic was in 1866. In France it was in 1882 and Germany in 1873. In the U.S. it took until 1933 and the advent of deposit insurance before banking panics ceased (Schwartz 1987).

With the advent of deposit insurance and other forms of government guarantees during the Great Depression and in some countries earlier (Grossman 2010), the nature of banking crises changed from panics to crises which were increasingly resolved by a fiscal rescue. This created a direct link between the banking system and the government's balance sheet. A costly bailout could create significant fiscal imbalance and even lead to a default. Moreover guarantees could lead to moral hazard, i.e that protected banks would increase their balance sheets and take on more risk knowing that they would be bailed out. This would in turn increase the cost of bailouts ex post and increase the strain on the government's finances, in turn increasing the likelihood of a default.

Before the 1930s, sovereign defaults had long been a fact of life reflecting over-borrowing (often in foreign currencies) to finance wars, infrastructure expenditure. Sudden stops of capital flows often led to sovereign defaults (Bordo, 2006; Bordo, Cavallo and Meissner,2010). Banking crises, even in the absence of guarantees could lead to fiscal distress by reducing real income and government revenue.

A wave of sovereign defaults tied to international capital flows occurred in the 1820s in many Latin American Republics as over-optimistic investors from Europe lent these fledgling republics more than their weak public finances could handle. It took four decades before these countries paid into arrears and could access the capital markets again. In the next two centuries Latin America had three more waves of default (Marichal 1989,)[1]. Most countries, with the principal exception of a few advanced countries, had sovereign debt defaults in the nineteenth and twentieth centuries (Reinhart and Rogoff 2009). Many of them were serial defaulters (Reinhart, Rogoff and Savastano,2003).

Currency crises—a speculative attack on a pegged exchange rate reflecting an inconsistency between domestic fundamentals and the peg—also were a frequent occurrence for emerging countries throughout the nineteenth and twentieth centuries (Bordo and Schwartz 1999). Advanced countries generally avoided them under the pre 1914 gold standard but they became a bigger problem for them in the interwar and during the Bretton Woods system (Bordo, Eichengreen et al 2001).

Currency crises often occurred simultaneously with banking crises, referred to as twin crises (Kaminsky and Reinhart 1999). Causality between them was often two-way. A banking crisis could lead to capital flight by foreign depositors as occurred in 1931 in Germany (Eichengreen 1992). Per contra a currency crisis could lead to insolvency for banks with extensive foreign currency denominated liabilities and domestic currency denominated assets as occurred in a number of emerging countries in both the pre-1914 and post 1973 eras of financial globalization.(Bordo and Meissner 2006, Reinhart and Rogoff, 2009).

Currency crises became linked to debt crises for emerging countries who had borrowed abroad in foreign currencies in the 1890s (Bordo and Flandreau 2003). With the advent of government guarantees on top of original sin (foreign currency denominated debt), currency, banking and debt crisis became interlinked in the emerging market crises of the late 1990s and early 2000s.

Thus the recent Eurozone crisis was the culmination of a long history of different types of crises and their growing interconnections which evolved along with the deep seated forces of financial globalization and a belief in the necessity for government to socialize the income losses of financial crises.

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[1] Kaminsky and Vega Garcia (2014) show that most of these defaults followed systemic financial crises in the core countries of Europe.

3 Financial and Fiscal Crises; Theory

In this section we survey the theoretical literature on financial and fiscal crises. We first survey traditional approaches. Most of the literature treated the two types of crises, along with currency crises separately. We then examine more recent approaches based on rational expectations and game theory that often combine financial and fiscal crises along with currency crises.

3.1 Banking Crises

The traditional view of a banking crisis was a banking panic or a liquidity crisis. It involved a scramble by the public for means of payment. Two frequent scenarios in which it occurred were: contagious banking panics when the public fearful that their banks will not be able to convert their deposits into currency attempts en masse to do so; the second is a stock market crash that leads to fears that loans will become unavailable at any price. Without intervention by the monetary authorities or lender of last resort—through open market operations or liberal discount window lending—the real economy will be impacted by a decline in the money supply, by impairment of the payment system, and by the interruption of bank lending.

In the post-World War II period, with the widespread adoption of deposit insurance (both explicit and implicit), and with the understanding of the role of the lender of last resort, old fashioned banking panics have become rare events. Instead banking crises largely involve the insolvency of significant parts of the banking system. They have occurred when asset prices have plunged, whether prices of equities, real estate or commodities; when the exchange value of a national currency experiences substantial depreciation; when a large financial firm or non-financial firm faces bankruptcy, or a sovereign debtor defaults. Unlike banking panics which are brief episodes resolved by the central bank, a banking crisis is a prolonged disturbance that is resolved by agencies other than the lender of last resort, although at some stage it may supply liquidity through the discount window or open market operations.

Three traditional approaches to the subject of banking crises are: the monetarist approach; the financial fragility approach and the business cycles approach. The modern literature based on rational expectations and game theory follows from these.

3.1.1 The Monetarist Approach

The monetarist approach of Friedman and Schwartz (1963) identifies financial crises with banking panics that either produce or aggravate the effects of monetary contractions. In a *Monetary History of the United States 1867-1960,* Friedman and Schwartz devote considerable attention to the role of banking panics in producing monetary instability in the United States. For Friedman and Schwartz, banking panics are important because of their effects on the money supply, and hence on economic activity.

According to them, banking panics occur because the public loses confidence in the ability of banks to convert deposits into currency. A loss of confidence is typically associated with the failure of some important financial institution (as happened in 1873, 1893 and 1907). Attempts by the public in a fractional reserve banking system to increase currency as a fraction of its money holdings, if not offset, can only be met by a multiple contraction of deposits. A banking panic, in turn, if not prevented by the monetary authorities, will lead to massive bank failures of otherwise sound banks. They are forced into insolvency by a fall in the value of their assets in a vain attempt to satisfy a mass scramble for liquidity. Banking panics such as occurred in 1930-33, have deleterious effects on economic activity primarily by reducing the money stock through a decline in both the deposit- currency and deposit-reserve ratios.

An extensive literature in economic history has been devoted to re-examining the banking panics of the 1930s. The debate swirled over the issue of whether the banking crises were really liquidity panics driven by "a contagion of fear" or whether they reflected bank insolvency as an endogenous response to the recession. Temin (1976) and most recently Calomiris and Mason (2005) provided evidence that cast doubt on the Friedman and Schwartz liquidity panic story. Richardson (2007) and Bordo and Landon Lane (2010b) provide evidence in its favor.

3.1.2 The Financial Fragility Approach

A tradition going back to the nineteenth century regards financial crises as an essential part of the upper turning point of the business cycle, as a necessary consequence of the ' excesses ' of the previous boom. Its twentieth century proponents, Hyman Minsky (1977) and Henry Kaufman (1986), basically extend the views Irving Fisher expressed in *Booms and Depressions* (1932) and in the "'Debt Deflation Theory of Great Depressions" (1933).

According to Fisher, the business cycle is explained by two key factors; over-indebtedness and deflation. Some exogenous event (displacement) that provides new, profitable opportunities for investment in key sectors of the economy that increase output and prices initiates the upswing in the cycle. Rising prices, by raising profits, encourages more investment and also speculation for capital gain. The whole process is debt financed, primarily by bank loans, which in turn, by increasing deposits and the money supply, raise the price level. An overall sense of optimism raises velocity, fueling the expansion further. Moreover, the rising price level, by reducing the real value of outstanding debt encourages further borrowing. The process continues until a general state of 'over-indebtedness' is reached. It exists when individuals, firms, and banks have insufficient cash flow to service their liabilities. In such a situation a crisis can be triggered by errors in judgment by debtors or creditors. Debtors, unable to pay debts when due or to refinance their positions, may be required to liquidate their assets.

Distress selling, if engaged in by a sufficiently large segment of the market, produces a decline in the price level because, as loans are extinguished and not renewed, bank deposits decline. Falling prices reduce net worth and profits, leading to bankruptcy. Both factors contribute to a decline in output and employment. In addition, while nominal interest rates fall with deflation, real rates increase, worsening the situation. The process continues until either widespread bankruptcy has eliminated the over-indebtedness, or at any stage reflationary monetary policy is adopted. However, once recovery begins, the whole process will repeat itself.

This approach has been revived since the Financial Crisis of 2007-2009. Indeed some commentators have described the failure of Lehman Brothers in September 2007 as a 'Minsky moment '(Brunnermeier and Omke 2013). It is also consistent with the credit boom approach of the BIS (Borio 2012) and the long-run comparative empirical work on credit

and asset price booms by Taylor and Schularick (2009) and Jordà, Schularick and Taylor (2011).

3.1.3 The Business Cycle Approach

This approach (Mitchell 1941) views banking panics as more likely during a recession because the returns on bank assets are likely to fall as borrowers become less like likely to repay their loans. Depositors anticipating an increase in non-performing loans will try to protect their wealth by withdrawing their deposits precipitating a bank run (Allen and Gale 2007). Gorton (1988) following this approach finds that depositors anticipating a decline in income in an attempt to smooth their consumption remove their funds from banks before the business cycle peak .

3.2 Recent Approaches to Banking Crises

3.2.1 Diamond Dybvig ; The Inherent Instability of Banking

In a seminal article Diamond and Dybvig(1983) argue that banks transform illiquid ones by offering liabilities with a different smoother pattern of returns over time. Banks provide efficient risk sharing which the private market cannot provide. However banks are vulnerable to runs because of the illiquidity of their assets. Thus there is a liquidity mismatch. A run can be triggered even on a sound bank by a random event (a sunspot) because rational depositors, not wishing to be last in line, will rush to convert deposits into currency. Only the presence of deposit insurance or a lender of last resort can prevent banking instability.

An explosion of articles in the past two decades build upon the Diamond and Dybvig model. A number of articles were critical of the sequential servicing constraint in the original Diamond and Dybvig model—that depositors had to wait their turn at the bank to access their cash. It was argued that as in the pre 1914 National banking era, banks could suspend convertibility (Jacklin 1987), on the other hand Wallace(1988) justified the sequential constraint endogenously in his model. Other papers that rationalized the Diamond Dybvig sequential service constraint were Diamond and Rajan (2001) and Calomiris and Kahn (2000). In an influential article Morris and Shin (1998) used the global games approach to reach a unique equilibrium without using a sunspot equilibrium as a coordinating device as in Diamond Dybvig.

Subsequent literature extended the basic Diamond Dybvig (DD) framework to encompass financial markets and the banking system (Allen and Gale 1998, 2004); to include bubbles and crises (Allen and Gale 2000b); to include money and monetary policy in the basic DD type model (Diamond and Rajan 2001, 2005, 2006, 2011, 2012); to include interbank markets (Bhattacharya and Gale 1987). The DD model also is embedded in several articles justifying lender of last resort intervention to provide liquidity in a financial crisis (Holmstrom and Tirole 1998, Gorton and Huang 2010 and Rochet and Vives 2004).

3.2.2 Information Asymmetry

The explanation of banking panics that the asymmetric information approach offers is that depositors cannot costlessly value individual bank assets, and hence have difficulty in monitoring the performance of banks (Jacklin and Bhattacharya1988, Chari and Jagannathan 1988). On this view, a panic is a form of monitoring. Faced with new information, which raises the perceived riskiness of bank assets, depositors force out both sound and unsound banks by a system wide panic.

3.3 Fiscal Crises

The canonical fiscal crisis is a debt crisis. It is a situation where a debtor is unable to service the interest and or principle as scheduled, hence impairing the financial health of the lender. A debt crisis arises when the fiscal authorities are unable to raise sufficient tax revenue in the present and the future to service and amortize the debt.

A debt crisis can then become a financial crisis when it impinges on the banking system and a currency crisis when it threatens the reserves of the central banks as was the case in the Asian crisis of the 1990s. Banking crises can feed into debt crises when the fiscal authorities bail out insolvent banks which then increases sovereign debt to a point where it becomes unsustainable. Debt crisis can also spill into banking crises when banks hold significant amounts of sovereign debt whether by choice or because of government attempts to force banks to hold significant levels of governments debt.

Below we survey the literature on sovereign debt crises and their linkages to financial(banking) crises.

3.3.1 Debt Crises; Theory

Two seminal articles have driven much of the modern literature on debt crises [2] Eaton and Gersovitz (1981) explained the existence of sovereign debt markets and the incentive of sovereign borrowers to repay their debt is access to credit markets. Debtors worried that a default could ruin their reputation and cut off future access to the foreign capital needed to finance economic development and to smooth output over time. Bulow and Rogoff (1989 a and 1989 b) argued that other methods of self-insurance can substitute for foreign borrowing and that the main reasons countries avoid default is because of the threat of sanctions, e.g., as in the nineteenth century the British (and other European lenders) would send in the gunboats to seize the defaulting countries customs revenues. Another early development was the analysis of Grossman and van Huyck (1988) of excusable default—that countries that defaulted because of a large shock to their economy not of their own making, they were treated better by the credit markets than countries which defaulted because of bad economic policy decisions.

The subsequent literature was doubtful of sanctions in the post-World War II era (Cole and Kehoe 1995, Eaton 1996, Kletzer and Wright 2000) although there is considerable historical evidence for this (Mitchener and Weidenmeir 2005) for the pre-World War I era. Emphasis was placed by some on the collateral damage to the economy from default(Cole and Kehoe 1998).[3]

An additional development was the focus on serial default. Reinhart, Rogoff, and Savastano (2003) showed that a number of defaulting emerging countries had a long historical record of debt default. This pattern of persistence extended to a number of European countries e.g. Spain and France which had an earlier history of serial defaulting. Moreover they found that countries which were serial defaulters also had debt intolerance, i.e. that they would tend to default at significantly lower debt to GDP ratios than advanced countries, e.g. Argentina defaulted in 2002 at a debt to GDP ratio of 35% whereas Japan today has a debt to GDP ratio well above 200% and it is not even close to defaulting.

Reinhart and Rogoff (2009)make an important distinction between domestic debt and foreign debt. They argue that domestic debt default by inflation, financial repression,

[2] See Panizza, Sturzenegger and Zettelmeyer (2009) for a recent survey.

[3] Two recent models of sovereign defaults which occur following adverse shocks to the economy are Aguiar and Gopinath (2006) and Arellano (2008).

redenomination, abrogation of gold clauses can have consequences as serious as external default. In addition they argue that defaulting on high domestic debt may be a strong rationale for the use of the inflation tax in many countries.

3.4 Fiscal Crises and Financial Crises

After the breakdown of the Bretton Woods system and the liberalization of global financial markets, as well as domestic financial systems across the world, the stage was set for waves of systemic financial and fiscal crises. A key integrating element between financial and fiscal crises was the widespread use of guarantees by the government of the liabilities of the banking system. The seminal article which lays out clearly the dynamics of fiscal financial crisis interaction was by Diaz Alejandro (1985). He describes the unfolding disaster that occurred in Chile from 1977 to 1982 after it liberalized its domestic financial system and opened up its capital account. Chile,, like the other Latin American countries, had extensive controls over the domestic financial system as well as capital controls since the 1930s. It was part of the plans of Raul Prebisch (1950) and others to insulate the region from foreign shocks.

The Pinochet regime, under the influence of the "Chicago boys" – students of Al Harberger-- liberalized every aspect of the economy. They reduced tariffs, eliminated controls over the domestic financial system and removed capital controls. They also in 1977 reduced barriers to entry into banking, they explicitly did not introduce deposit insurance, and they forswore a bailout of the banking system in the event of trouble. They also pegged the Chilean peso to the U.S. dollar.

The new liberalized regime encouraged massive capital inflows which led to increases in bank credit and fueled an asset price boom. A major bank failure in 1977 led to a bail out for fear of contagion. Afterwards the government again forswore against future bailouts. The bailout which soon did follow encouraged moral hazard and the credit boom continued. In early 1982 more banks failed and their liabilities were guaranteed. This meant that the government had taken on a new contingent liability which in turn led to a growing fiscal deficit. The central bank financed the deficit with the inflation tax. This led to inflation and set the stage for a speculative attack on its reserves. A major banking and currency crisis

ensued in the summer of 1982 leading Chile to abandon its peg and nationalize its banking system. It was followed by a debt crisis in 1983.[4]

McKinnon and Pill (1986) model the effects of liberalization and reform on a previously financially repressed emerging country. In their model, like in Diaz Alejandro (1985), there is a large unsustainable lending boom financed by foreign capital, intermediated by the banks. The banks believe that their foreign loans are guaranteed by the government. This over borrowing phenomenon leads to rising domestic credit, an increase in money growth, inflation and an asset price boom. A foreign shock leads to a collapse in the boom, a banking crisis, a currency crisis and a reversal of the reforms.

3.4.1The Asian Crisis

The Asian crisis of 1997-98 involved banking, currency and debt crises and these crises were all connected by government guarantees and an ostensibly "new" factor "original sin'. A key mechanism by which foreign borrowing led to banking crises was that the Asian tigers (Thailand, Indonesia, Malaysia, and Korea) borrowed abroad extensively in foreign currency denominated securities. They did this because they had not yet financially developed enough to issue debt in their own currencies as could the advanced countries. Borrowing abroad e.g. in dollars, gave access to foreign capital at low international interest rates. The risk associated with original sin is that if the country has a currency crisis and ends up devaluing its currency then it will have to generate greater tax revenues in domestic currency and export earnings to service its foreign debt. This in turn would depress the real economy and increase the likelihood of a sovereign default. The likelihood that exports could rise sufficiently depended on strong global demand and high elasticities. Moreover the banking systems in these countries funded their loans with foreign securities (often short-term) and after the devaluation, their balance sheets would become impaired increasing the likelihood of insolvency and a banking crisis.

The Asian crisis led to the creation of 'third generation" speculative attack models. They were an extension of both first and second generation speculative attack models . The first generation model of currency crises (Krugman 1979) posited that a speculative attack

[4] Velasco (1987) provided a model of this experience.

would occur once agents with perfect foresight realized that domestic fiscal and monetary fundamentals were inconsistent with adherence to a pegged exchange rate. The second generation models (Obstfeld 1994) which posited that speculative attacks would occur when agents, who understood the weights that the government placed on the stability of the domestic economy and adhering to a peg, anticipated that the government would prefer domestic stability in the event of a crisis and thereby by selling the currency short made it happen.

Several authors extended the first and second generation models to incorporate special features of the Asian Crisis including moral hazard (guarantees), short-term borrowing in foreign currencies, and currency depreciation. Krugman (1998) argued that the currency and financial crises in Asia reflected the role of moral hazard as the progenitor of financial instability which in turn was a key cause of currency crises. According to his story, financial institutions in these countries engaged in risky lending on the assumption that they would be bailed out, financed by offshore loans at close to international interest rates. The capital inflow and domestic bank lending fueled an asset market boom which in turn encouraged the banks to lend more. This process encouraged a domestic investment and consumption boom and a growing current account deficit. When external factors revealed the exchange rate to be overvalued a classic speculative attack led to devaluation. The devaluation in turn sparked a financial crisis as the banks' short-term, foreign currency denominated loans mushroomed,, making them both illiquid and insolvent. Bailouts of the financial system and especially of their dollar obligations in turn precipitated further speculative attacks and exhausted the monetary authorities international reserves.

Dooley (2000) viewed the liabilities of the monetary authorities backing the financial safety net as an alternative claimant on emerging countries international reserves. Market agents understood this and staged a speculative attack at the moment that net liabilities exceeded international reserves.

Krugman (1999) focused on the balance sheets of firms which have borrowed abroad in foreign currencies. A speculative attack would occur when market agents anticipate that a depreciating currency will lead to insolvency and contracting economic activity pull out their funds hence precipitating the adverse chain of events.

Burnside, Eichenbaum and Rebelo (2004) also emphasize the key role of government guarantees in explaining the Asian, crisis. In their model banks borrow in

foreign currencies unhedged because their foreign debt is guaranteed by the government. But when a devaluation occurs, following an external shock, the banks default on their foreign debt and declare bankruptcy, but the government does not have the resources to pay for a bailout. This leads to both a banking crisis and a currency crisis when the central bank uses seigniorage to fund the fiscal deficit .

Corsetti, Pesenti and Roubini (1999) also model the Asian crisis. In their model the government guarantees the banks foreign currency loans which are used to finance domestic investment. This leads to a capital inflow boom, a current account deficit and an investment boom. Private sector borrowers believe that they and the banks will be bailed out When a foreign shock occurs this leads to both a banking crisis and a possible debt crisis as the contingent liabilities that the government has to cover increase the fiscal deficit.[5]

3.4.2 The Eurozone crisis.

The Eurozone crisis of 2010 -2014 was a sequel to the global financial crisis of 2007 -2009. Reinhart and Rogoff (2009, 2011) provide comprehensive evidence on the link between banking and fiscal crises. They show that banking crises often precede debt crises and that for a large panel of advanced and emerging countries in the twentieth century that the debt to GDP ratio rises by 86% in the three years following a banking crisis setting the stage for a downgrading of credit and a possible default. The Eurozone crisis seems to fit this prediction well. During the subprime mortgage crisis several European countries that had been connected to the US crisis engaged in expensive bond financed bank bailouts which increased the fiscal deficit leading to debt surges. The bailouts across Europe followed the example of Ireland which in September 2008 guaranteed its entire financial system To fight the recession that accompanied the crisis they also engaged in expansionary automatic and discretionary fiscal policy which also increased the deficits. Reinhart and Rogoff argue that the decline in tax revenues produced by the fall in output plus the expansionary government expenditures explained more of the run up in deficits and debt than the bailouts themselves. Laeven and Valencia (2013) provide a crude measure that

[5] Other papers that model the Asian crisis and place emphasis on government guarantees include : Arellano and Bond (2008) Burnside, Eichenbaum and Rebelo (2001), Burnside (2004), and Schneider and Tornell (2000).

separates out the rise in debt due to bailouts and a remaining portion due to discretionary fiscal expansion.

Against this background of weakening fiscal positions across the Eurozone, the announcement in 2009 that the Greek government had falsified its fiscal books, set the stage for the Eurozone debt crisis which first involved the threat of a Greek default and then contagion to other members via their banks which had significant holdings of Greek and other peripheral countries sovereign debt. Unsurprisingly bond spreads in Ireland, Portugal, Spain, and Italy spiked.

Bolton and Jeanne (2011) model the interconnection between sovereign risk and the banking system in a currency union where the banks in each country diversify their portfolios by holding the sovereign debt of other member states. Holding government bonds serves as safe collateral which allows them to increase their leverage. The default by one member spreads to the others via the weakening of bank portfolios.

Gennaioli, Martin and Rossi(2014) also model the interconnection between sovereign default and the banking system. As in Bolton and Jeanne, banks hold sovereign debt as collateral which allows them to increase their lending. A debt crisis leads to a credit crunch and a decline in real income. The authors demonstrate that the costs of a fiscal shock are higher for more financially developed countries.

Acharya, Drechsler and Schnabl (2013) model a two way interconnection between fiscal crises and banking crises. Bank bailouts lead to an increase in sovereign risks because of the increase in fiscal deficits and debt ratios. This in turn weakens the banking system which holds sovereign debt as collateral.

They use the Irish bailout of 2008 as their example. Their model predicts that the spreads between bank CDSs and sovereign CDSs should rise during the banking crisis. Then after the bailout, bank CDSs should decline and Sovereign CDSs should rise. This reflects the transfer of risk from the banks to the government. Empirical evidence for the advanced countries in the Euro zone backs this up. After the subprime crisis began in 2007 bank CDSs rise dramatically with no change in Sovereign CDSs. Then after the Lehman collapse and the Irish guarantee at the end of September 2008 Sovereign CDSs rise and bank CDSs decline.

Mody and Sandri (2012) examine the behavior of sovereign risk spreads of the Eurozone countries before and after the crisis of 2007-2009. They show that after the

creation of the Euro in 1999 sovereign spreads converged across the Eurozone. Then after the Bear Stearns bailout in March 2008 spreads increased in countries which had vulnerable financial sectors likely to be bailed out. After the Lehman failure in September 2008 spreads increased dramatically in countries that had higher debt ratios. Then after the failure of Anglo Irish bank in January 2009 spreads increased across the Eurozone reflecting the increased vulnerability of the financial systems of all the member countries.

4. Empirics of Financial Crises Over the Long Run

4.1 Dating of Financial Crises: A History of Comprehensive Chronologies

A number of different chronologies of financial crises exist. The crisis dates enumerated by each source are quite different. The coverage also varies in terms of the years and number of countries included in each sample. Because of all these discrepancies, the conclusions from each study are likely to differ and sometimes dramatically so. In this section we survey the methodologies of the leading databases for dating financial crises.

Economists for the last 200 years have been drawn to major financial events and used them to learn about the macro-economy. Charles Conant (1915) surveyed the history of central banking in many different nations in the early 20th century along the way detailing the prospective causes and impacts of financial events. The National Monetary Commission of the United States held lengthy hearings from leading financial experts and significant amounts of evidence on the financial histories of many countries were submitted as evidence.

Edwards and Santaella (1993) provided a chronology of currency devaluations from the Bretton Woods period. By the 1990s, researchers at the World Bank like Caprio and Klingebiel (1996) were providing dates for systemic banking crises in a large sample of countries. These crises were an economic phenomenon that had mainly disappeared between the 1940s and the 1970s. By the 1980s and early 1990s such crises became increasingly common place in advanced and emerging economies alike which attracted significant interest by policy makers and academic researchers alike.

Kaminsky and Reinhart (1999) provided a systematic account of banking, currency and "twin" crises for non-advanced countries. Laeven and Valencia (2008, 2013) compile a comprehensive dataset of banking, currency and debt crises for the period 1970-2011. Laeven and Valencia's dataset covers the experience of 162 countries advanced, emerging and less developed economies.

For the long run, three major contributions stand out. Bordo, Eichengreen, Klingebiel and Martinez-Peria (2001) dated banking, currency and twin crises for all years between 1880 and 1997. For the years 1880-1945 their sample included 21 now advanced countries and from 1945 data from 56 countries is available. Reinhart and Rogoff (2009) and Reinhart (2010) provide accessible data on banking, currency and debt crises for up to 70 countries. Their record on sovereign debt crises extends back to the medieval period but only for a select number of European kingdoms and countries. From 1800 this source is able to track banking, currency, and debt crises for an increasingly broad sample. Carmen Reinhart's website provides an excellent set of excel spreadsheets for researchers..[6] Finally, Alan Taylor (2015) provides the dates for "systemic" financial crises (mainly banking crises) for 17 countries 1870-2010.

Recently Romer and Romer (2015) have collected a new set of dates for financial distress based on their readings of the OECD Economic Outlook 1967-2007. While previous studies have mainly provided binary indicators of the various financial crises, Romer and Romer generate a measure based on a scale of 0 to 15. We discuss the merits of all of these dating methodologies below.

4.2 Financial Crises: The Record

Figures 1 through 9 show the sample probabilities of experiencing a financial crisis. This variable is calculated as the ratio of the number of years in which the set of countries in the sample is in the first year of a banking, currency, debt, twin (banking and currency) or triple (banking, currency, debt) crisis to the total number of country years.[7] We compare

[6] http://www.carmenreinhart.com/

[7] Twin crises happen when a currency crisis event takes place within two years before or after a banking crisis. Triple crises are twin crises with an associated sovereign default within a two year window. We avoid double counting by assigning a zero to all banking and currency crises that occur in the context of twin or triple crisis. Similarly we any twin crisis that occurs with a sovereign default is only counted as a triple crisis.

outcomes for various chronologies and across four time periods: The classical gold standard (1880-1913), the interwar period (1919-1939), Bretton Woods (1945-1972), and the recent period of globalization (1973-present).

Currency crises are the most frequent types of crises followed by banking crises, debt crises, twin crises, and finally triple crises. By and large, all of the different chronologies agree on the trends. For the three datasets that cover the Interwar period, only two out of three agree (Bordo et. al. and Taylor) that this period saw the highest frequency. Reinhart and Rogoff's dating seems to suggest that the recent period has a higher incidence of banking, currency, triple, and debt crises than in the interwar period. Their data also show the same frequency of twin crises in the Interwar and the post-1973 period.

Figures 3 through 9 also present frequencies by crisis type for up to four leading chronologies. Roughly speaking the frequencies in Bordo et. al are in agreement. This agreement hides some dis-similarity in terms of dating crises for a constant country sample, as we discuss below. It also compares frequencies across different samples of countries. In a constant 21 country sample, for 1973-1997, Bordo et. al. report banking crises to have a 0.021 probability while Reinhart and Rogoff report a 0.032 probability. The dating methodology of Taylor shows a noticeably higher probability of a banking crisis in all periods.

Figure 4 shows that currency crises shot up in probability in the Interwar period and from then on have remained fairly constant with Bordo et. al and Rinehart and Rogoff reporting probabilities in the range of 0.07 to 0.09. These two datasets are in strong disagreement with the Laeven and Valencia dataset in the recent period. Even in samples where the years and countries overlap exactly Laeven and Valencia report only half the currency crises that are recorded in Reinhart and Rogoff or Bordo et. al.

Figures 10 through 14 show the number of crises that occur alone or coincidentally with other types of crises. We leave for future revisions an attempt to provide a measure of how frequently and which types of crises precede the other. Of course research along the lines of Kaminsky and Reinhart (1999) provide evidence that currency crises frequently accompany banking crises in LDCs and Reinhart and Rogoff (2009) suggest that many debt crises are preceded by banking crises. Bordo and Meissner (2006) discuss the historical experience in some detail.

In terms of time trends in twin crises, Bordo et. al find that their frequency was highest in the Interwar and lowest in the Bretton Woods period. Reinhart and Rogoff's data disagree showing that a country would be equally likely to suffer a twin crisis in the interwar period as in the recent period. Once again, Laeven and Valencia date many fewer twin crises due to their comparatively lower number of currency crises which are included in the other two datasets.

Finally for triple crises, both Bordo et. al. and Reinhart and Rogoff agree that these are rare events and they occur in less than 1% of the country years within sample. Both data sets agree they are now more frequent than in the previous three periods. [8] Once again, Laeven and Valencia do not concur for the 1973-2011 period suggesting that triple crises are much more rare than in the other two datasets at (0.001 %).

4.3 Definitions and Disagreements

In our view the leading chronologies are those of Bordo et. al., Reinhart and Rogoff and Laeven and Valencia. The dataset provided by Taylor is limited by the fact that it restricts attention to systemic financial/banking crises for 17 countries. The other data sets allow researchers to separate currency, banking, debt, twin, and triple crises, each of which are important phenomena. Two questions immediately arise. How well do these sources agree on their documented dates and which source(s) are the best?

In answer to the first question regarding agreement, there is some significant evidence that the correlation between dating methodologies is not extremely high even within constant country samples. Tables 1 through 5 show cross-tabulations of crisis indicators for each of four sources (Bordo et. al., Reinhart and Rogoff, Taylor and Laeven and Valencia) for four different periods (1880-1913, 1919-1939, 1945-1972 and the years after 1973). We restrict attention in these tables to the first year of a banking crisis for a country.

In each sub-table we show the number of non-crisis country-years, and the number of country-years with crises in either of the two datasets at hand. The entry in column 2, row 2 of each table records the number of times both datasets are in agreement, and the last two columns provide a measure of the agreement between sources calculated as the percentage of all crisis-years dated within the period and the country sample in which the two sources

[8] Note we use Reinhart and Rogoff's debt crisis dates when dating a triple crisis within the Bordo et. al. dataset.

agree. We provide this percentage for crises occurring in the same year and then allow for a one year-window to allow for small variations in timing.

The minimum percentage in Tables 1 to 5 is 0.34 (comparing Reinhart and Rogoff to Taylor for Taylor's 17 countries in the years, 1880-1913). For the years excluding the Bretton Woods period, the maxima are 0.73 (Bordo et. al. vs. Reinhart and Rogoff for 21 countries 1919-1939) and 0.72 (Bordo et. al. vs. Reinhart and Rogoff for 21 countries 1973-1997. The average percentage of times that the head-to-head comparisons agree is 0.59.

Matters are obviously slightly worse in terms of correspondence than these numbers suggest since the figures are calculated based only on overlapping samples of countries. The fact that Reinhart and Rogoff and Laeven and Valencia provide much larger samples means that the absolute number of crises reported will be higher. Frequencies also vary as seen above in Figures 1 through 9.

Disagreement amongst datasets exists because of differing definitions of what constitutes a crisis. Table 6 gives the stated criteria for dating the various types of crises. As is evident, for banking and currency crises, the definitions vary by sets of authors leading to significant disagreements both about timing and whether there was or was not a crisis. In particular, for banking crises, authors disagree about how many banks must be closed or what percentage of capital must be impaired for a crisis to be classified as systemic. Laeven and Valencia require that major policy interventions take place. Reinhart and Rogoff classify more crises than other authors likely because they only require bank runs lead to the "closing of *one* or more financial institutions" (our emphasis).***

Another issue with the historical dating of crises is that authors must rely on the research of other economic historians or significant amounts of scattered primary sources from multiple country-specific sources. Often historical sources are vague as to how many financial institutions were closed or faced runs which leads to discrepancies in the dating of crises. Andy Jalil (forthcoming) studied six leading chronologies of the American banking system in the 19th and early 20th century and observed major discrepancies amongst them. Jalil argues that "quantitative sources alone are not sufficient to identify banking panics", and carries out an extensive and careful reading of contemporary sources to identify banking panics (as opposed to systemic banking crises).

Matters are significantly worse for dating currency crises in history especially in the 19th century. As it turns out, finding reliable exchange rate data for samples outside of the

leading 21 countries is extremely difficult if not impossible since active and liquid markets in foreign exchange did not exist without some prior financial development. Reinhart and Rogoff (2009) provide an extensive list of dates for which nominal exchange rates are available from which shows cases in point such as: Argentina (available from 1880 only), Finland (from 1900), Korea (1905), Greece (1872), New Zealand (1892), South Africa (1900), Uruguay (1900) etc. In other cases using an exchange market pressure index will be difficult prior to the 1930s or even the 1950s and the Frankel and Romer approach will have to suffice. Relying exclusively on exchange rates changes neglects many important episodes.

More disconcerting is the disagreement on sovereign defaults in the period since 1973. These data are mainly gathered from primary and secondary sources as noted in Laeven and Valencia (2013) and Reinhart and Rogoff (2009). While Reinhart and Rogoff find 64 defaults between 1973 and 2009 Laeven and Valencia (2013), *in the same set of countries*, only find 34. This is not simply a matter of widening the window of years in which a default is classified. Many defaults in Reinhart and Rogoff such as Algeria (1991), Brazil (2002), Uruguay (1990) etc. are not recorded in the Laeven and Valencia dataset. This is hard to understand given the fact that most sovereign defaults are highly publicized events and the IMF and World Bank keep careful track of their member countries' experiences.

4.4 Causes of Crises

As discussed above there are many forms of financial crises. Banking crises for example can be caused by panic and sudden losses on the liability side of the balance sheet a la Diamond Dybvig and as recently occurred in the repo market in the sub-prime crisis. Banking crises can also arise due to impaired assets which stem from large declines in asset prices and the business cycle impact on a bank's assets. The question arises, are banking crises predictable and if so which economic variables are the best predictors?

A large number of variables are on the list of potential determinants of banking crises. Recent literature has focused on the credit growth and capital inflows. Credit booms, whatever their origins, cause a build-up of household or non-financial firm debt. Economic shocks can then cause large losses on the balance sheets of banks leading to a systemic crisis (Taylor and Schularick, 2009; Reinhart and Rogoff, 2009; Jordà et al. 2011; Mian and Sufi, 2014). Capital inflows, especially in small open economies, subject these nations to credit

booms, sudden stops and reversals adverse changes in the real exchange rate and sharp changes in demand (Calvo, Izquierdo and Mejia, 2004; Mendoza and Terrones, 2012).

A number of other variables have also been highlighted as potential determinants of banking crises. These include the growth rate of M2 (possibly relative to reserves), real interest rates and global interest rate shocks, output and asset price shocks, corporate governance issues (limited liability, moral hazard e.g., the S&L crisis in the US), loose fiscal policy and regulations that feed banks excess government debt, the exchange rate regime, the level of capital controls etc. Kaminsky and Reinhart (1999) amongst others provide detailed econometric tests of the predictive power of these variables. The historical literature on banking crises in the US and in comparative perspective has focused on issues related to regulation, inter-bank contagion, limited liability, the exchange rate regime, the types of shocks countries are exposed etc. (Grossman, 1994, Carlson and Mitchener, 2006 Mitchener, 2005).

Our initial reading from the literature is that overall it is very hard to predict the exact timing of financial crises with a high degree of accuracy. Jordà et. al. argue that credit provides good predictive power while other variables add little to the predictive power of econometric models. It could be asked whether this is a product of the selected country and crisis sample they use. Larger samples from other studies highlight other key, statistically significant determinants. Our reading from the literature is that it is very hard to predict financial crises with a high degree of accuracy..

In terms of fiscal crises, Reinhart and Rogoff highlight both private and public borrowing surges. In their review of the historical record, private borrowing, mediated by the banking sector often precedes fiscal crises. They emphasize the possibility that when and if private debts go bad that governments provide large bailouts to the financial sector. Another possibility is that a banking crisis leads to output losses, lost revenue, higher outlays if automatic stabilizers are present, and a worsening debt burden relative to GDP. Countries, especially in the developing world, would be in an especially tight situation if borrowing or lending constraints tighten in the downturn. Austerity measures could have a negative impact on output assuming there is a fiscal multiplier of one or higher.

The literature has typically found that fiscal policy was more pro-cyclical in LDCs than in advanced economies. However, the recent crisis has shown that such an outcome can arise in advanced economies. Ireland, Spain, Portugal, Italy, and possibly Greece faced

massive economic shocks and lacked "fiscal space". These countries, despite their advanced economic status were viewed as being close to a threshold where increases in debt were unsustainable. Other countries have worried about fiscal sustainability and limited their fiscal response such as the United Kingdom, Germany and to an extent, the United States.

Over the long run this type of dynamic seems less common in advanced countries. For the most part governments were much smaller in scope. The use of bailouts and guarantees was not uncommon prior to the 1940s, but the size and scope was more limited. Moreover, these economies had greater wage and price flexibility, especially prior to the 1930s such that adjustment obtained relatively quickly. There are of course exceptions to the rule in history as in Argentina in 1890-1891 when government guarantees of the banking system and the non-financial sector became overwhelming.

4.5 Output Losses of Financial Crises

Financial crises are often associated with economic downturns and deviations of output from long-run trends. A large number of studies investigate the path of output, output growth, other macroeconomic aggregates, and even health indicators (Stuckler, Meissner, Fishback, Basu, and Mckee, 2010). It is our intention, in the next draft to provide a brief meta-study of this body of research. We expect to find that banking crises and other financial crises are associated with significant output losses and deviations of growth from trend.

For the time being, Table 7 provides a short-list of papers, methodologies and bottom lines for the impact of financial crises. There is substantial variation in the methodologies used for calculating the costs of financial crises. Some authors prefer to study the marginal impact of crises and financial distress on growth rates. Others calculate the cumulative loss of output or GDP per capita from the peak of economic activity and up to five years later. Differences in methodologies, dependent variables, and samples leads to large differences in the size of the estimated costs of financial crises. Still, nearly all studies agree that financial crises are associated with economically significant downturns in output and growth.

One major issue is causality. Real shocks may cause an output decline and problems in the financial sector, but equally, financial shocks are widely believed to generate output declines. Reinhart and Rogoff (2014) observe in their sample that the peak of economic expansions usual coincides with banking crises but that in several instances the peak pre-dates the crisis.

If unobservable shocks are the worry, then it may be difficult to establish the "causal impact" of financial crises on output. For now we highlight two approaches that have been taken to deal with causality. Bordo et. al. compare recessions without financial crises to recessions with financial crises. After controlling for a small set of observables the authors find that financial crises are associated with higher output losses. Della'Ariccia et. al. (2008) argue that if financial sector distress matters then it should be the case that sectors which are more dependent on external finance should be the hardest hit when the banking sector is in trouble. Their evidence is consistent with this line of reasoning. Mladjan (2012) provides similar evidence for the Great Depression. In addition Ziebarth (2013) and found strong quasi-experimental evidence from the 1930s that where bank failures were larger these were associated with greater declines in output, lower revenue and a slower pace of entry by firms.

Using crisis data from Bordo et. al, Reinhart and Rogoff, and Laeven and Valencia and data on output per capita from Barro and Ursua (2008) we calculate the output losses in different periods and using different crisis dates. Here the goal is to use one methodology to compare output losses in a consistent fashion over the long-run. In particular we study the cumulative deviation of GDP per capita from the pre-crisis trend level from the outbreak of the crisis to three years later. Pre-crisis trends are given by the average change in log points of the logarithm of GDP per capita in up to 10 years prior to a crisis. [9]

We provide these losses for banking, twin and triple crises in Figures 15 through 39. Output losses as we define them here are economically very large. In the period 1880-1913 Figure 15 shows that these averaged about 26-27%. Twin crises and triple crises are associated with much larger losses in the Reinhart and Rogoff (RR) data than in the Bordo

[9] We eliminate crises that occur within 3 years of another crisis. Previous crises may have an impact on the trend and level of output. We also estimate losses separately for banking crises without currency and currency and debt crises so as to separate the event states into mutually exclusive bins.

et. al. (BEKM) data. Losses are much larger in the interwar, largely driven by the Great Depression. Here, for the three different crises losses are never lower than 30%. Losses in the BEKM and RR data sets are even larger in the post 1973 period. Here the averages are on the order of 70% in the BEKM data ranging in the RR data from 57% (banking crises) to 86% (6 triple crises).

Output losses are different in size due to different methodologies. Laeven and Valencia (Figure 18) report much lower losses than we have calculated when using the BEKM or RR dates. Laeven and Valencia use GDP and not per capita GDP, although, in practice this should have only a minimal effect. LV also use an HP filter whereas we have opted for a simplified exponential de-trending procedure. One interesting fact is that while we find some instances where losses are not negative (i.e., below trend), probably because the pre-trend is already quite low, LV report no instances where this is the case. It appears that the lag length for calculating the trend matters. Figure 20 shows the median output losses as calculated by Laeven and Valencia for advanced and EM/LDC countries. Local polynomial regressions in Figures 21 and 22 and 31 through 33 show the data on a case-by-case basis for various years. Figures 23 through 30 show kernel density plots over various data sets, periods and types of crises so the reader can see the enormous variation in output losses. Figures 34 to 39 provide the time series plots for two of the most significant crises in each of three periods (1880-1913, 1919-1939 and 1973-1997) so the reader can explicitly see how output losses are calculated and how they can be so large.

Our bottom line is that financial crises are associated with significant deviations of output from trend. This stylized fact occurs over the long-run in different periods of institutional development. Surprisingly output losses seem to larger in the recent despite a greater reliance on liquidity support, fiscal interventions and other policies which attempt to remedy the financial shocks that regularly occur. Of course, without such interventions, output losses might have been higher although without further work on the research design to sort out causality and selection we can take no firm stance on the causal impact of financial distress and systemic banking crises.

TO BE DONE: A REVIEW OF THE DETERMINANTS OF THE SPEED OF RECOVERIES AFTER FINANCIAL CRISES. THERE IS A LARGE DEBATE HERE.

5. Fiscal Crises, Banking Crises and a new Trilemma

Following the research of Reinhart and Rogoff (2009) and after observation of events in Europe, research has focused on the impact of banking crises on the probability of a debt crisis especially in advanced countries. While developing countries faced such troubles from the 1970s, advanced countries largely had fewer and smaller crises until recently. Reinhart and Rogoff suggest however that public debt increased by about 86 percent in the wake of banking crises due to the impact of falling revenues. These increases were not apparently due to the fiscal costs of bailouts and guarantees.

Laeven and Valencia provide a systematic data set on the rise in Debt to GDP ratios for all of the banking crises in their data set. The average rise in the debt to GDP ratio for all systemic crises in their data was 12 percent while in advanced economies this figure rises to 21.4%. Fiscal costs, counted as the rise in outlays due to restructuring the financial sector averaged 6.8% (in terms of GDP. Laeven and Valencia subtract the rise in fiscal outlays due to restructuring from the rise in total debt to calculate the degree of discretionary fiscal policy. The median for this variable is 7%.

Tagkalakis (2013) empirically examines the feedback loop from fiscal policy to financial markets and back in a sample of 20 OECD countries 1990-2010. Fiscal instability leads to financial instability and financial instability leads to fiscal instability via bailouts. Fratzscher and Rieth (2015) using structural VARs with daily financial markets data for 2003-2013 confirms the two way causality between sovereign risk shocks and bank risk. They find that sovereign risk shocks are more important in explaining bank risk, than the reverse.

The findings in Tagkalakis (2013) are intriguing since it appears that the rise in debt following a financial crisis is larger the bigger the size of the financial sector. Laeven and Valencia (2013) also argue that the largest fiscal costs of crises since the 1970s have been in Ireland, Iceland, Israel (1977), Greece, and Japan (1990s).

Putting all of these findings together suggests the possibility that there is a potential tradeoff for countries along the lines of a trilemma. This trilemma suggests that countries have two of the following three choices: a large financial sector (measured by total assets/GDP), a large bailout package, and a strong discretionary reaction to the downturn associated with financial crises. The logic is as follows. A country with a large financial sector will be more likely to have a financial crisis. If so, then the government can either provide a

large bailout package and use up its fiscal space in this way, or else it could lower the size of the bailout and devote its fiscal space to discretionary fiscal policy. Obviously the smaller the financial sector the less binding will be the fiscal constraints since the size of the bailout would by definition be smaller.

The cases of the United States and Greece post 2007 are illustrative. The US had a large financial sector, but its bailout, as measured by the fiscal costs was relatively small (4.5% pf GDP). On the other hand the rise in the debt to GDP ratio was on the order of 19 percentage points (Laeven and Valencia, 2013). While Greece also had a rise in debt to GDP of about 17 percent, its downturn was much larger and likely merited, based on past experience a much larger response. Its fiscal costs of the bailout are reported by LV to be 27% (as a percentage of GDP) which does not account for the various bailout packages provided by the troika and re-scheduling of the national debt. Obviously the ability of countries to finance either a bailout or a discretionary package depends on the willingness of capital markets to fund deficits. In this regard, the trilemma would be more applicable or more binding for countries which had better debt sustainability measures at the beginning of their crisis events.

TO BE DONE: We will attempt to construct a more systematic test of this hypothesis in our future draft.

6.Conclusions

To be done…

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Figure 1 Crisis Frequencies Bordo, et. al. 1880-1997

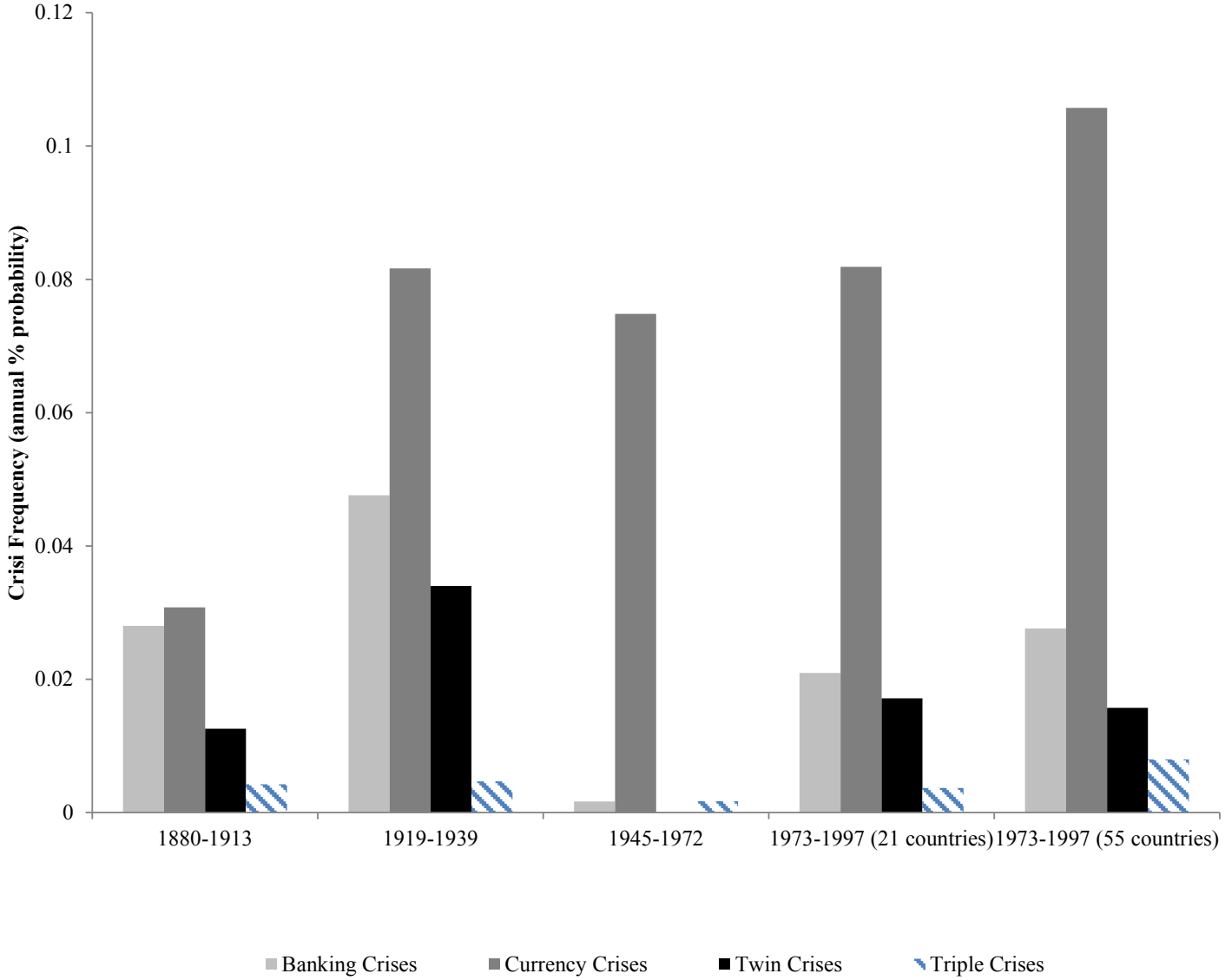


Figure 2 Crisis Frequencies Reinhart and Rogoff . 1880-2009

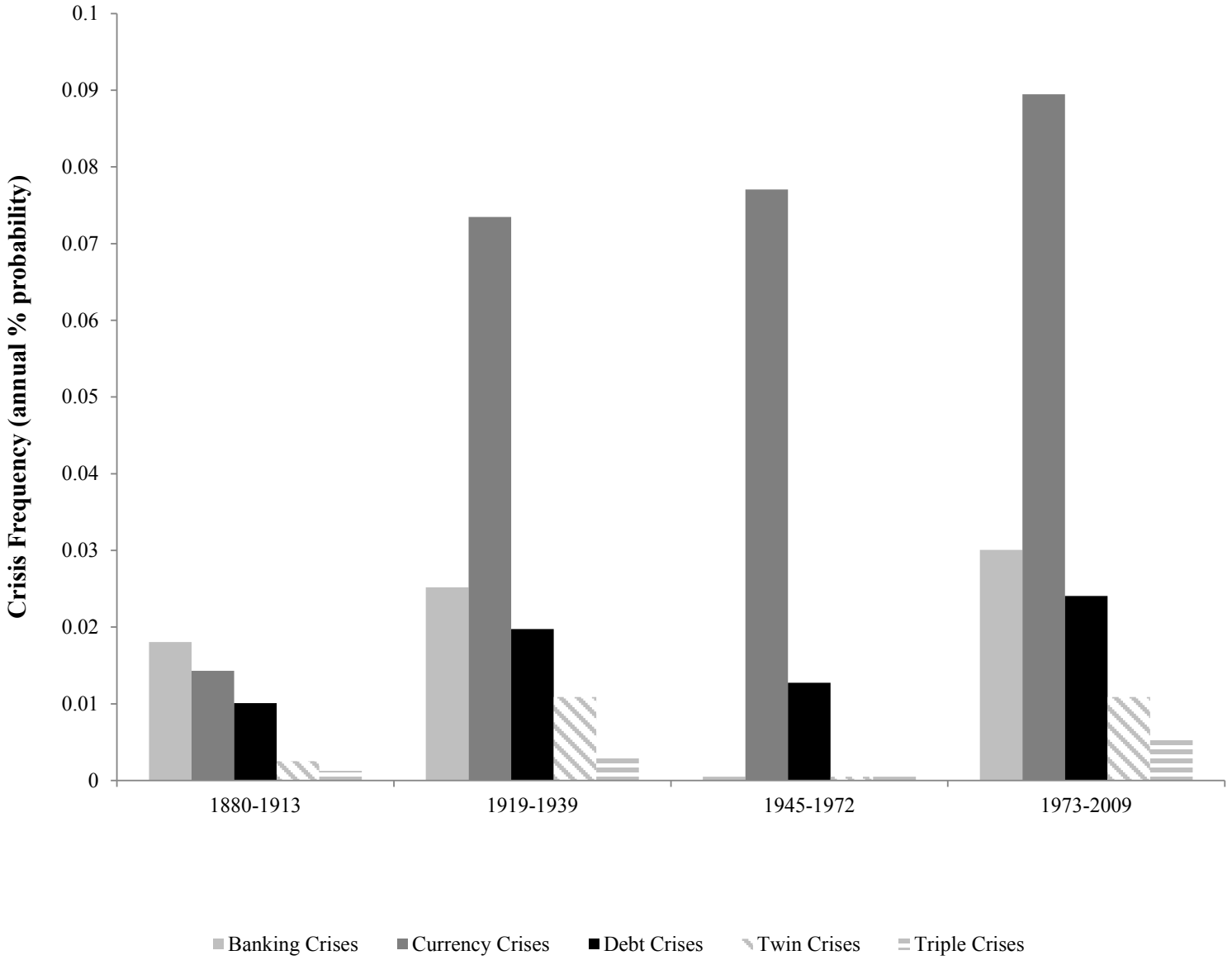


Figure 3 Banking Crisis Frequencies Four Datasets, 1880-2011

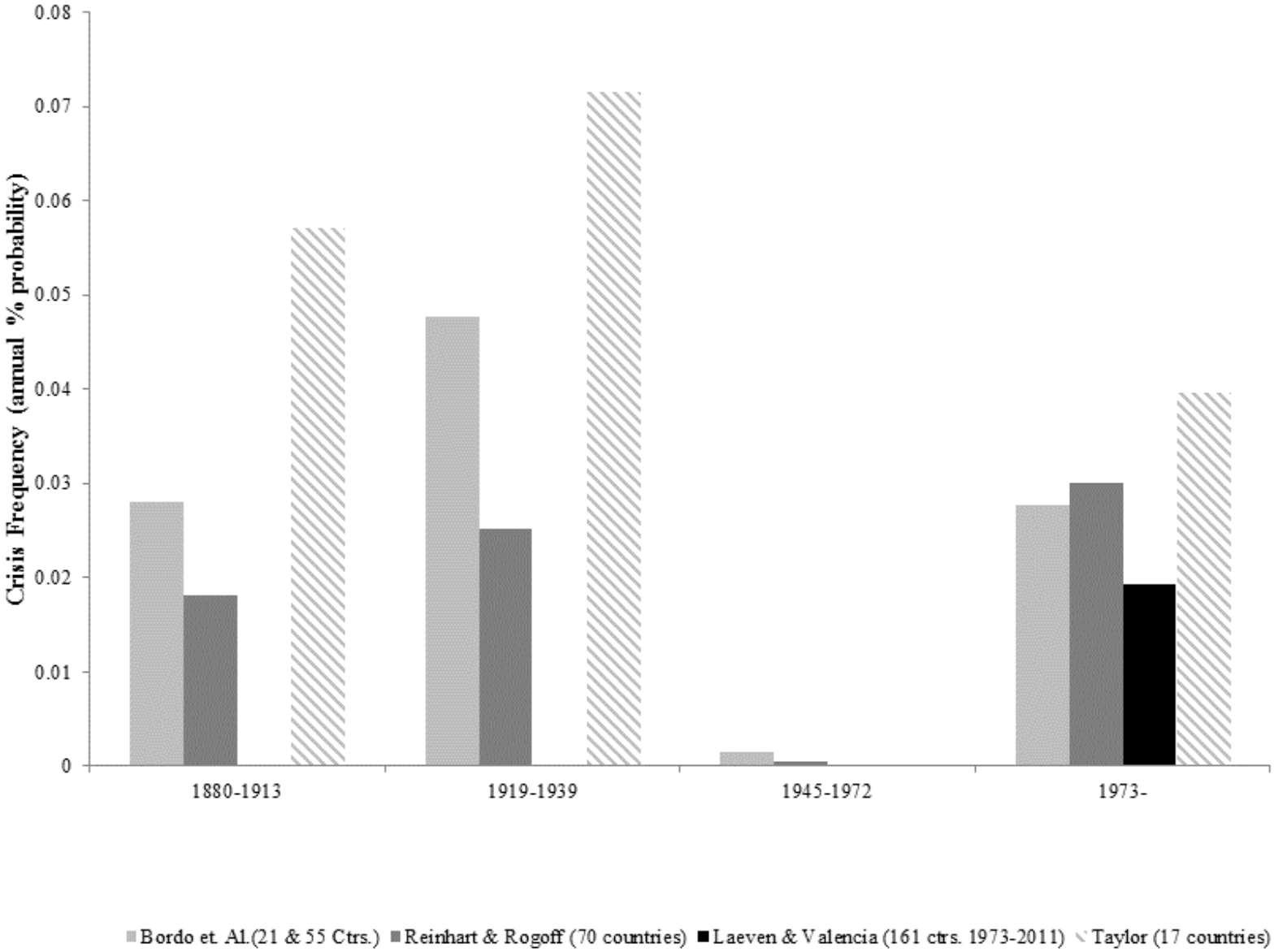


Figure 4 Currency Crisis Frequencies, three Datasets, 1880-2011

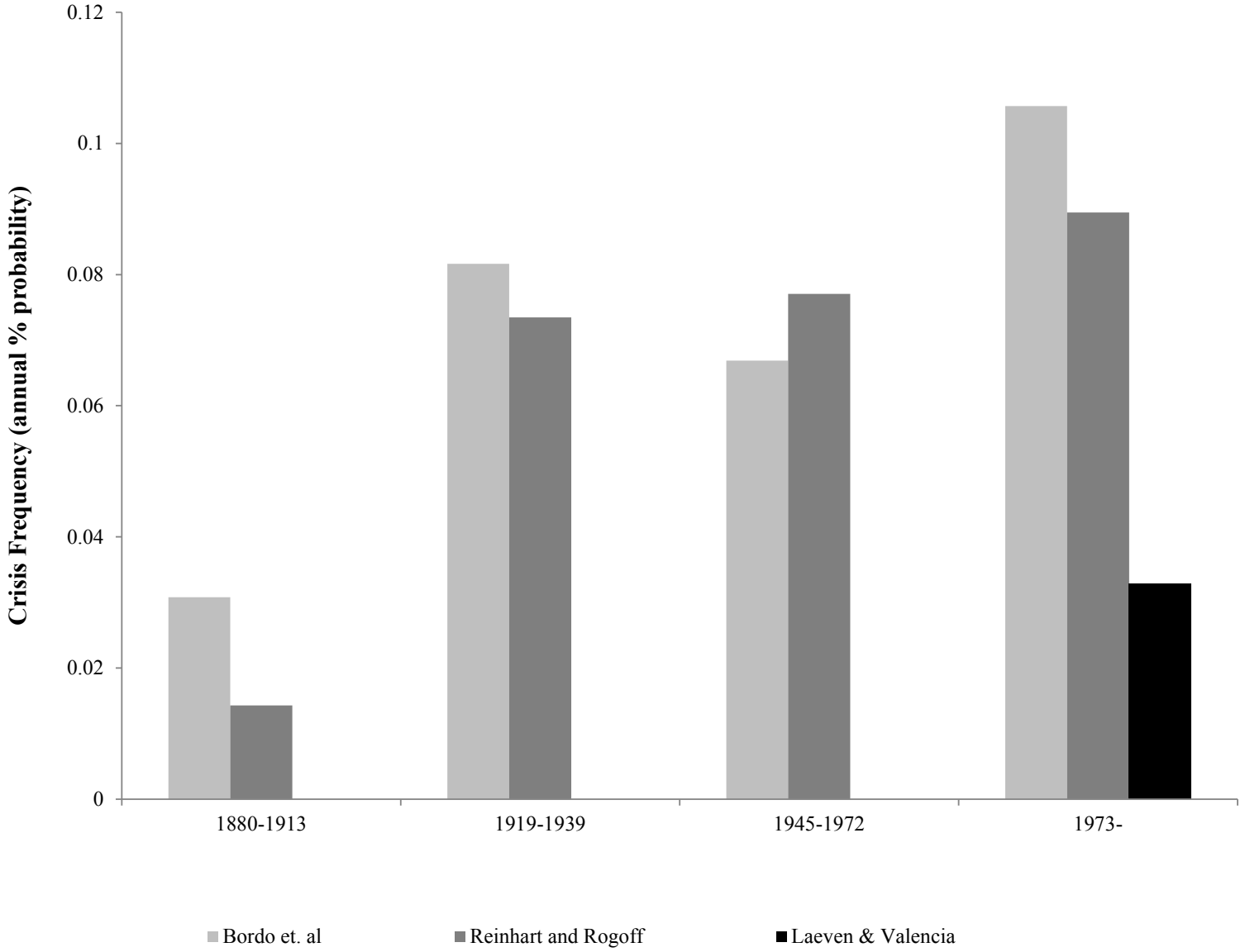


Figure 5 Twin Crisis Frequencies, 1880-2011

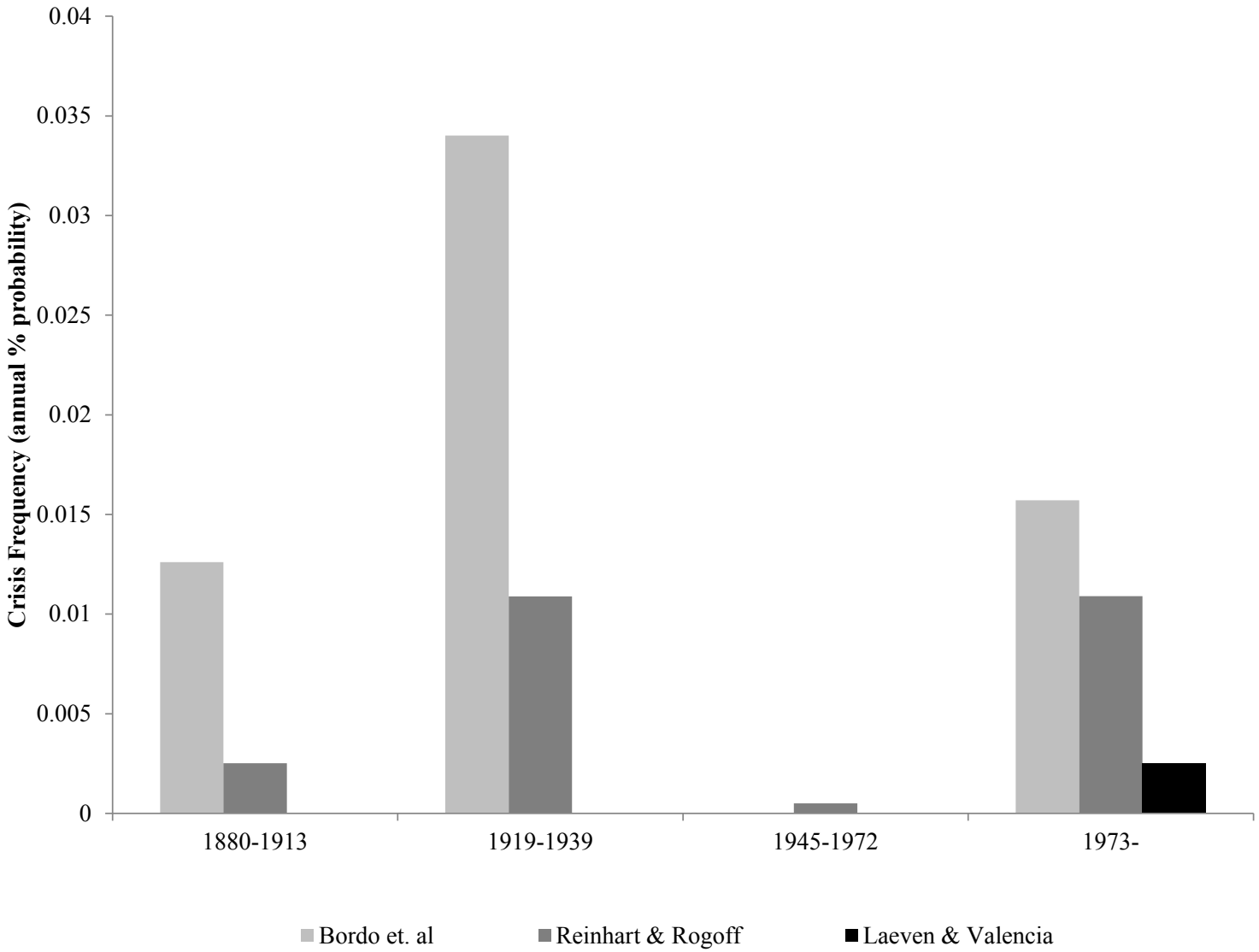


Figure 6 Triple Crisis Frequencies, Three datasets 1880-2011

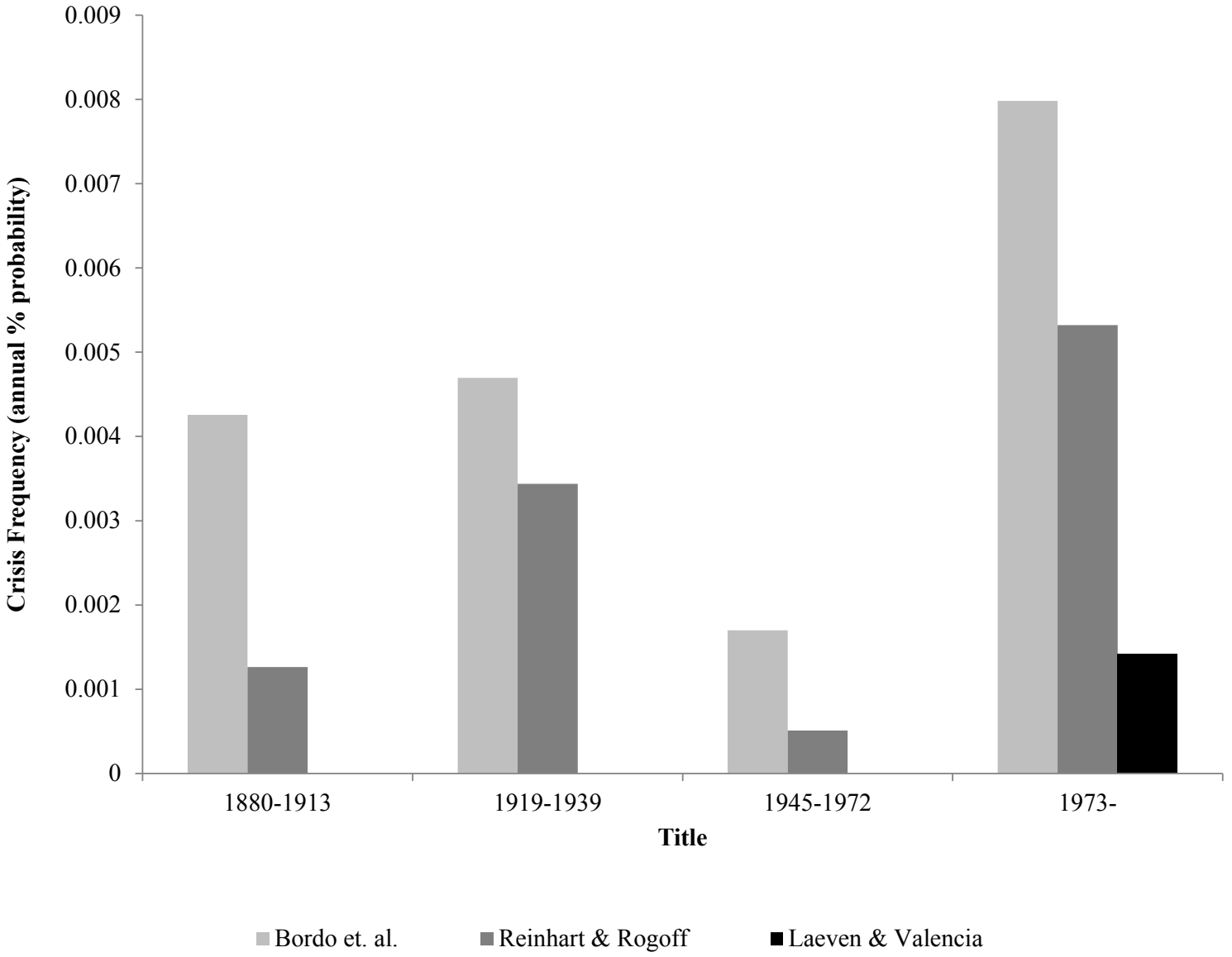


Figure 7 Number of Countries Experiencing a Banking Crisis, by level of development, 1975-2011. (Laeven and Valencia)

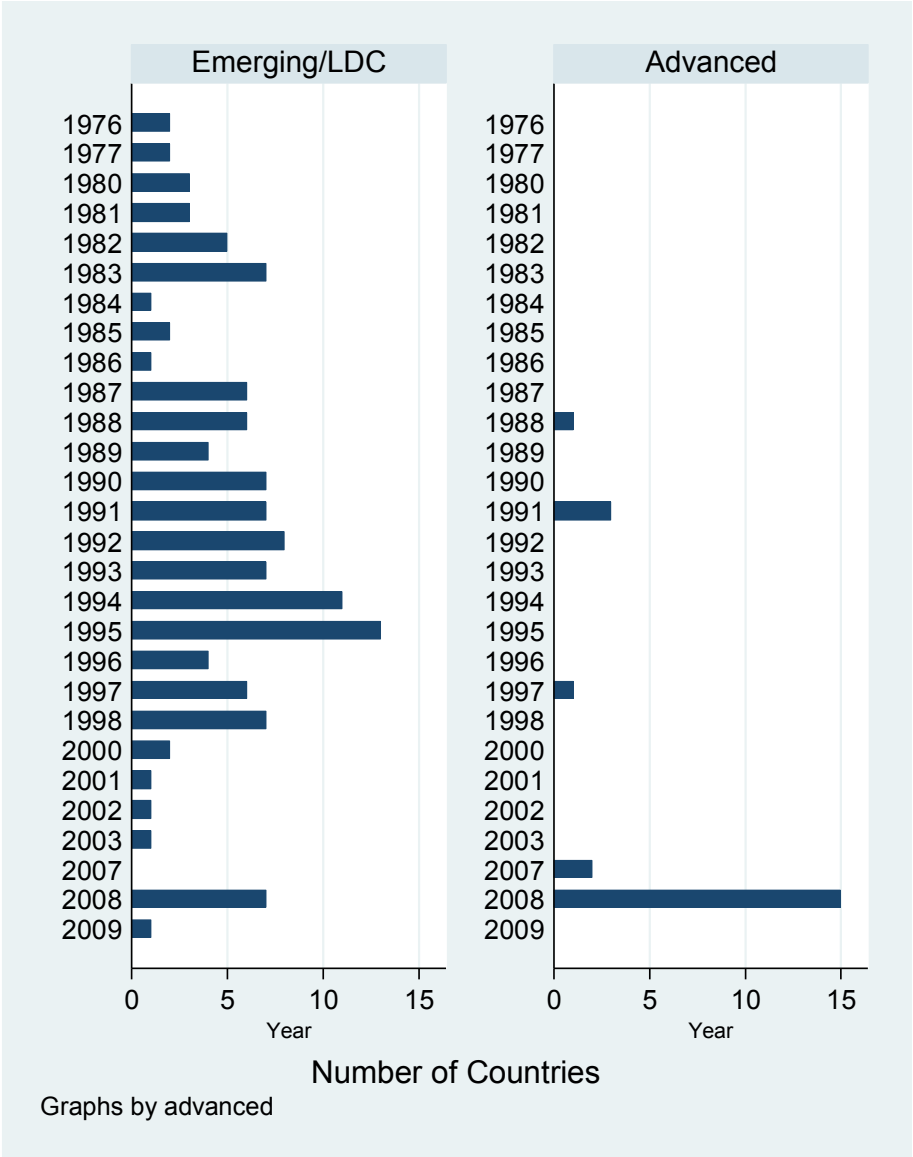


Figure 8 Percentage of Advanced Countries in Banking Crisis, 1975-2011 (21 Advanced countries-Laeven and Valencia)

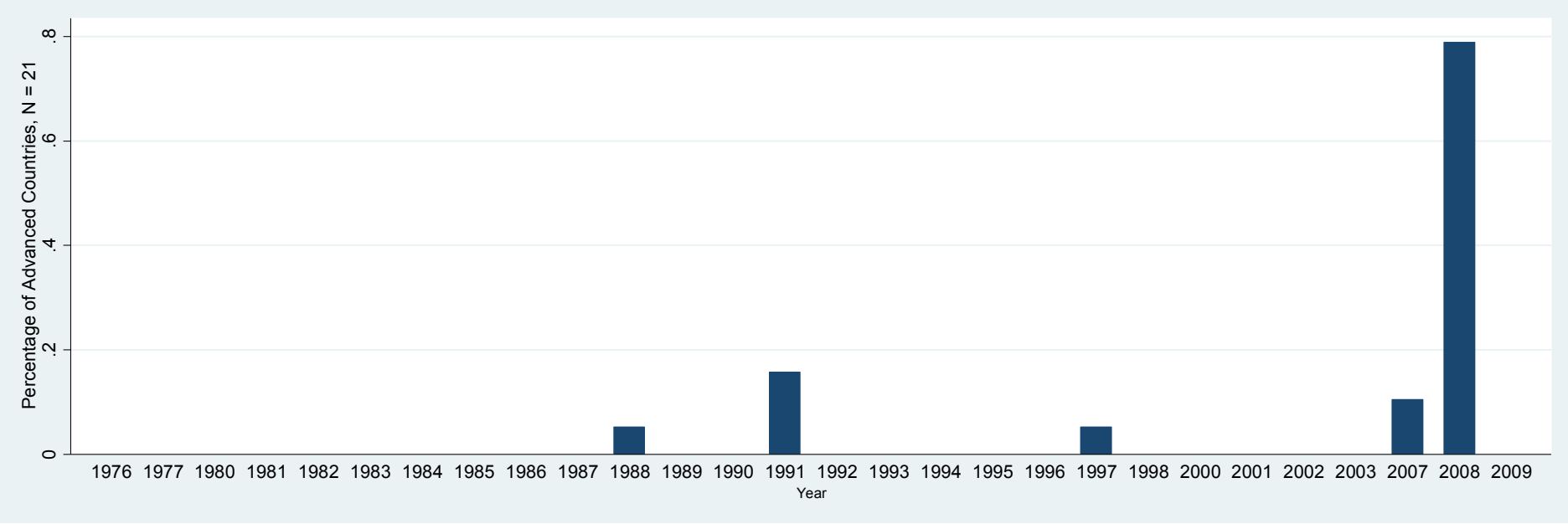


Figure 9 Percentage of Advanced and LDC/Emerging Market Countries in Banking Crisis, 1975-2011 (Laeven and Valencia)

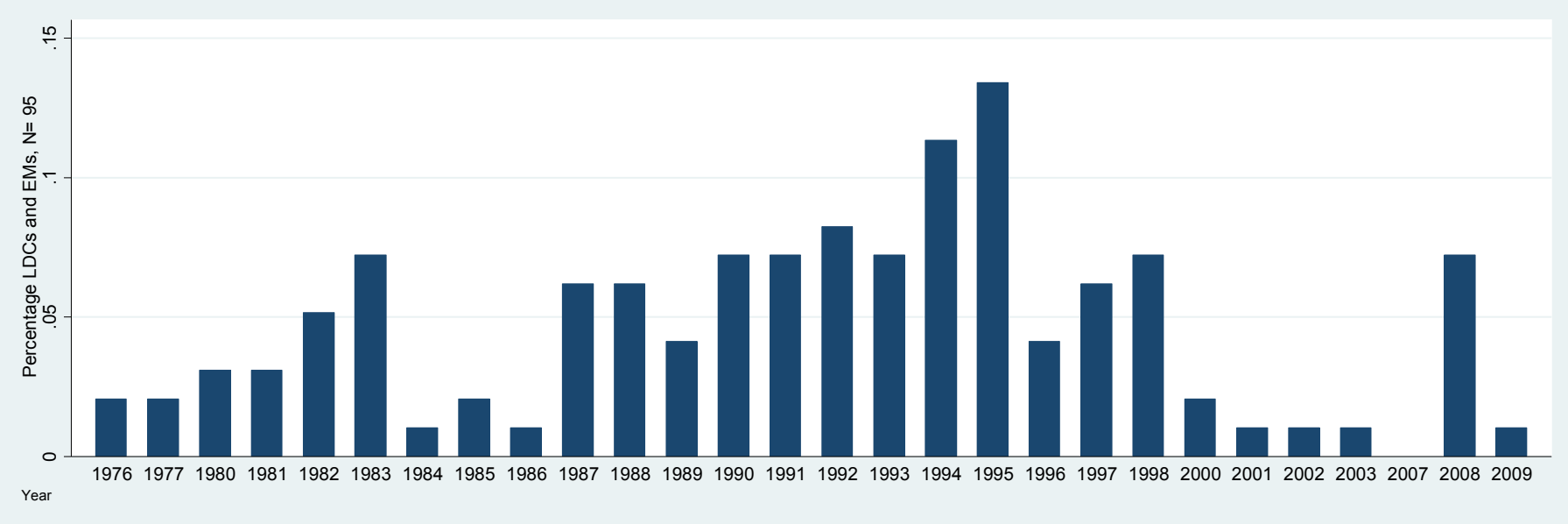


Figure 10 Coincidence of Banking, Currency and Debt Crises, 1880-1913

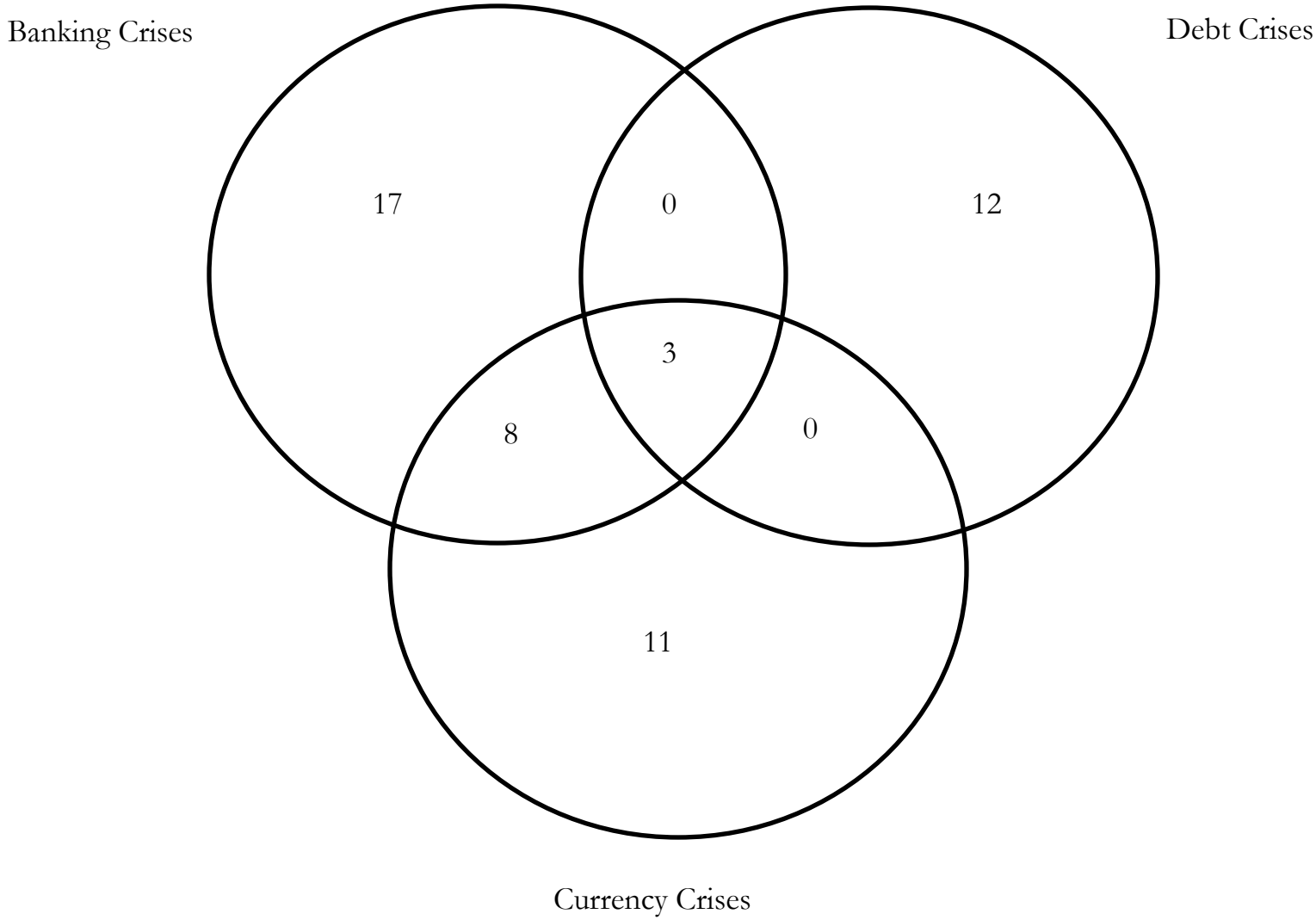


Figure 11 Coincidence of Banking, Currency and Debt Crises, 1919-1939

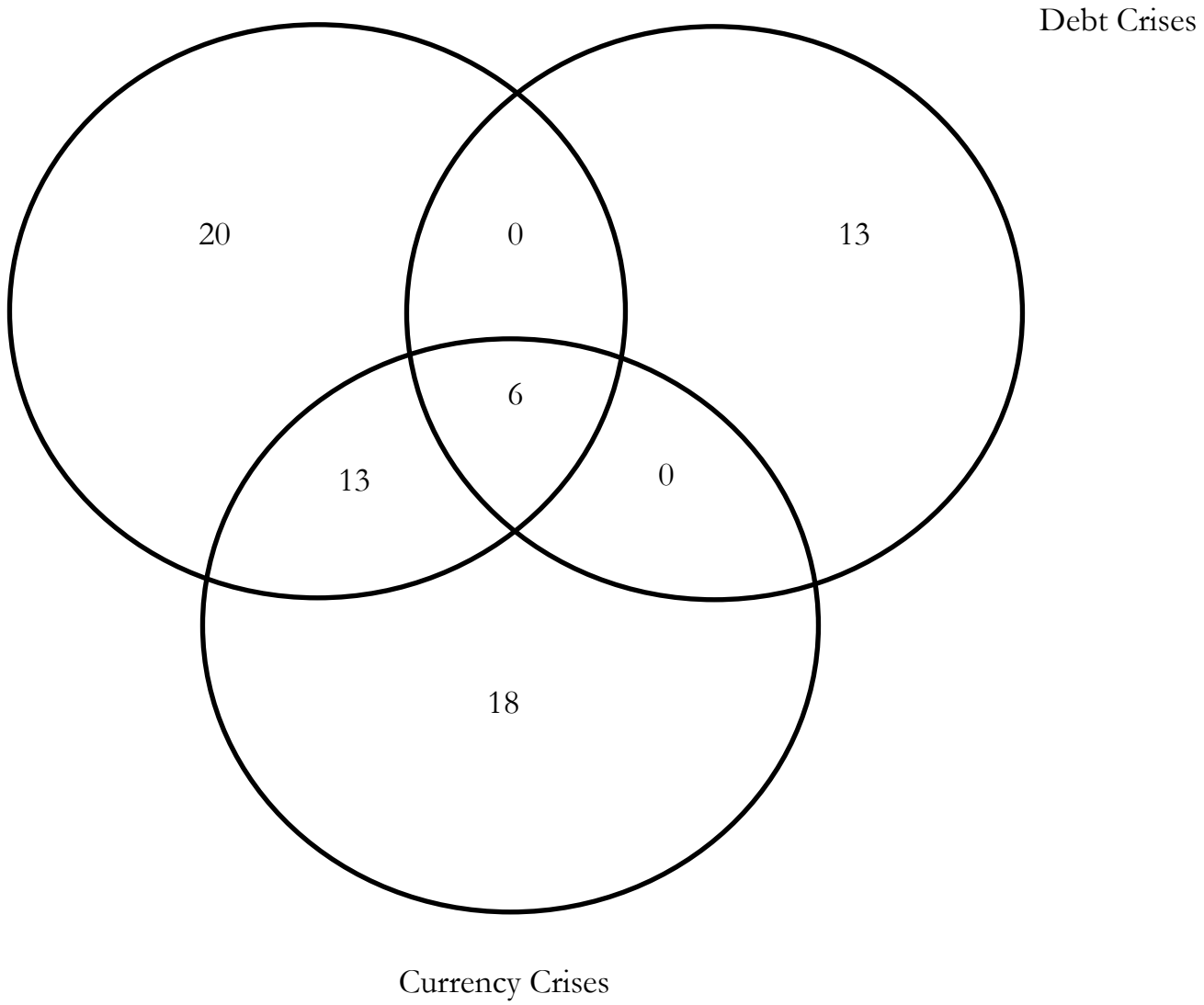
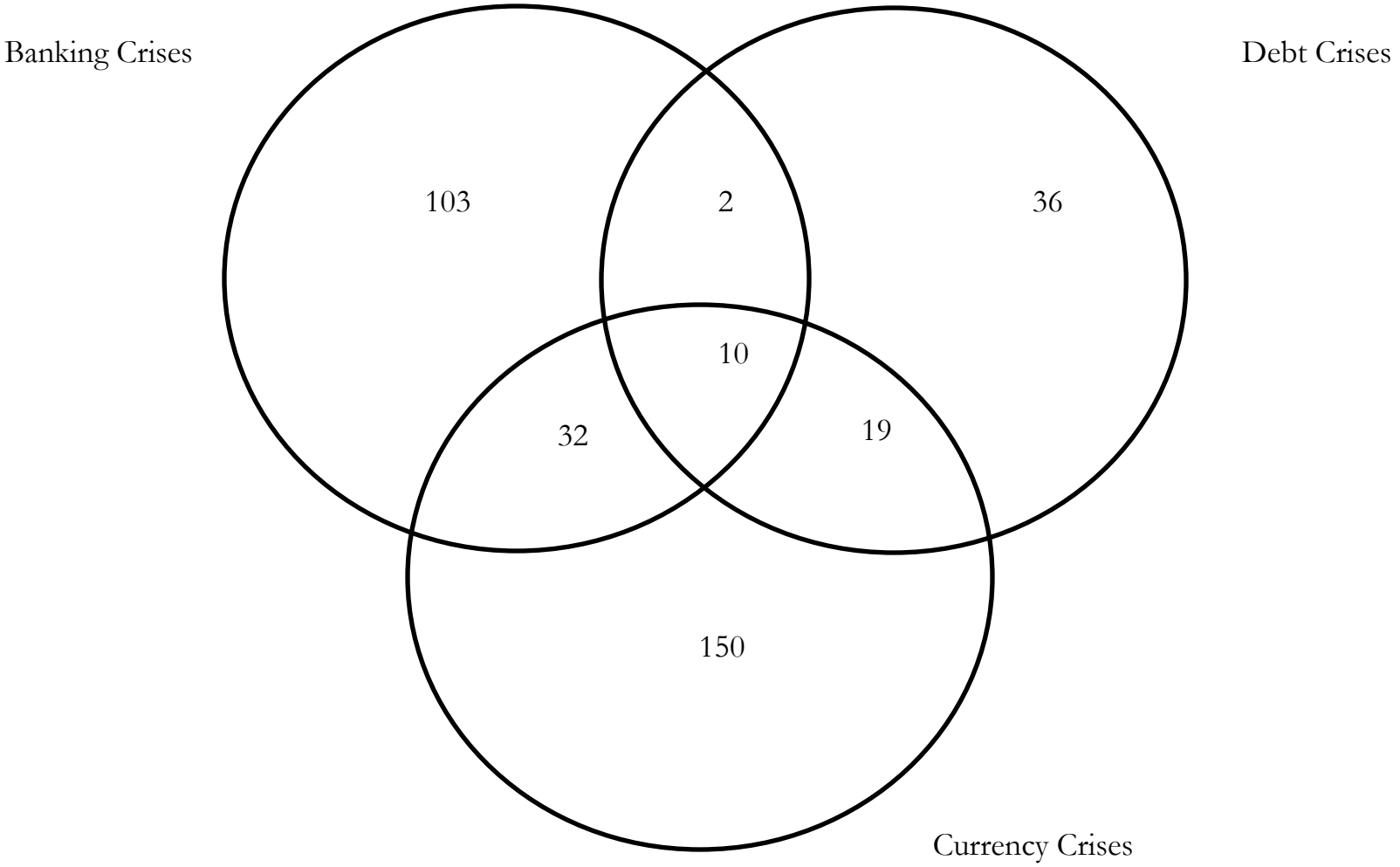
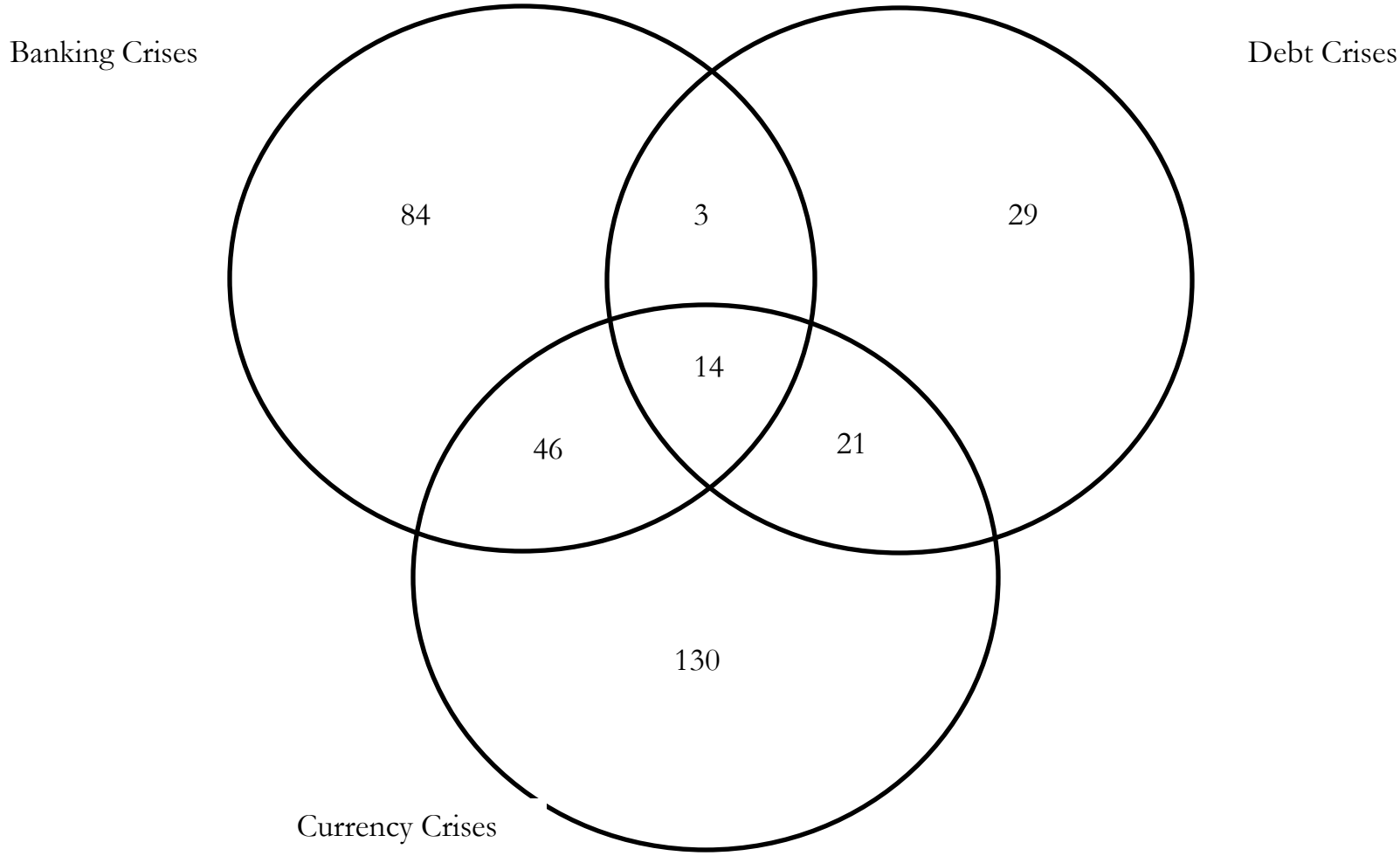


Figure 12 Coincidence of Banking, Currency and Debt Crises, 1970-2012 (Laeven and Valencia)



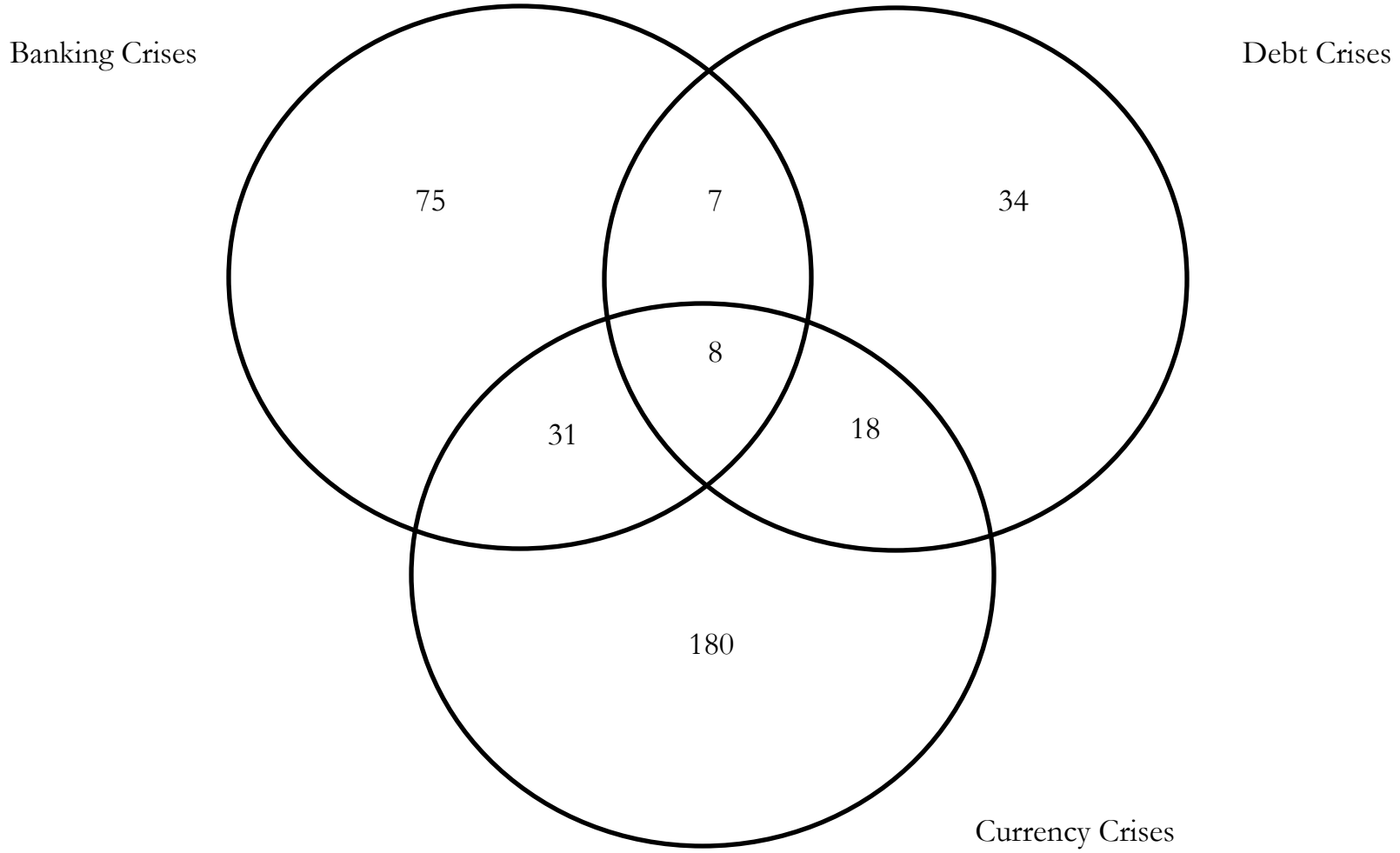
Notes: Source Laeven and Valencia (2013)

Figure 13 Coincidence of Banking, Currency and Debt Crises within a two year Window, 1970-2012 (Laeven and Valencia)



Notes: Source Laeven and Valencia (2013) A two year window is used.

Figure 14 Coincidence of Banking, Currency and Debt Crises, 1970-2012 (Reinhart and Rogoff)



Notes: Source Reinhart and Rogoff (2009)

Figure 15 Output Losses 1880-1912 Bordo et. al. and Reinhart & Rogoff

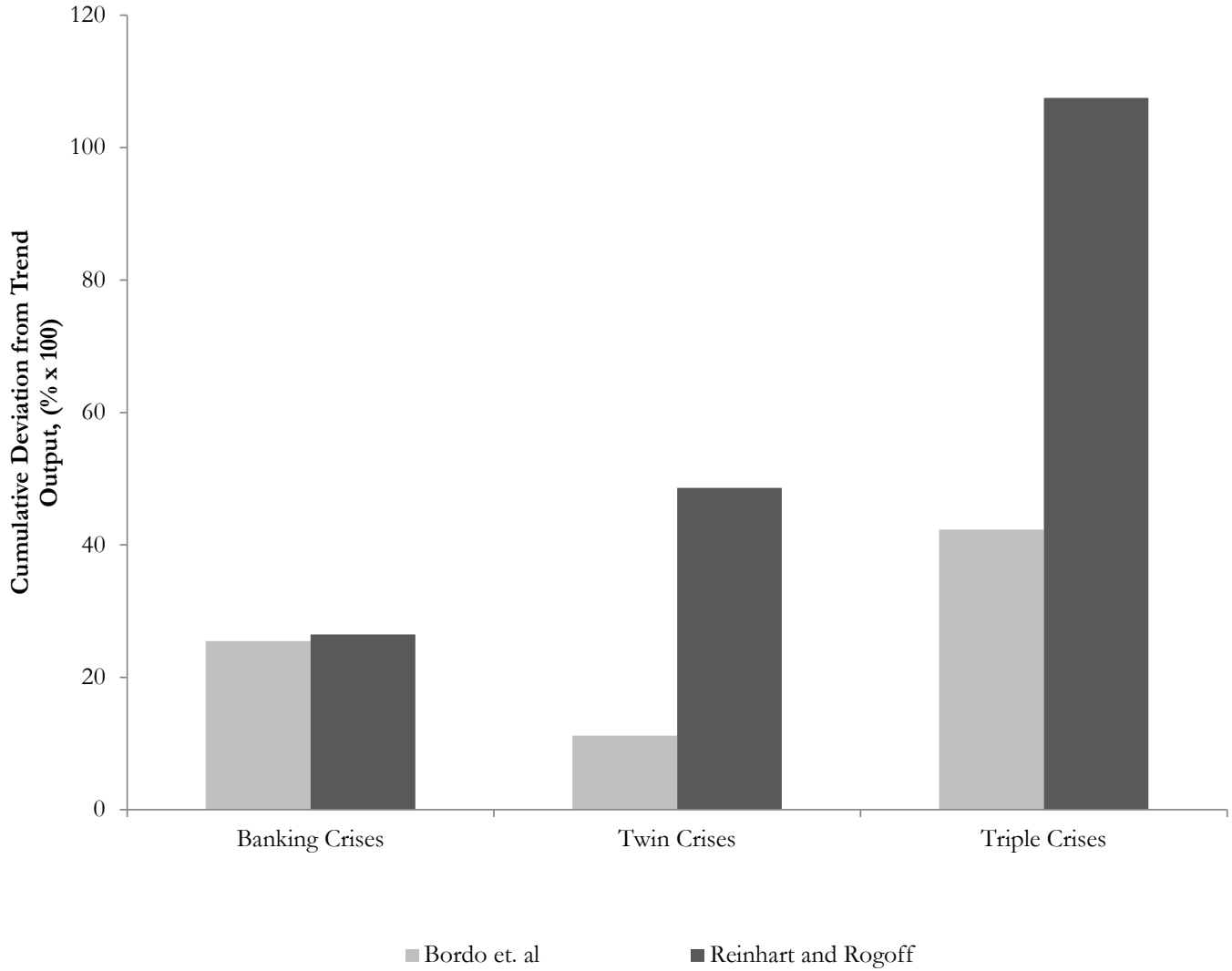


Figure 16 Output Losses, 1919-1939

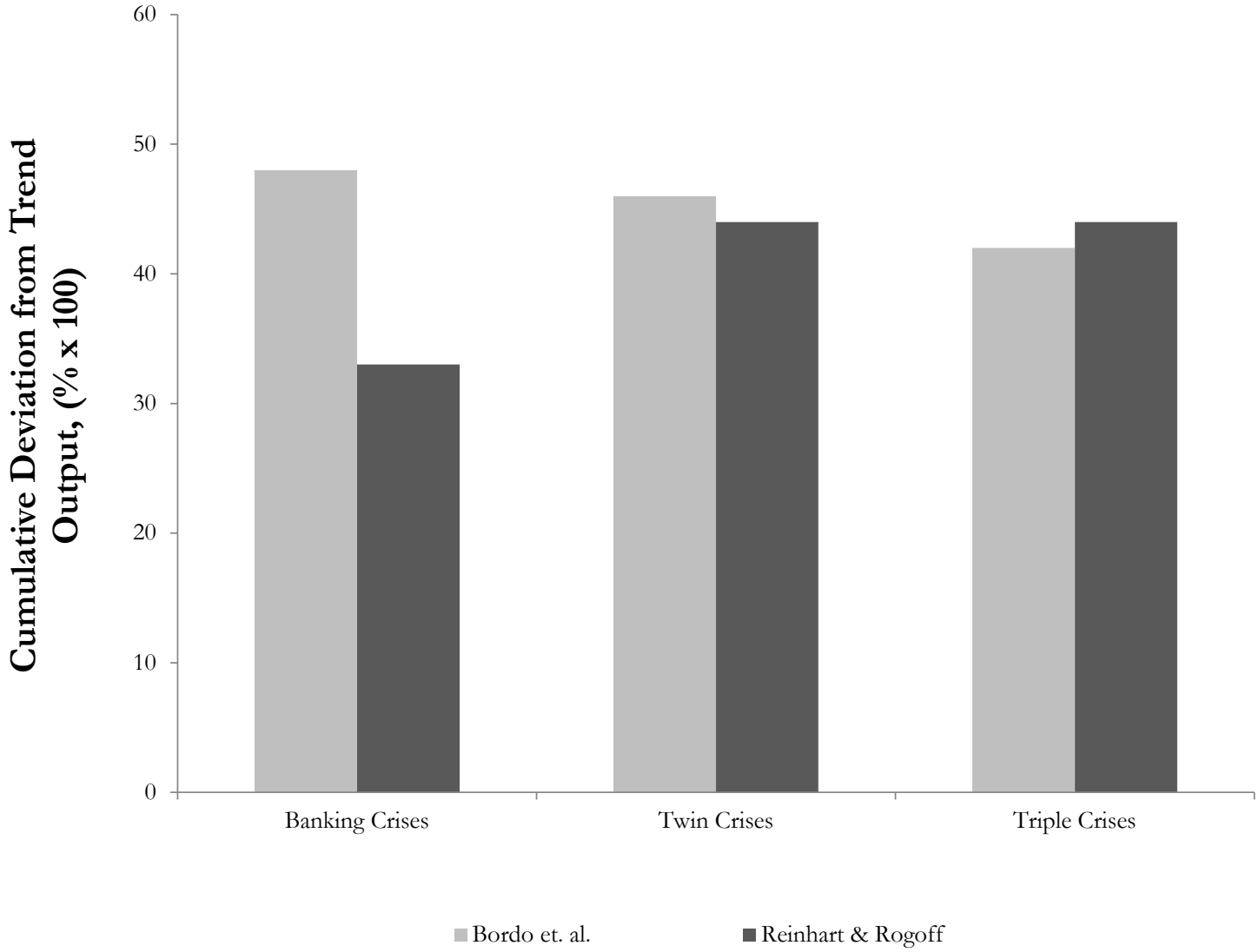


Figure 17 Output Losses, 1973-1997 (Bordo et. al.), 1973-2009 (Reinhart and Rogoff)

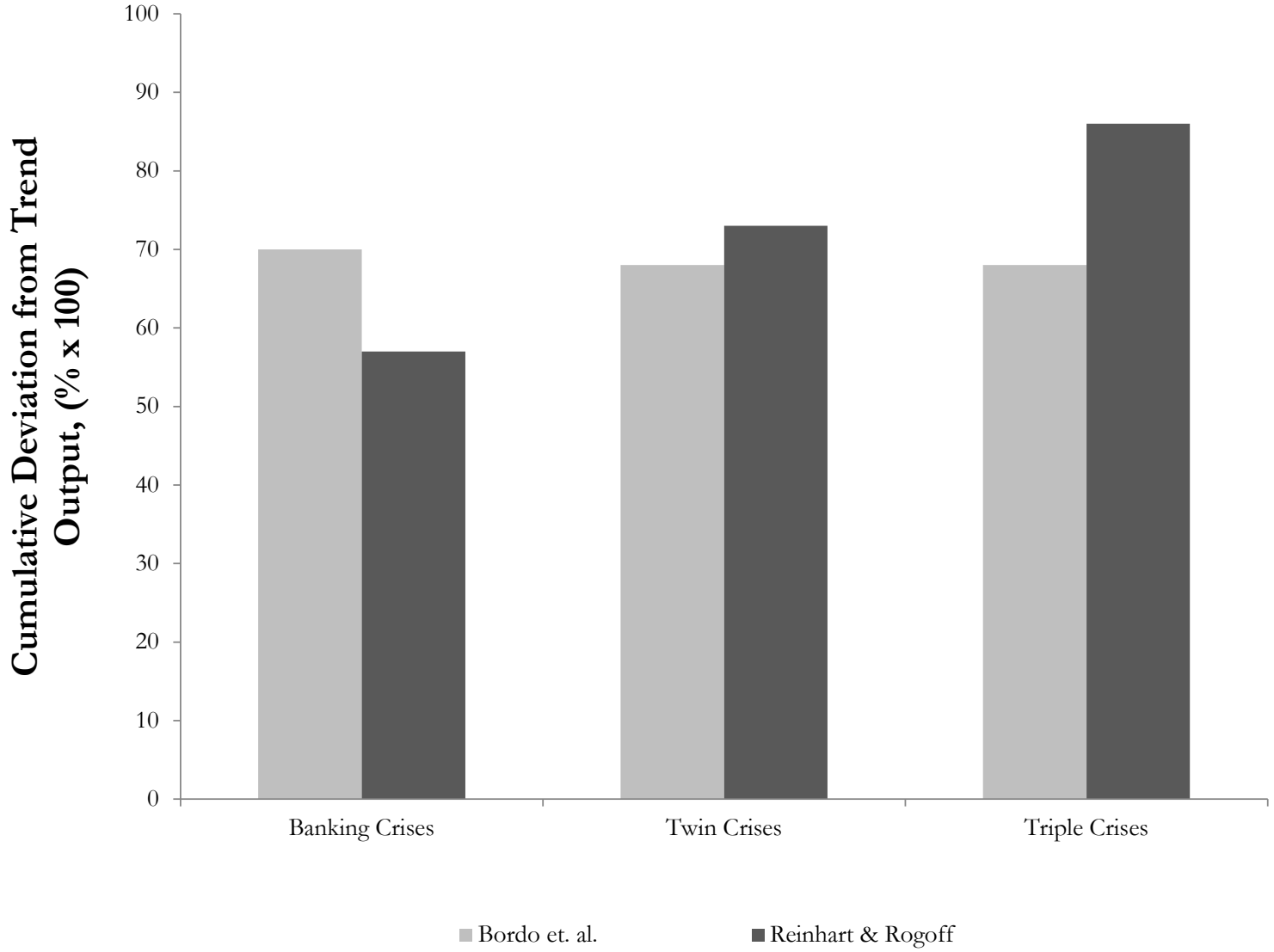


Figure 18 Output Losses 1973-2011 as reported in Laeven and Valencia (2013)

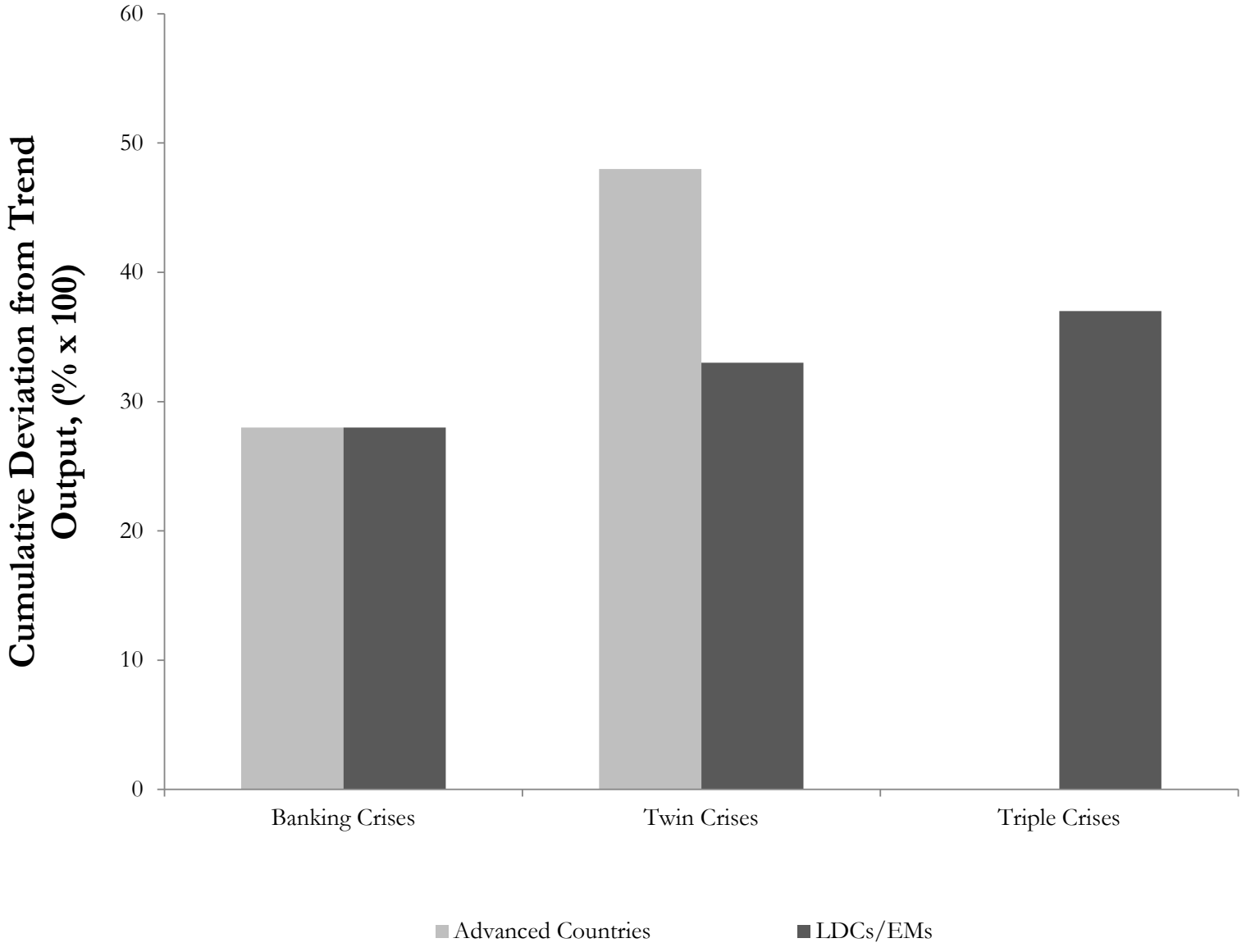


Figure 19 Output Losses, Three data sets, 1973-1997 (21 countries in Bordo et. al.)

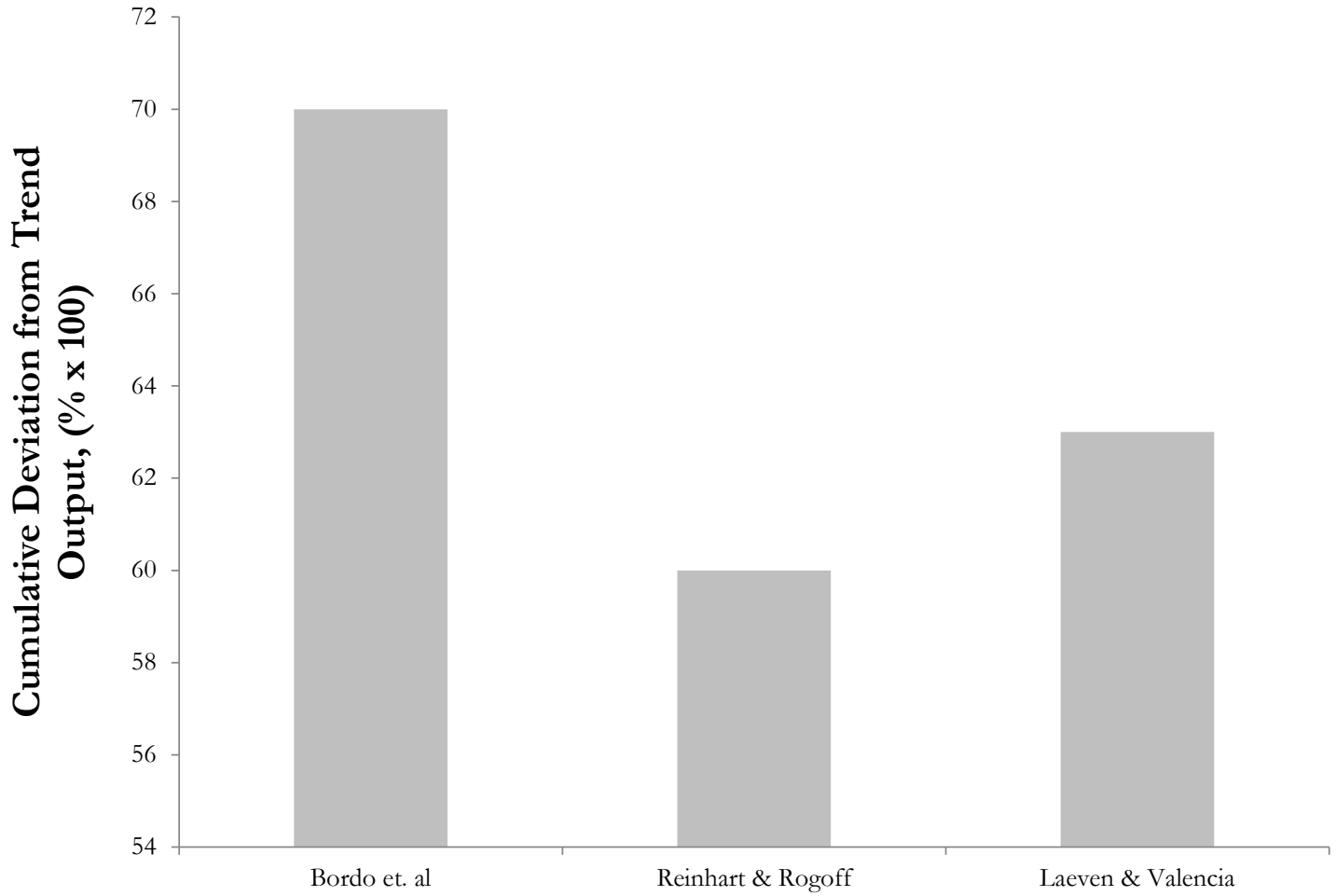


Figure 20 Median Output Losses by Level of Development and year, 1975-2011 (Laeven and Valencia)

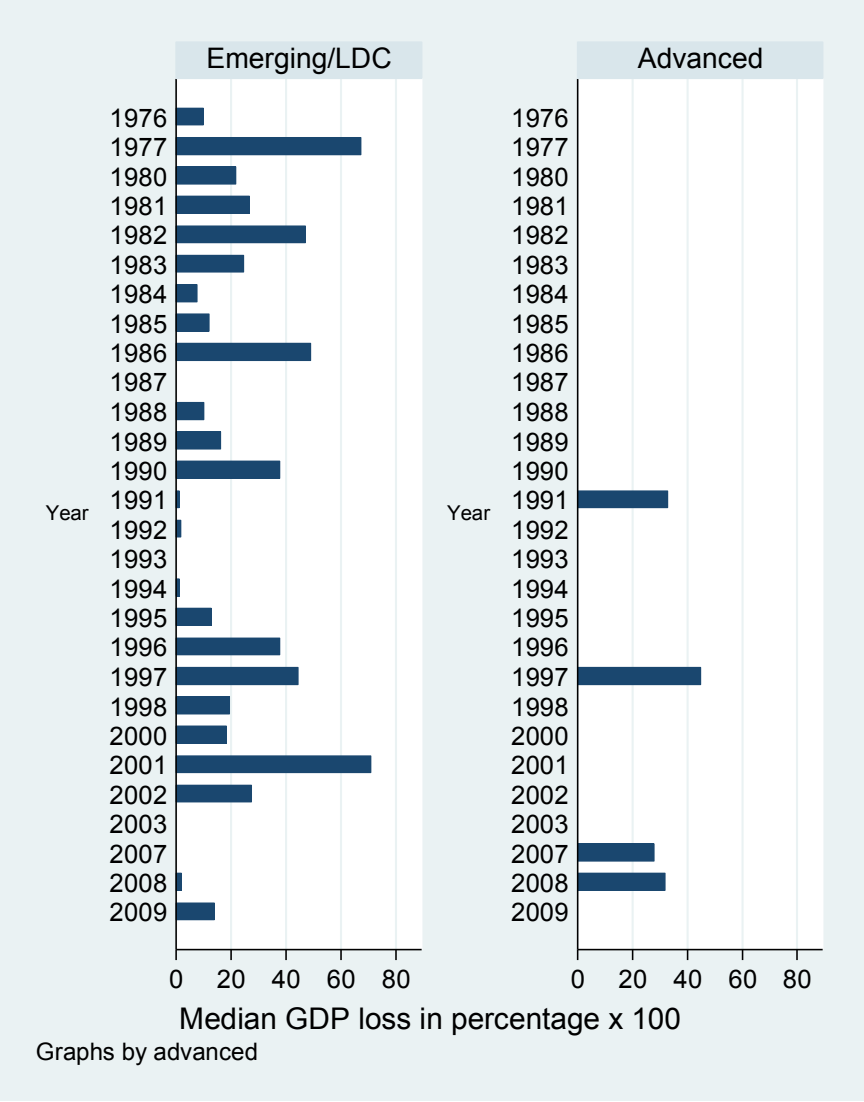


Figure 21 Output Losses from Banking Crises for Advanced Countries, 1985-2011 (Laeven and Valencia losses are zero prior to 198)

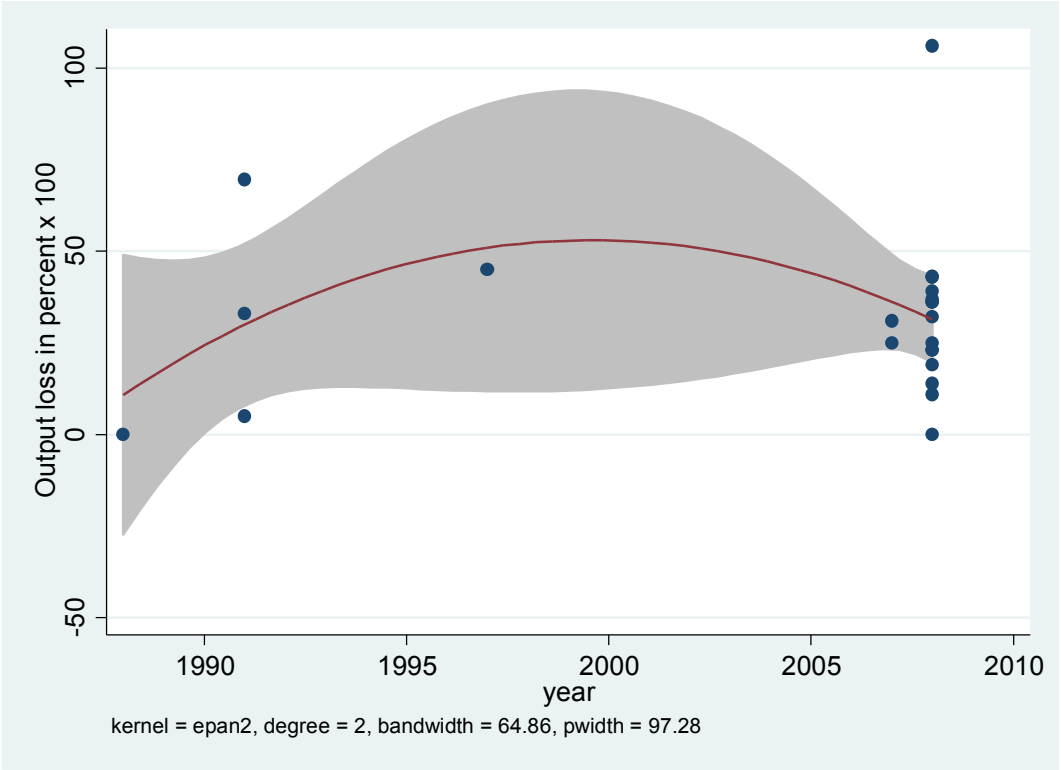


Figure 22 Output Losses from Banking Crises for LDC and EM Countries, 1975-2011 (Laeven and Valencia)

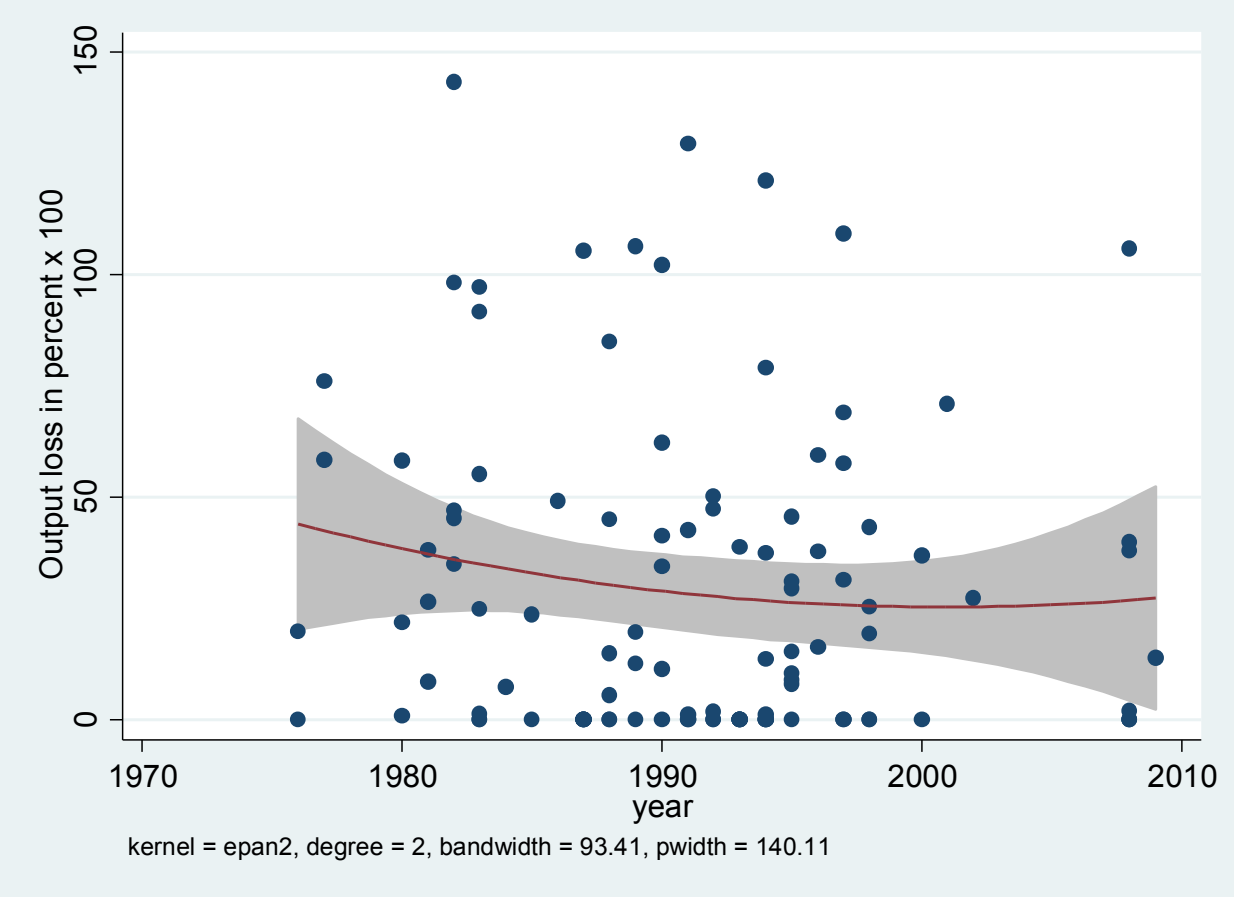


Figure 23 Output Losses from Banking Crises Bordo et. al.

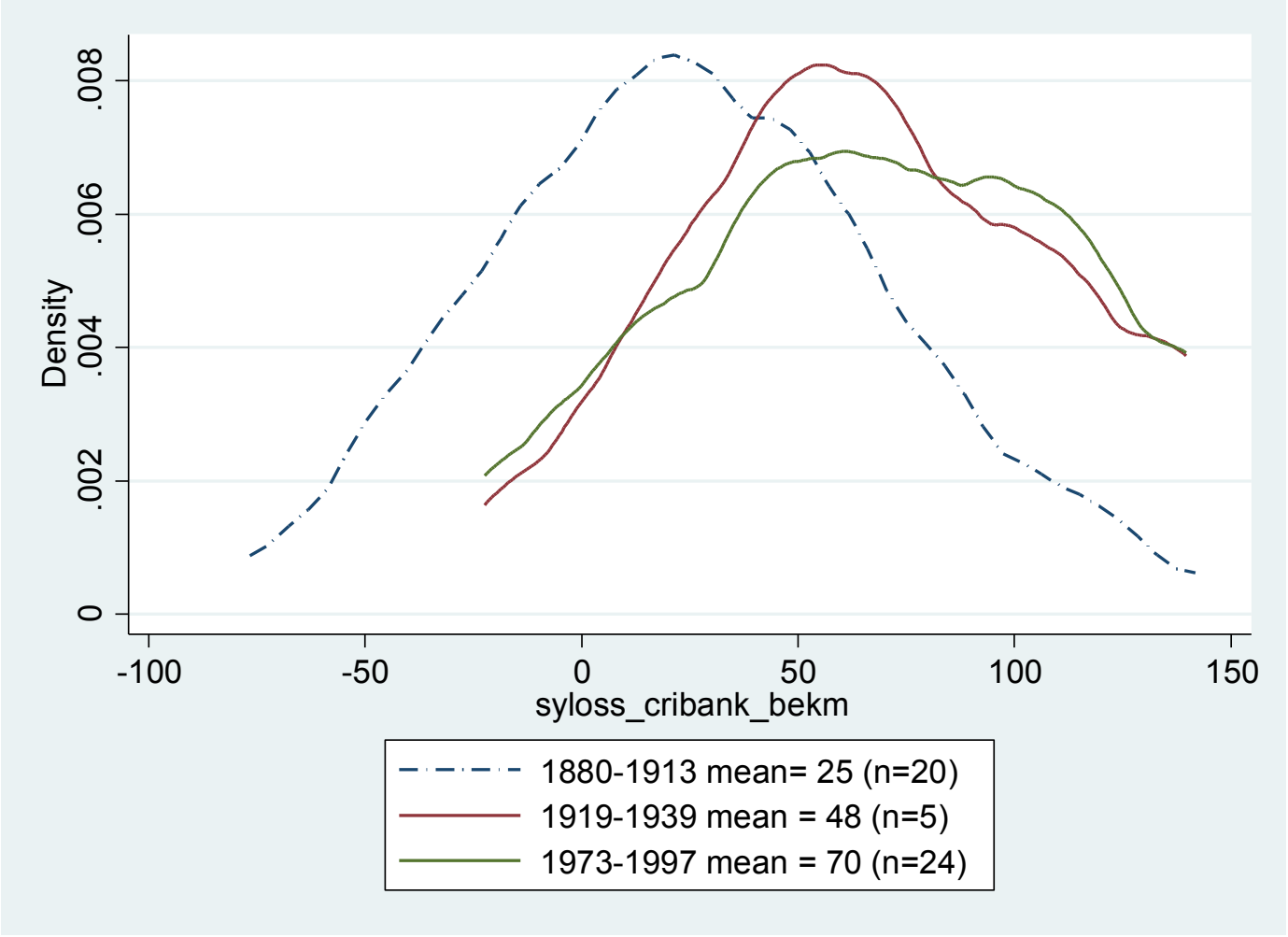


Figure 24 Output Losses from Banking Crises Reinhart & Rogoff

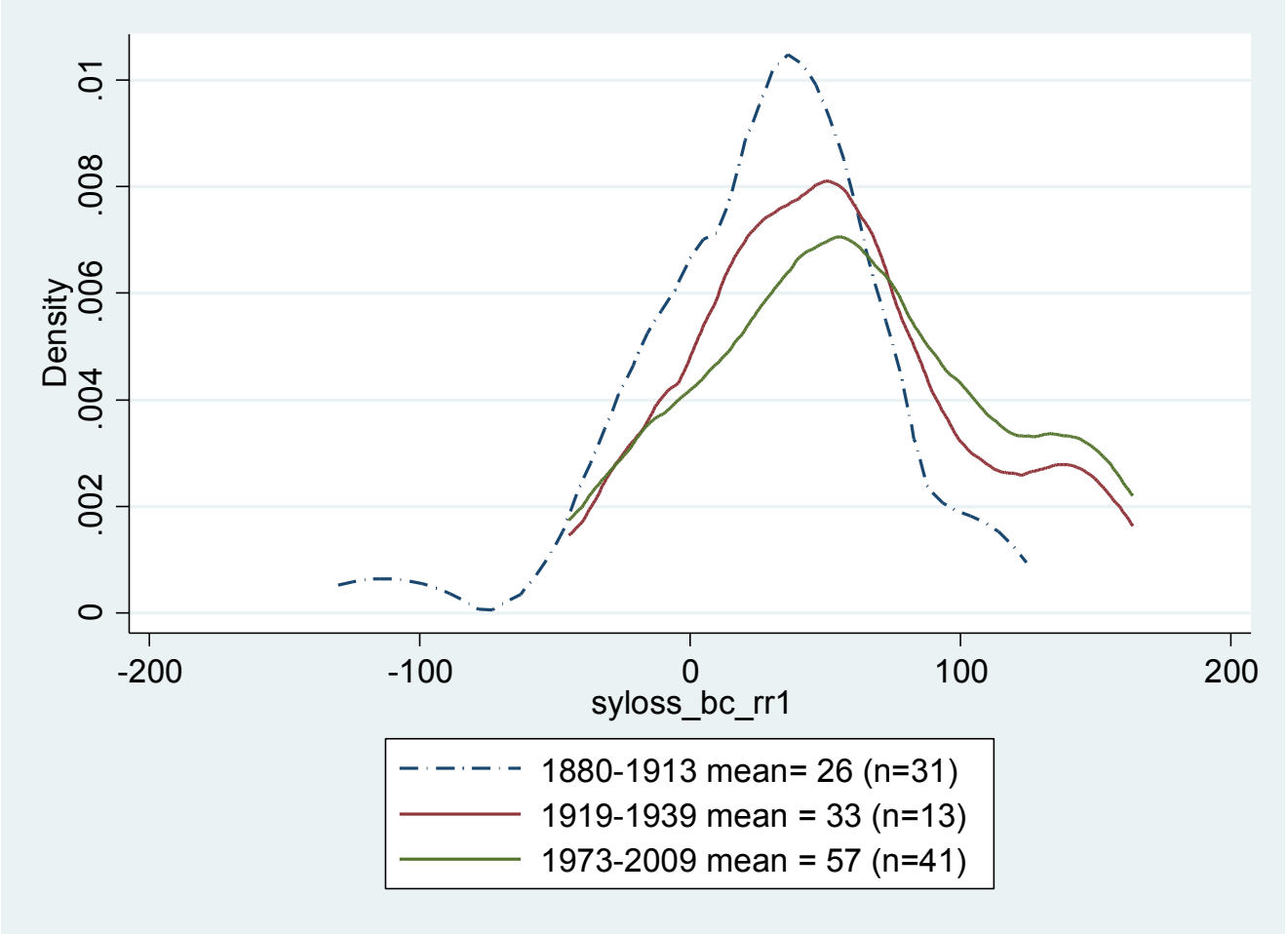


Figure 25 Output Losses from Twin Crises, Bordo et. al.

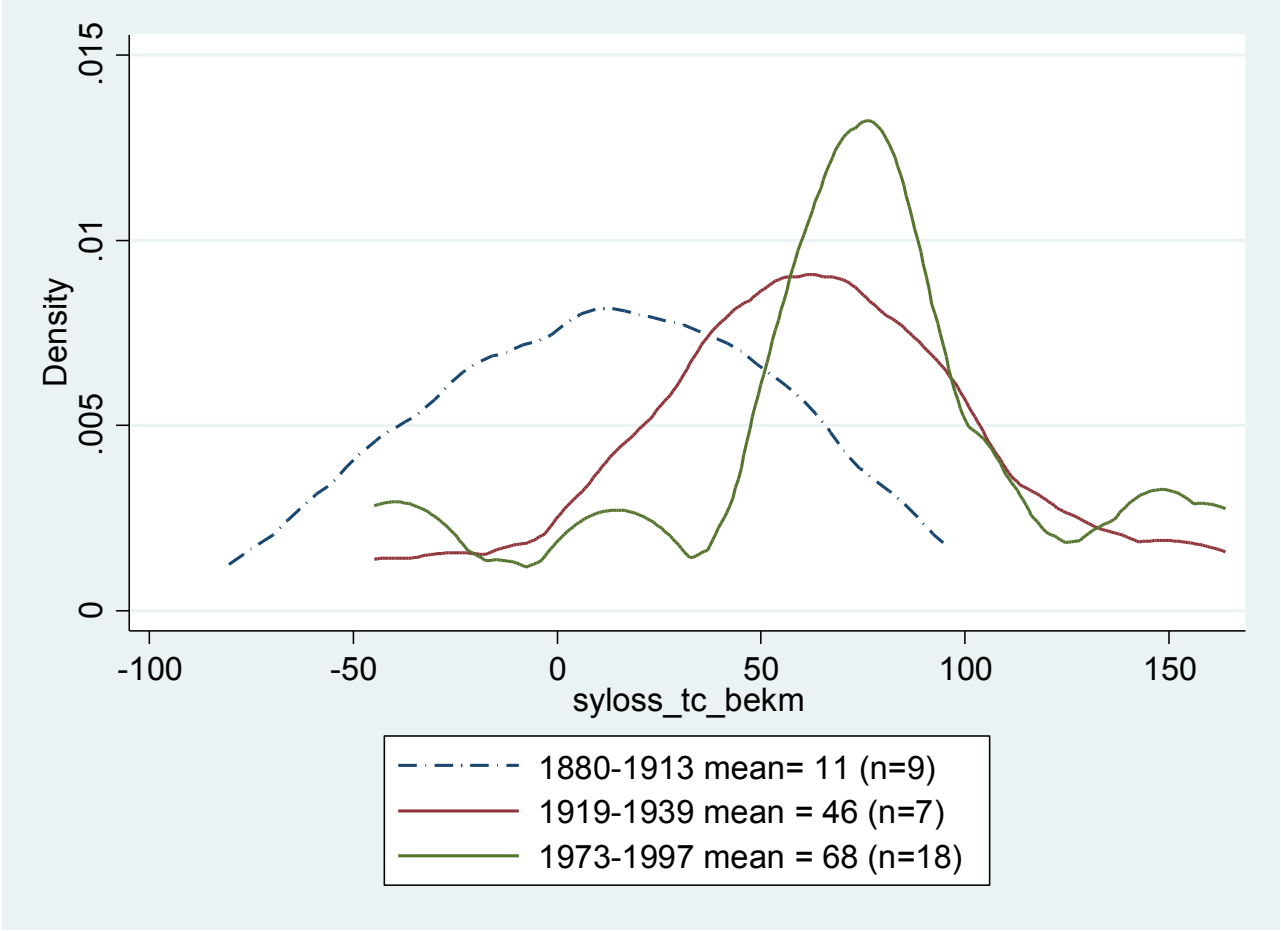


Figure 26 Output Losses from Twin Crises, Reinhart and Rogoff

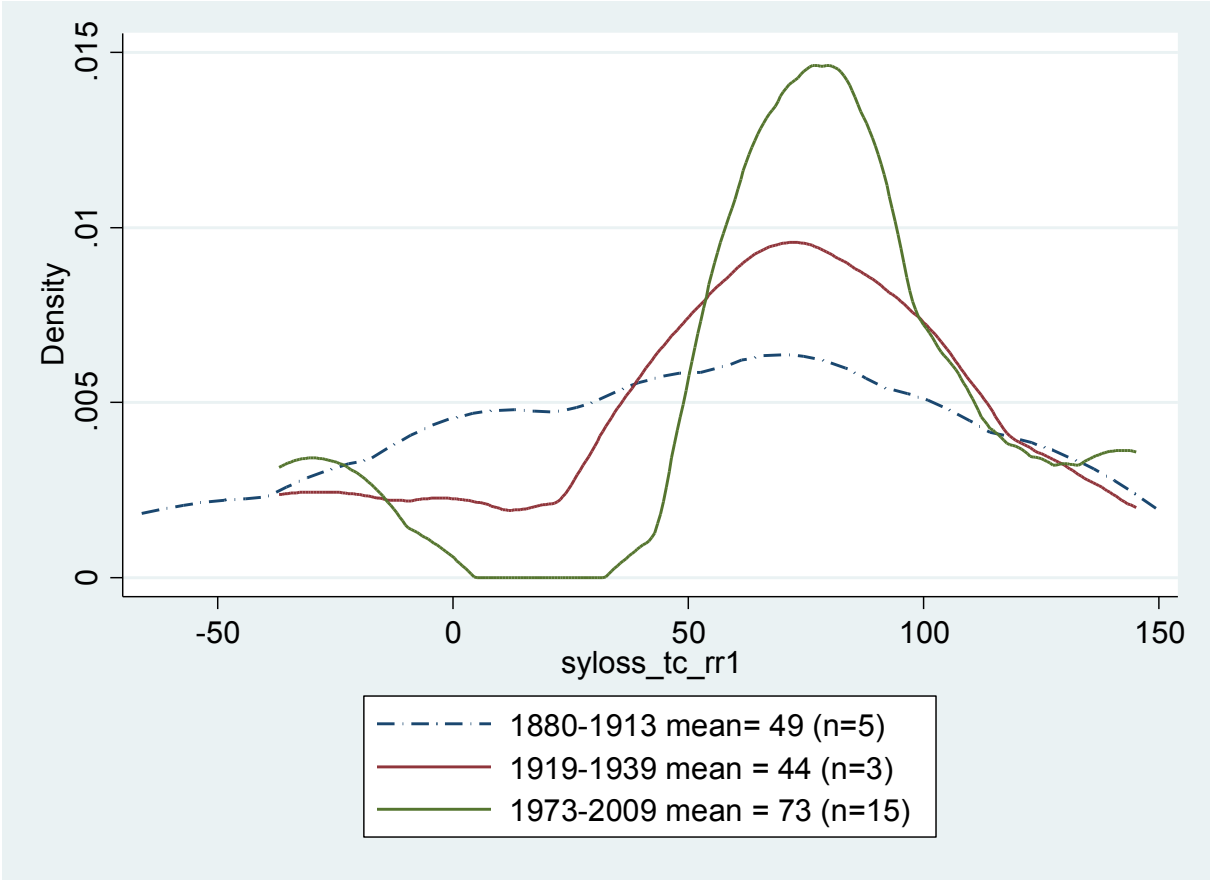


Figure 27 Output Losses from Triple Crises Bordo et. al.

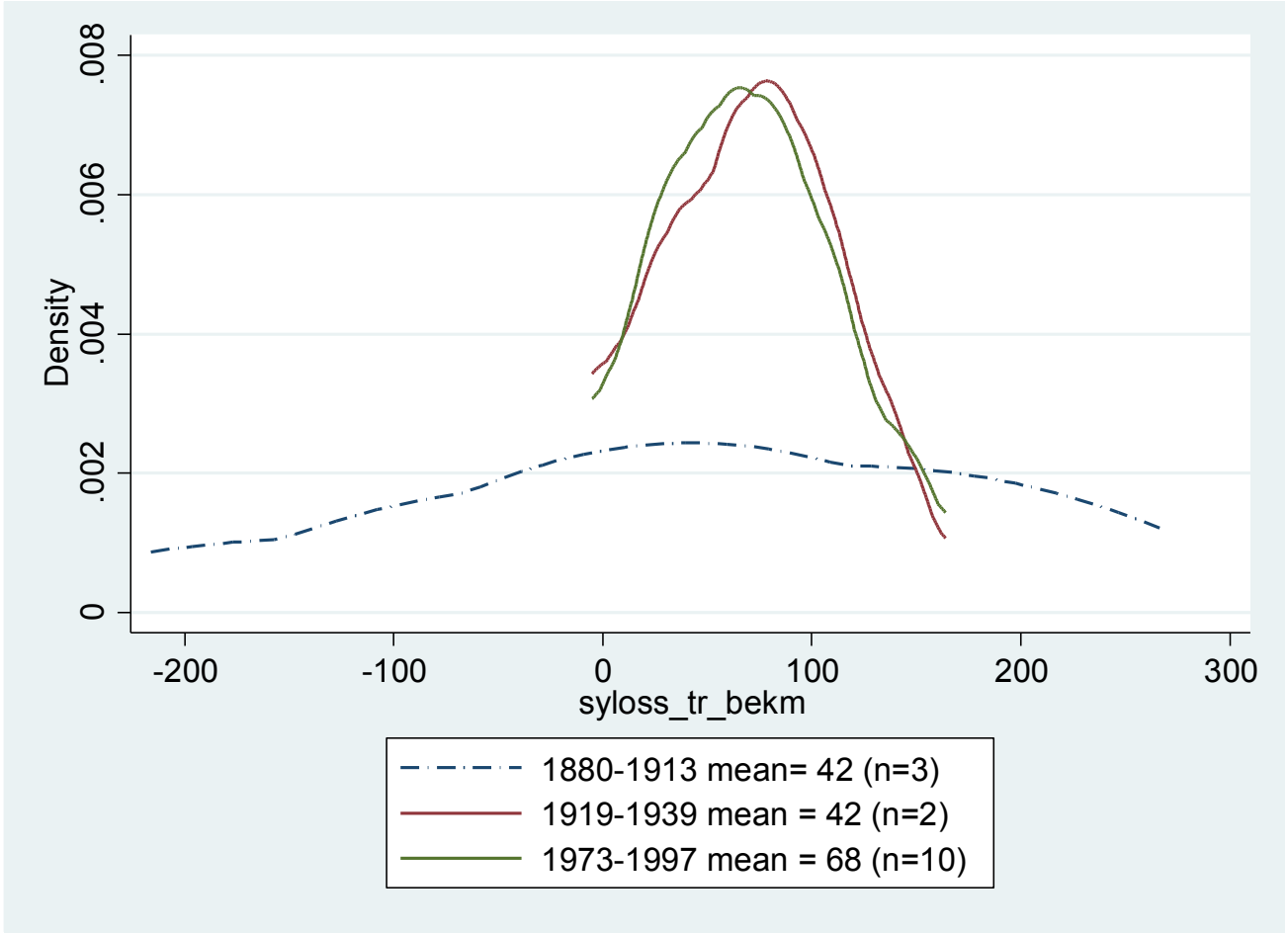


Figure 28 Output Losses from Triple Crises, Reinhart & Rogoff

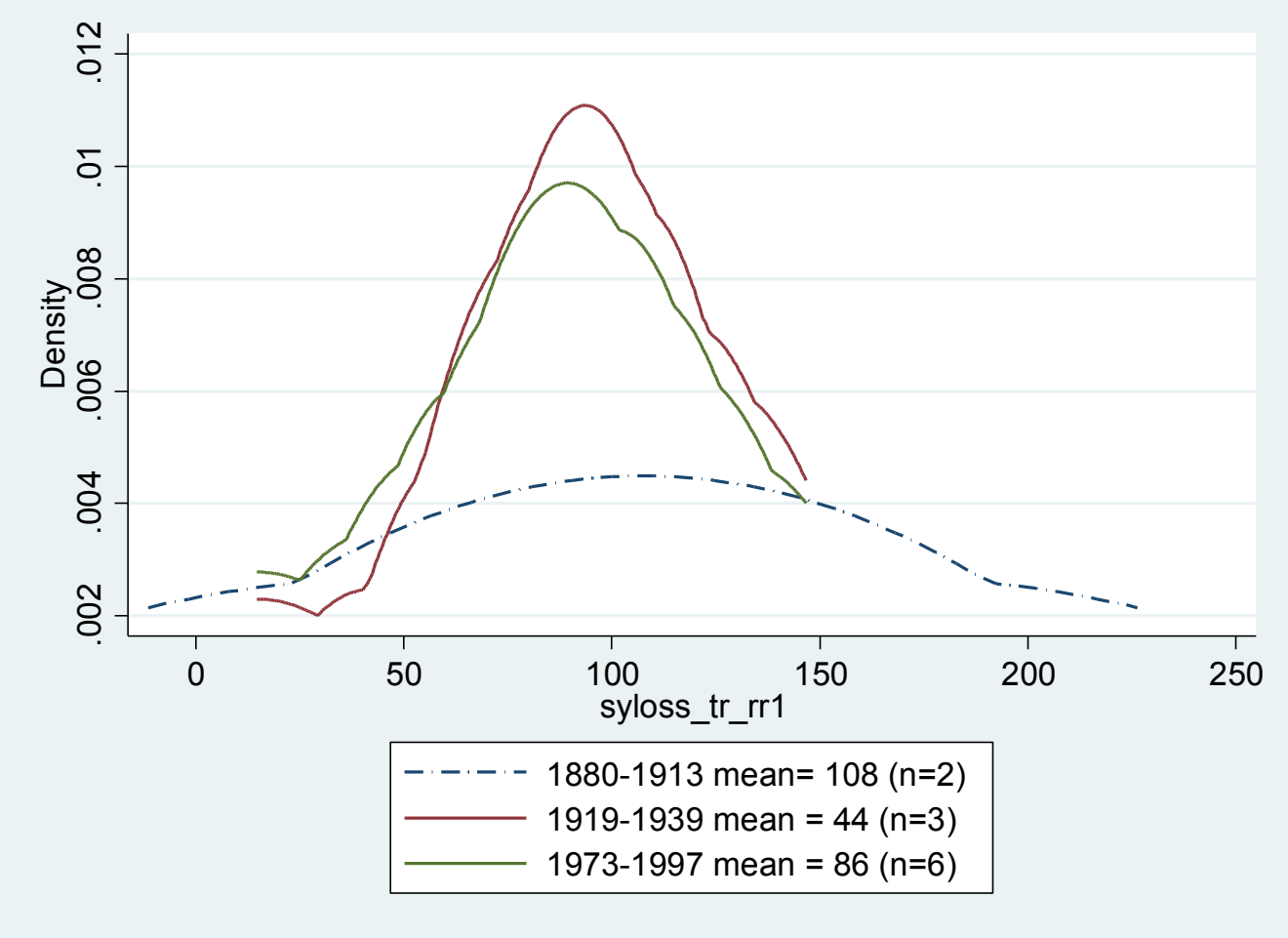


Figure 29 Output Losses from Banking Crises, Laeven and Valencia

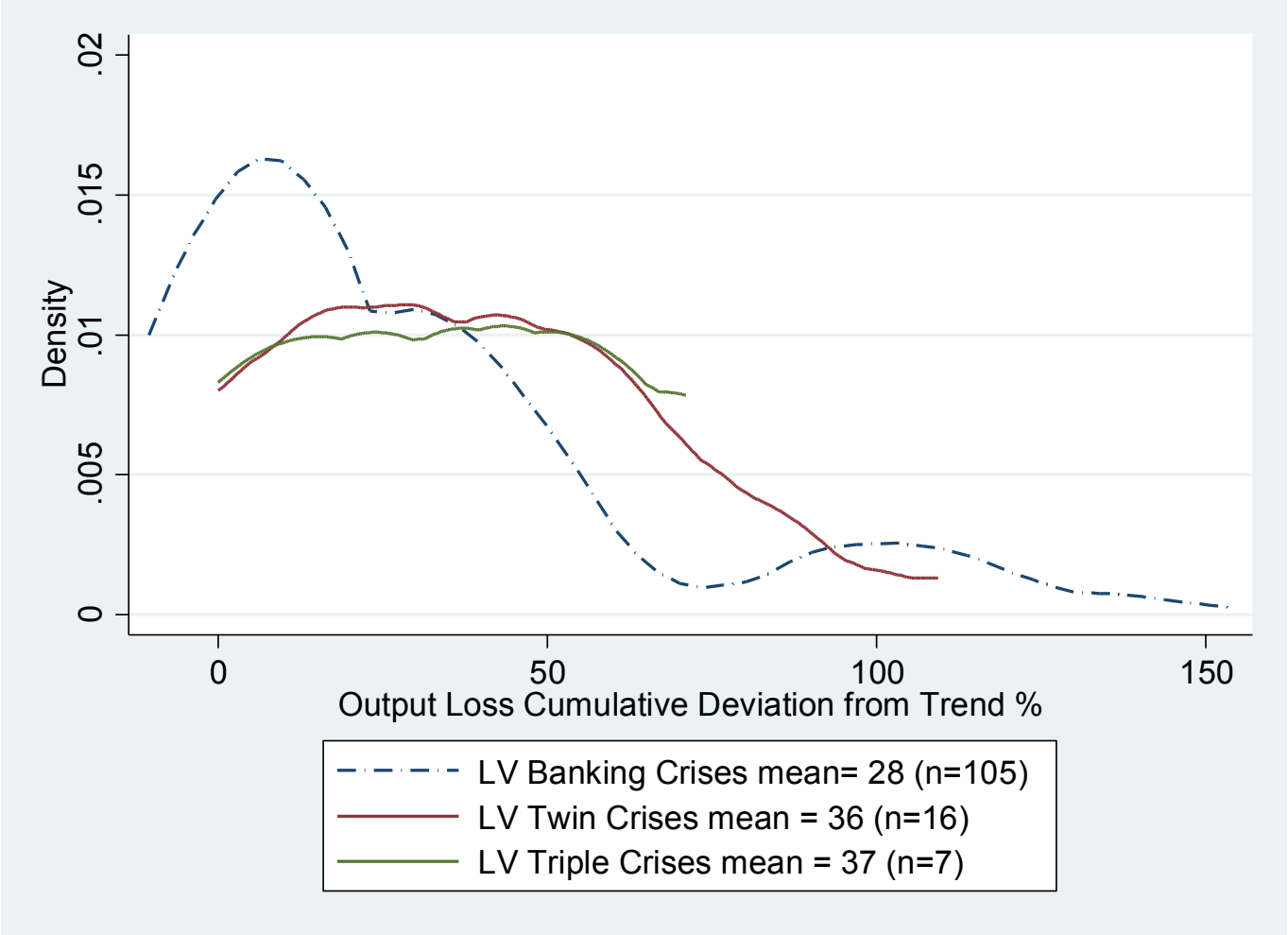


Figure 30 Output Losses from Banking Crises, Bordo et. al., Reinhart & Rogoff, Laeven & Valencia, 1973-1997

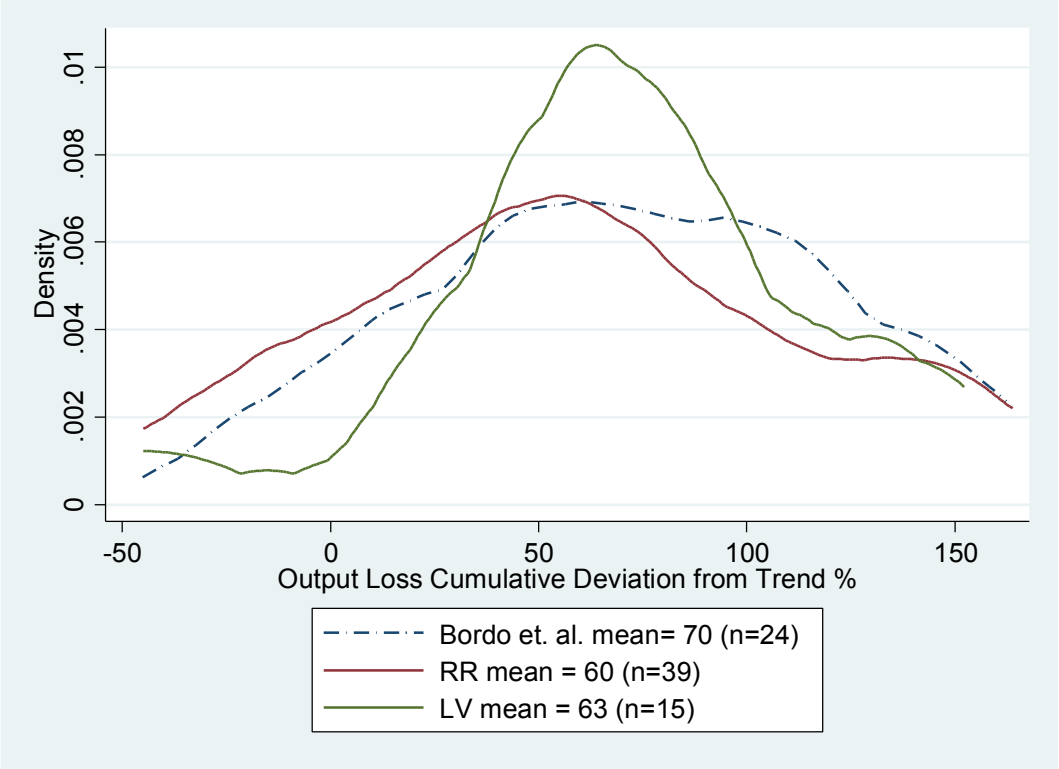


Figure 31 Output Losses from Banking Crises, 1973-1997 Bordo, et. al.

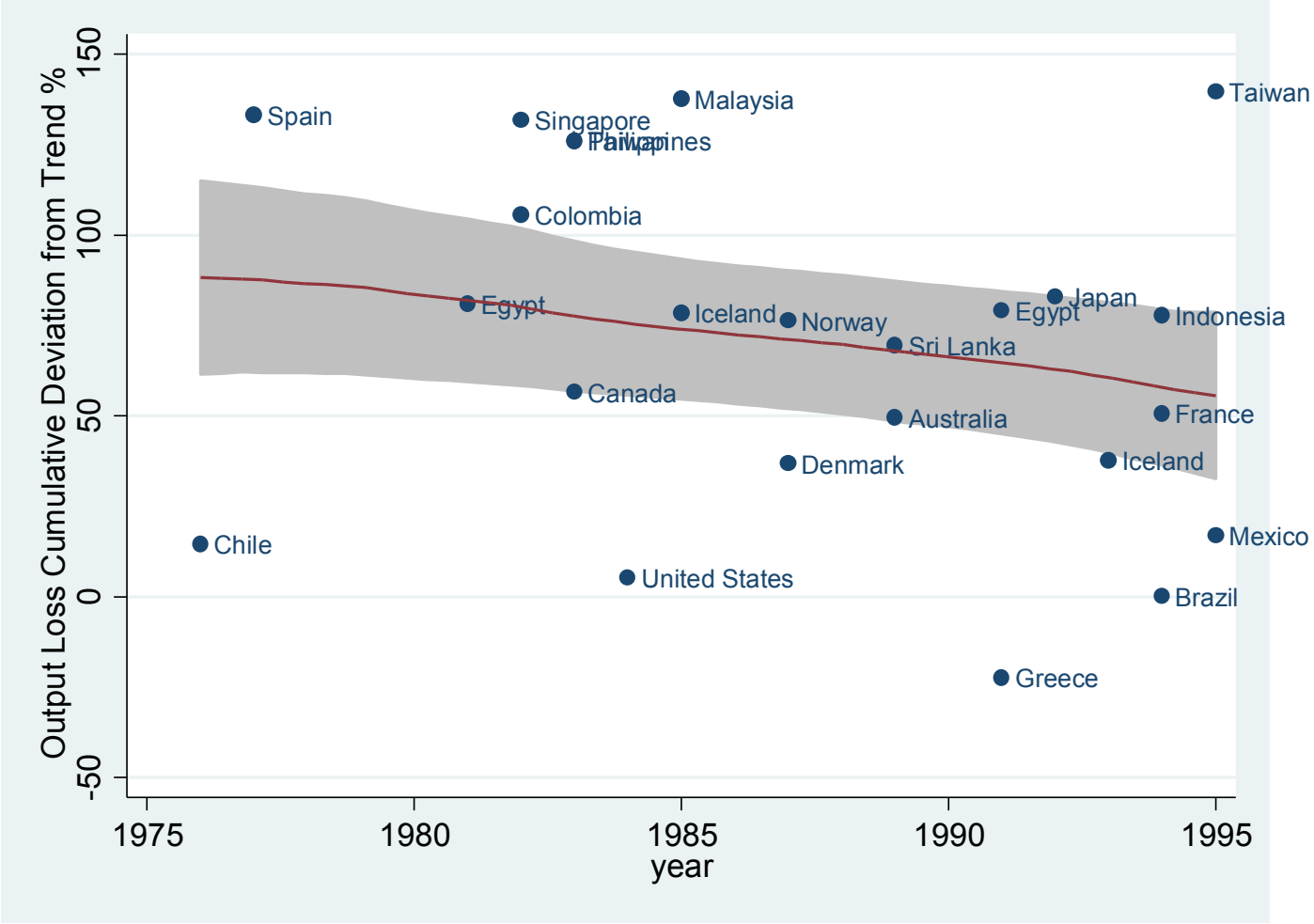
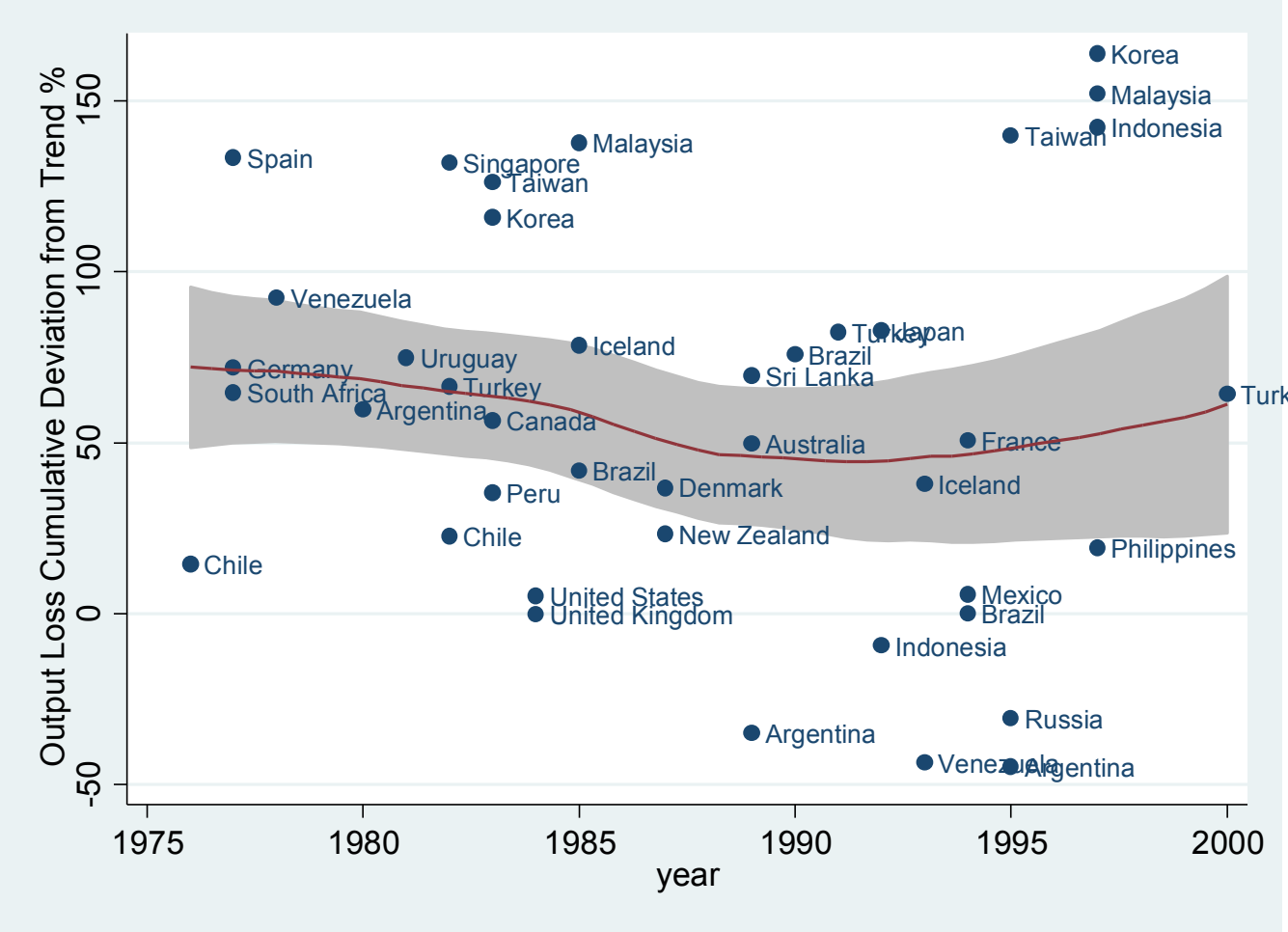


Figure 32 Output Losses from Banking Crises, 1973-2009 Reinhart & Rogoff



Output 33 Losses from Banking Crises, Laeven and Valencia, 1973-2012

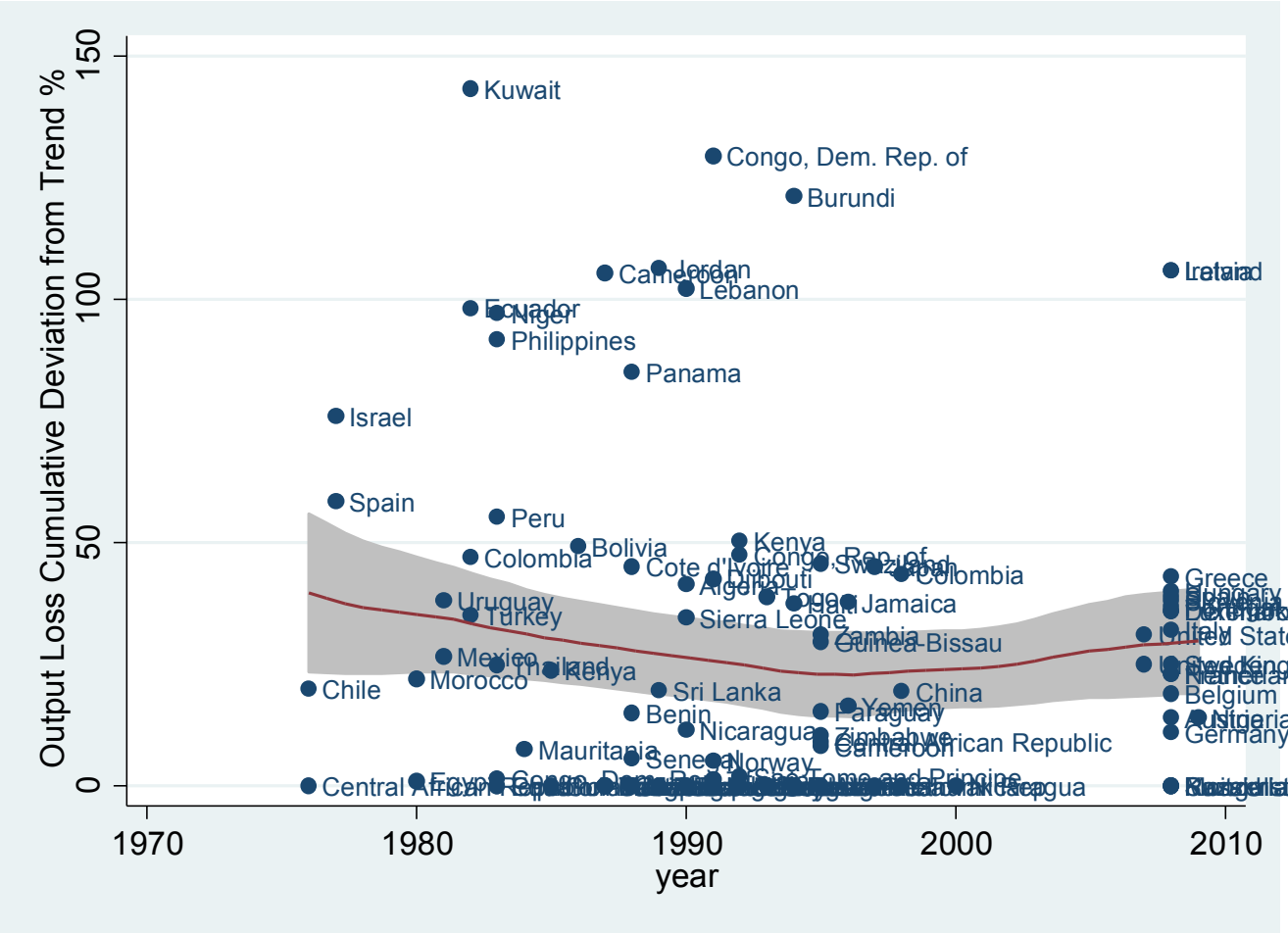


Figure 34 GDP per person Actual and Counterfactual, USA, 1907

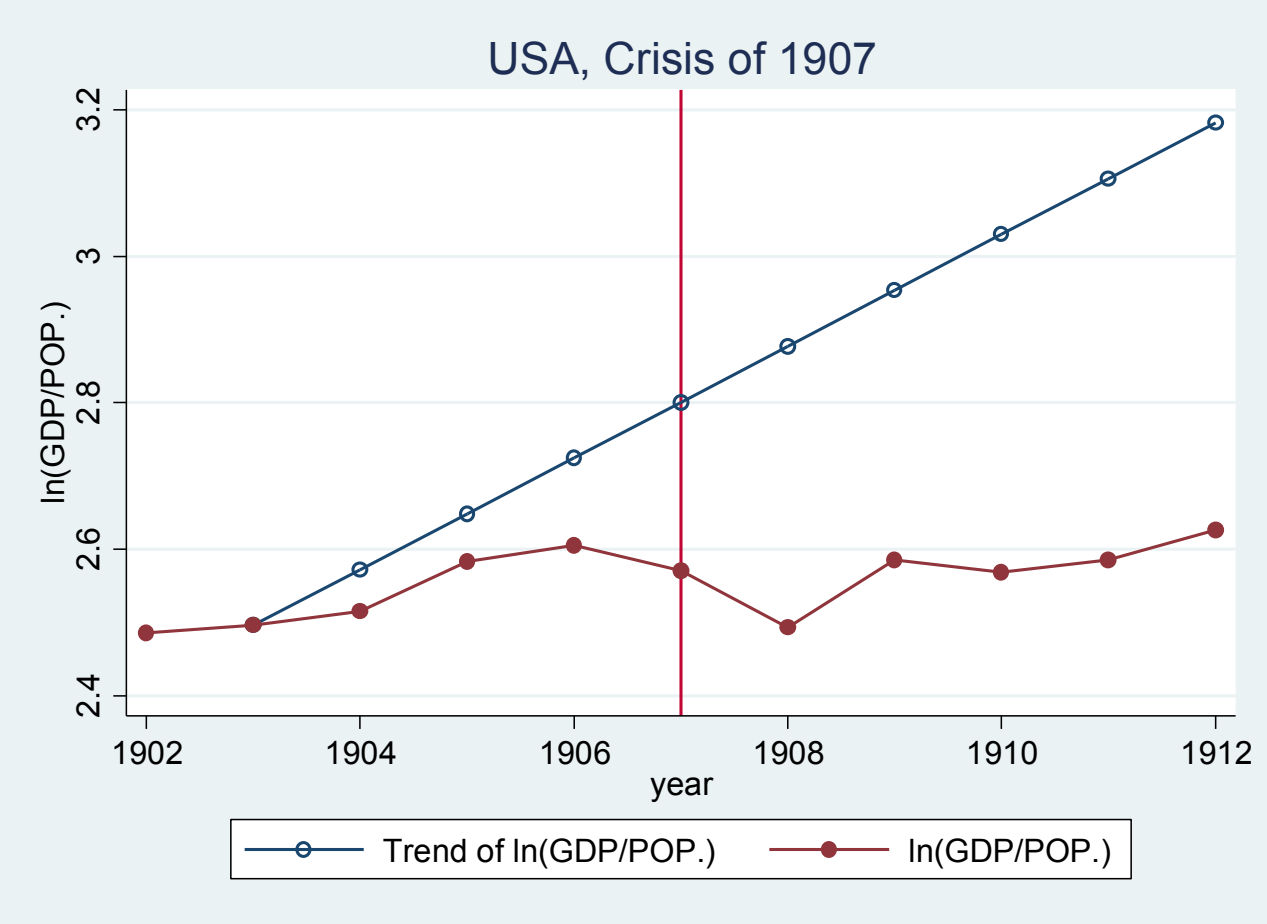


Figure 35 GDP per person Actual and Counterfactual, Argentina, Baring Crisis

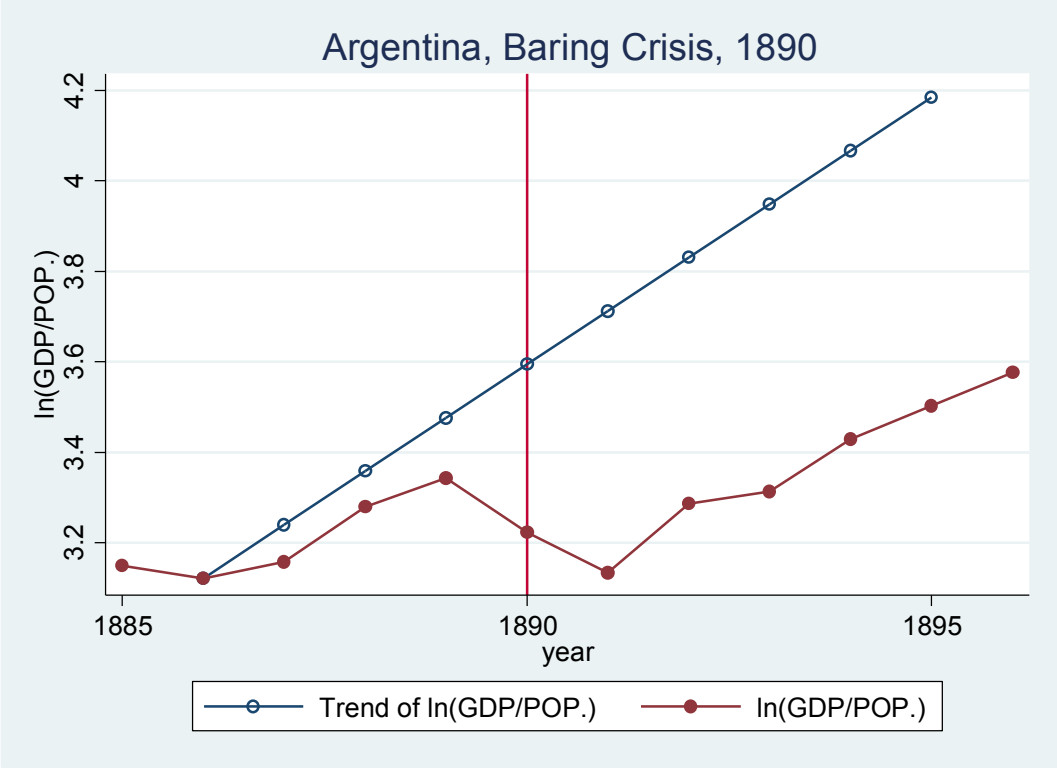


Figure 36 GDP per person Actual and Counterfactual, France, Great Depression

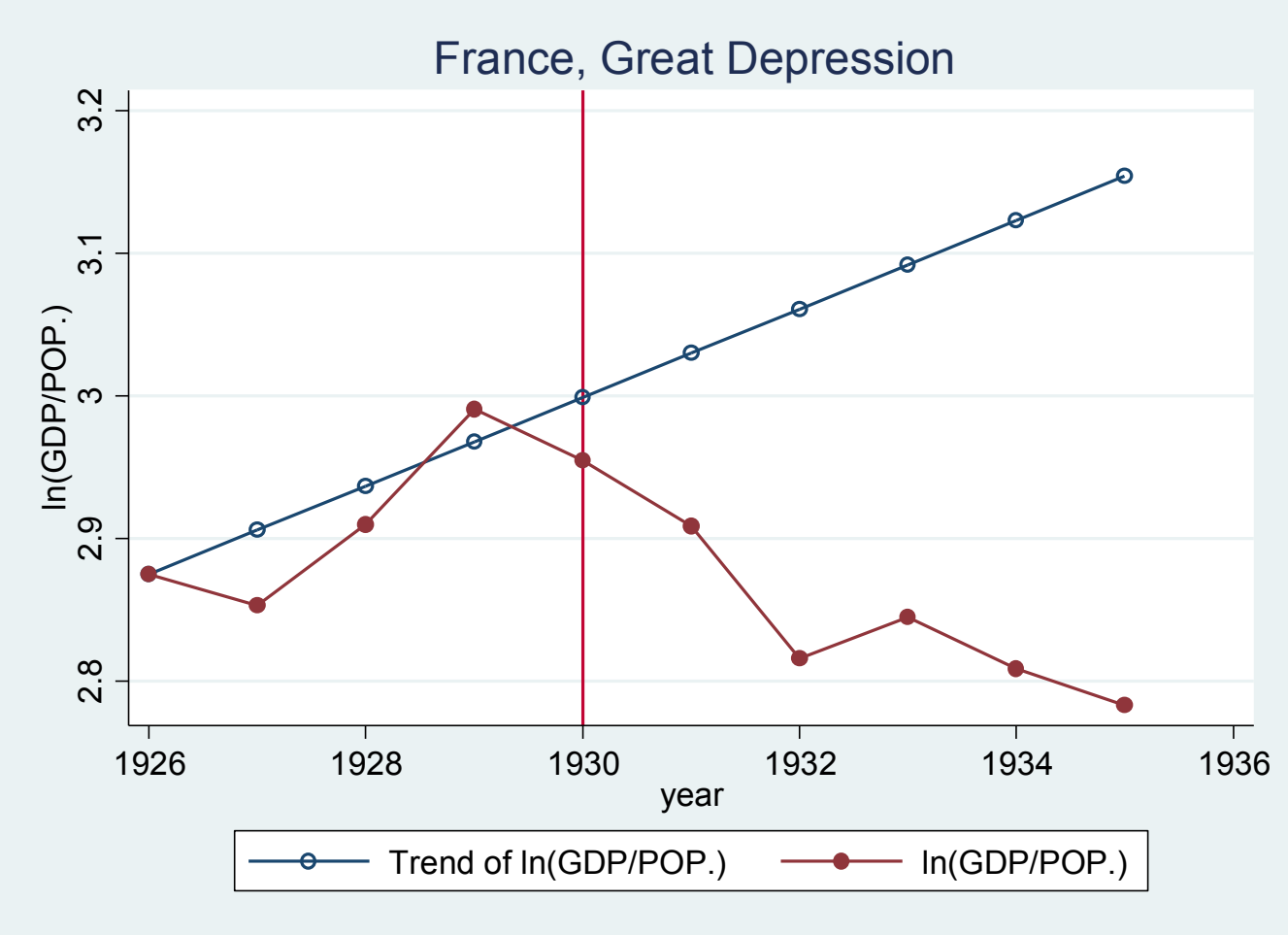


Figure 37 GDP per person Actual and Counterfactual, United States, Great Depression

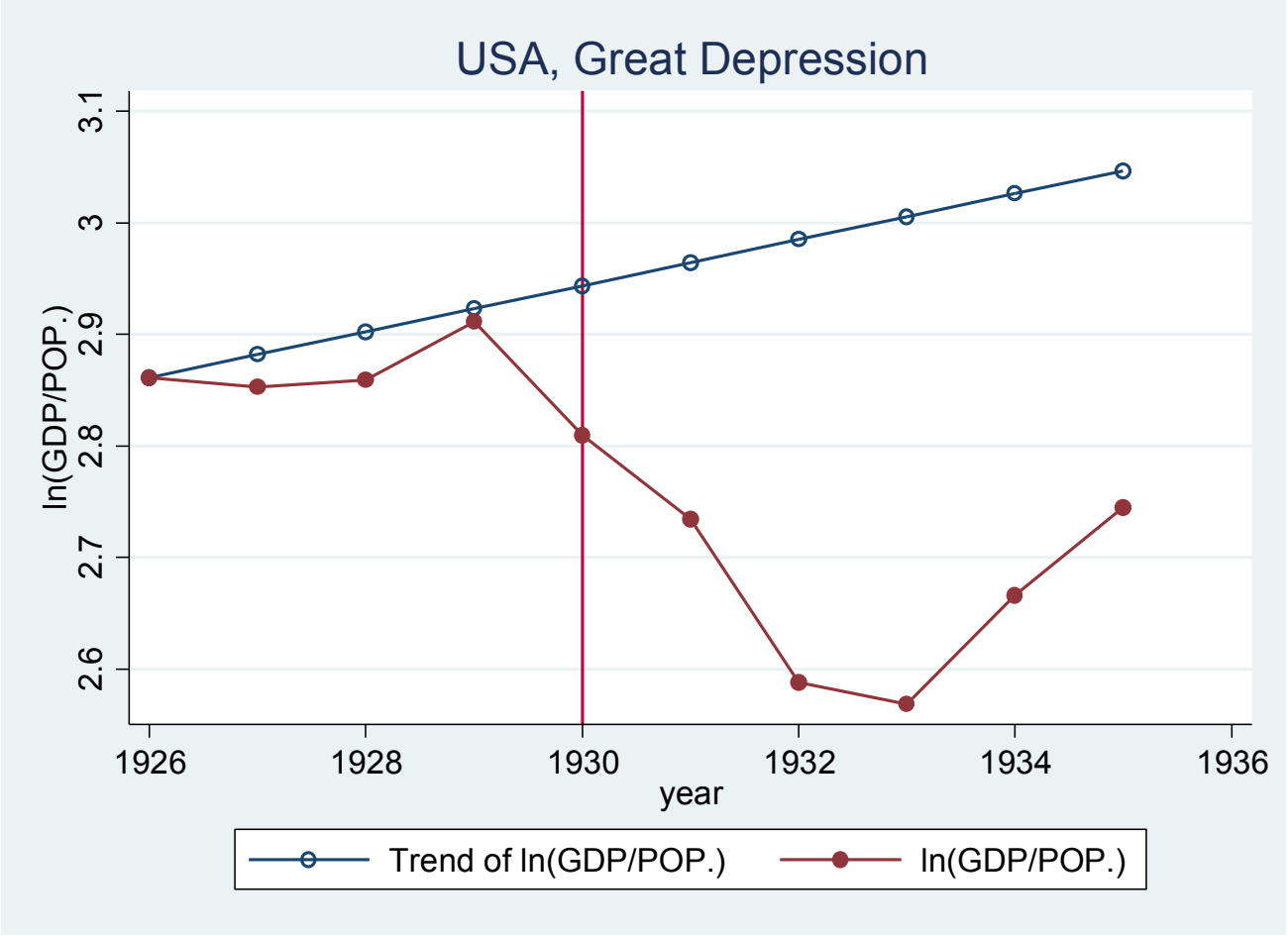


Figure 38 GDP per person Actual and Counterfactual, Sweden, 1991

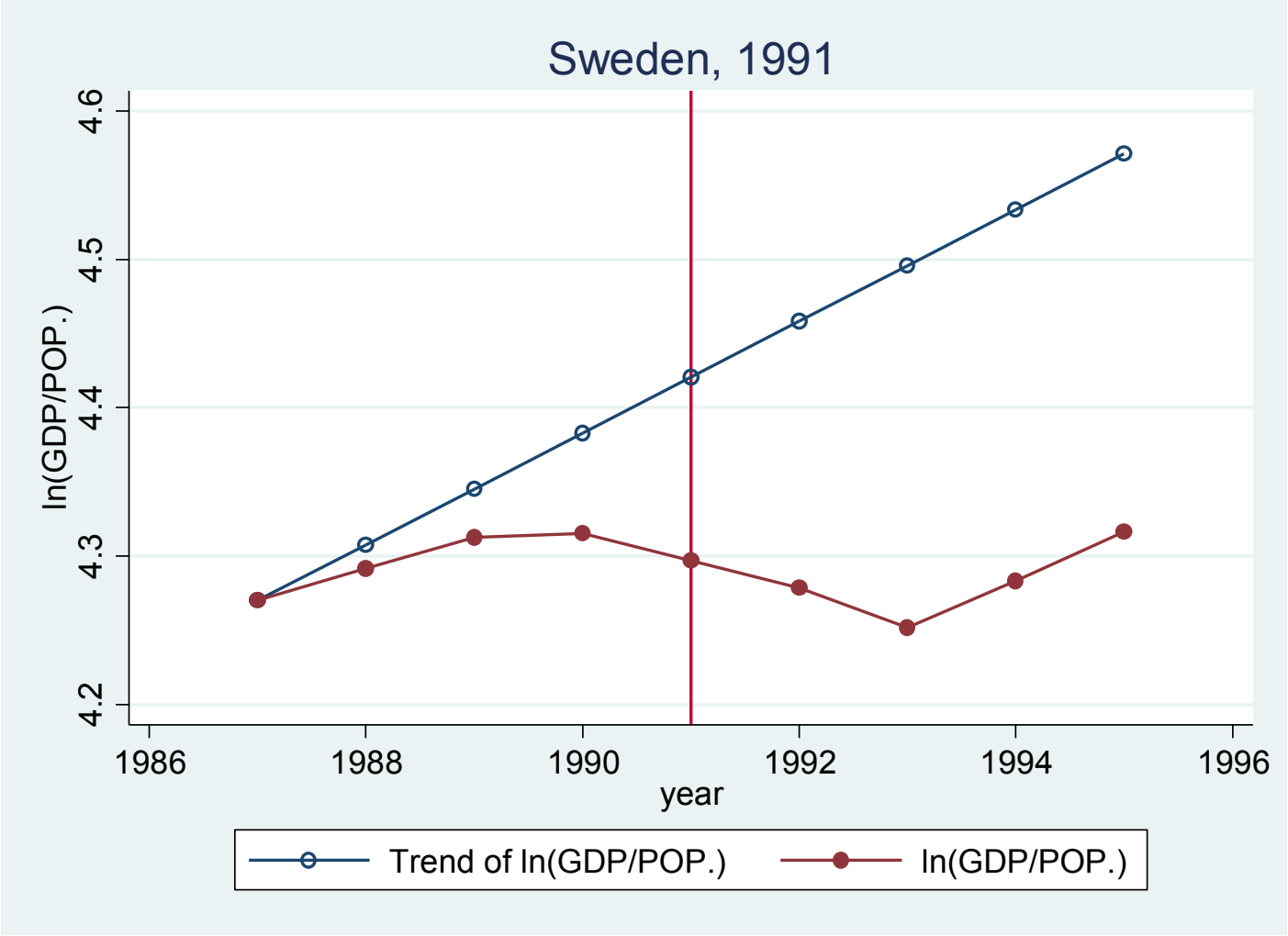


Figure 39 GDP per person Actual and Counterfactual, Argentina, 2001

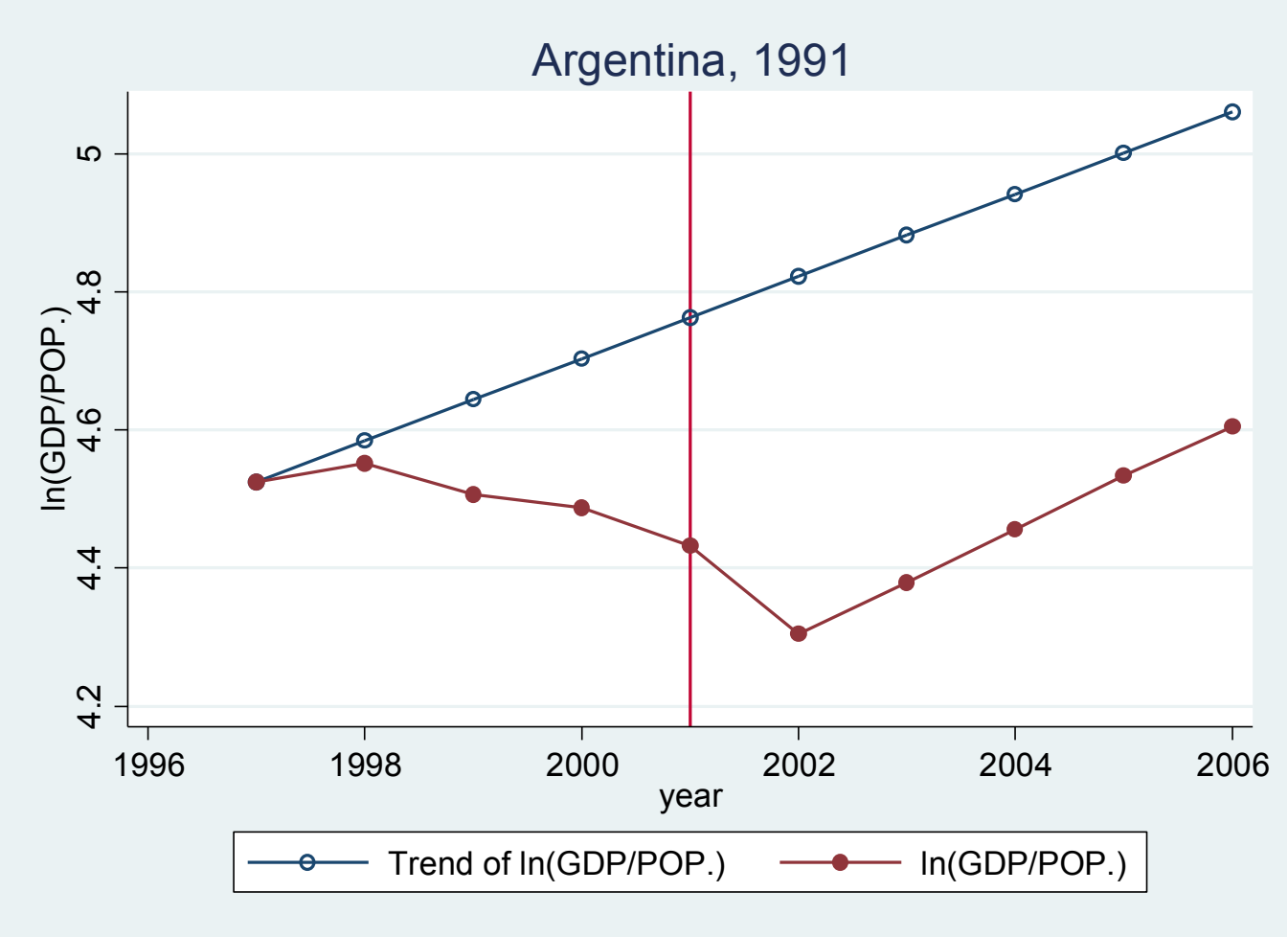


Table 1 Comparison of Leading Crisis Chronologies, 1880-1913

PRE-WWI

1880-1913
Bordo et. al. vs. RR

		Reinhart & Rogoff		% agree	
		No crisis	Banking Crisis	same year	+/-1 yr.
Bordo et. al.	No crisis	672	14	0.52	0.62
	Banking Crisis	6	22		

21 countries (21 in Bordo et. al. & 70 in Reinhart & Rogoff)

1880-1913
RR vs. Taylor

		Taylor		% agree	
		No crisis	Banking Crisis	same year	+/-1 yr.
Reinhart & Rogoff	No crisis	495	16	0.34	0.47
	Banking Crisis	13	15		

17 countries (70 in Reinhart & Rogoff & 17 in Taylor)

1880-1913
Bordo et. al. vs. Taylor

		Taylor		% agree	
		No crisis	Banking Crisis	same year	+/-1 yr.
Bordo et. al.	No crisis	507	17	0.38	0.43
	Banking Crisis	6	14		

17 countries (21 in Bordo et. al. & 17 in Taylor)

Table 2 Comparison of Leading Crisis Chronologies, 1919-1939

INTERWAR	1919-1939 Bordo et. al. vs. RR				
		Reinhart & Rogoff		% agree	
		No crisis	Banking Crisis	same year	+/-1 yr.
Bordo et. al.	No crisis	396	10	0.69	0.73
	Banking Crisis	4	31		
	21 countries (21 in Bordo et. al. & 70 in Reinhart & Rogoff)				

	1919-1939 RR vs. Taylor				
		Taylor		% agree	
		No crisis	Banking Crisis	same yr.	+/- 1 year
Reinhart & Rogoff	No crisis	284	2	0.67	0.70
	Banking Crisis	9	22		
	17 countries (17 in Taylor & 70 in Reinhart & Rogoff)				

	1919-1939 Bordo et. al. vs. Taylor				
		Taylor		% agree	
		No crisis	Banking Crisis	same yr.	+/- 1 year
Bordo et. al.	No crisis	306	3	0.70	0.77
	Banking Crisis	6	21		
	17 countries (21 in Bordo et. al. & 17 in Taylor)				

Table 3 Comparison of Leading Crisis Chronologies, 1950-1972

BRETTON WOODS — 1950-1972 Bordo et. al. vs. RR

		Reinhart & Rogoff		% agree	
		No crisis	Banking Crisis	same yr.	+/- 1 year
Bordo et. al.	No crisis	537	1	0.50	0.50
	Banking Crisis	0	1		

21 countries (21 in Bordo et. al. & 70 in Reinhart & Rogoff)

1950-1972 RR vs. Taylor

		Taylor		
		No crisis	Banking Crisis	% Agree
Reinhart & Rogoff	No crisis	368	0	1.00
	Banking Crisis	0	0	

17 countries (17 in Taylor & 70 in Reinhart & Rogoff)

1950-1972 Bordo et. al. vs. Taylor

		Taylor		
		No crisis	Banking Crisis	% Agree
Bordo et. al.	No crisis	368	0	1.00
	Banking Crisis	0	0	

17 countries (21 in Bordo et. al. & 17 in Taylor)

Table 4 Comparison of Leading Crisis Chronologies, 1973-2012

POST-BRETTON WOODS	1973-1997 Bordo et. al. vs. RR				
		Reinhart & Rogoff		% agree	
		No crisis	Banking Crisis	same yr.	+/- 1 year
Bordo et. al.	No crisis	1146	19	0.65	0.72
	Banking Crisis	9	51		

55 countries (55 in Bordo et. al. & 70 in Reinhart & Rogoff)

	1973-2011 RR vs. Taylor				
		Taylor		% agree	
		No crisis	Banking Crisis	same yr.	+/- 1 year
Reinhart & Rogoff	No crisis	577	6	0.58	0.68
	Banking Crisis	7	18		

17 countries (17 in Taylor & 70 in Reinhart & Rogoff)

	1973-1997 Bordo et. al. vs. LV				
		Taylor		% agree	
		No crisis	Banking Crisis	same yr.	+/- 1 year
Laeven & Valencia	No crisis	1280	8	0.49	0.53
	Banking Crisis	28	34		

55 countries (55 in Bordo et. al. & 162 in Laeven & Valencia)

Table 5 Comparison of Leading Crisis Chronologies, 1973-2012 (cont.)

1973-1997
Bordo et. al. vs. Taylor

		Taylor		% agree	
		No crisis	Banking Crisis	same yr.	+/- 1 year
Bordo et. al.	No crisis	383	5	0.41	0.47
	Banking Crisis	5	7		

17 countries (55 in Bordo et. al. & 17 in Taylor)

1973-2011
RR vs. LV

		LV		% agree	
		No crisis	Banking Crisis	same yr.	+/- 1 year
Reinhart & Rogoff	No crisis	2481	21	0.43	0.50
	Banking Crisis	59	61		

70 countries (70 in Reinhart & Rogoff & 162 in Laeven & Valencia)

1973-2011
Taylor vs. LV

		LV		% agree	
		No crisis	Banking Crisis	same yr.	+/- 1 year
Taylor	No crisis	581	3	0.52	0.55
	Banking Crisis	10	14		

17 countries (17 in Taylor & 162 in Laeven and Valencia)

Table 6 Crisis Definitions 4 Data sets

	Sample	Banking Crisis Definition	Currency Crisis Definition	Debt Crisis Definition
Bordo et. al. (2001)	1880-1939 21 Advanced Countries 1945-1997 21 Advanced Countries + 34 LDCs and Emerging Markets	Financial distress resulting in the erosion of most or all of aggregate banking system capital as in Caprio and Klingebiel (1996, 1999)	Forced change in parity, abandonment of a pegged exchange rate, or an international rescue. Or: an exchange market pressure above a critical threshold (calculated as a weighted average of exchange rate change, short-term interest rate change, and reserve change relative to the same for the center country, the UK before 1913 and the US after). A crisis is said to occur when this index exceeds a critical threshold. We score an episode as a currency crisis when it shows up according to either or both of these indicators	No debt crises are dated in this data set.
Reinhart and Rogoff (2009)	1800-2011 70 Countries	A banking crisis occurs when there are one of two types of events: (1) bank runs that lead to the	Reinhart (2010) refers to a working paper version of Reinhart and Rogoff (2011) stating they follow	"External debt crises involve outright default on payment of debt obligations

		closure, merging, or takeover by the public sector of one or more financial institutions; or (2) if there are no runs, the closure, merging, takeover, or large-scale government assistance of an important financial institution (or group of institutions), that marks the start of a string of similar outcomes for other financial institutions.	Frankel and Rose (1996). Frankel and Rose date a currency crisis as a period with a nominal depreciation of more than 25% which represents a greater than 10% increase in the rate of depreciation. Reinhart's website provides the following definition: "An annual depreciation versus the US Dollar…of 15 percent or more.	incurred under foreign legal jurisdiction, repudiation, or the restructuring of debt into terms less favorable to the lender than in the original" (Reinhart and Rogoff, 2011)
Laeven and Valencia (2013)	1970-2011 162 countries	Two conditions 1."Significant signs of financial distress in the banking system (as indicated by significant bank runs, losses in the banking system, and/or bank liquidations) 2.Significant banking policy intervention measures in response to significant losses in the banking system.	Nominal depreciation of the currency against the dollar of at least 30% that is also 10 percentage points higher than the rate of depreciation in the year before.	"default and restructuring" Data from Calomiris and Beim (2001), World Bank (2002), Sturzenegger and Zettlemeyer (2006), IMF staff reports and reports from rating agencies.
Taylor (2015)	1870-2011 17 Countries	Taylor (2015) and Jordà et. al. (2011)describe their coding as following Bordo et. al. Reinhart and	Not dated.	Not dated.

		Rogoff, Laeven and Valencia and Cechetti et. al (2009).		

Table 7 Definitions and Values of Output Losses from Financial Crises, six datasets

	Sample	Crisis Definition	Methodology for Calculating the Economic Costs of Financial Crises	Average "losses"
Bordo et. al. (2001)	1880-1939 21 Advanced Countries 1945-1997 21 Advanced Countries + 34 LDCs and Emerging Markets	Banking Crises	Cumulative loss of output between onset and recovery found by subtracting pre-crisis trend growth from actual growth. Recovery occurs when growth obtains its pre-crisis trend level.	7% (21 countries, 1973-1997) 6.2 % (56 countries, 1973-1997)
Reinhart and Rogoff (2014)	1800-2011 70 Countries	100 Systemic Banking Crises defined as in Reinhart and Rogoff (2009) possibly accompanied by currency, or debt crises or both.	1. Peak to trough decline in GDP per capita 2. Severity index = -1*(peak to trough decline in GDP per capita) + number of years until peak level of GDP per capita is attained	-11.5% (mean) -8.8% (median) 8.3 years peak to recovery (mean) 6.5 years peak to recovery (median)
Laeven and Valencia (2013)	1970-2011 162 countries	Systemic Banking Crises possibly accompanied by currency, or debt crises or both.	Cumulative loss of real GDP between onset of crisis and 3 years after crisis starts calculated as the difference between actual output and the HP filter trend calculated over	23% (mean) 32% (mean advanced) 26% (mean emerging markets)

			the 20 years prior to a crisis (or fewer years if data are not available)	
Jordà et. al. (2013)	1870-2008 14 Countries	"Financial Recessions" (i.e., recessions associated with systemic financial crises) with and without large growth in real credit.	Local projections from tear T+1, to T+5 of log differences of GDP per capita in year *t* from peak year level.	16.9% Cumulative deviations from peak for "financial recessions"
Hutchison and Noy (2005)	1975-1997 24 emerging markets	Twin crises	Regressions of growth of real GDP on crisis indicators and lags	Average loss of GDP of 15-18% over the average duration of 3-4 years after the onset of a crisis.
Dell'ariccia et. al (2008)		Banking crises: there were extensive depositor runs; the government took emergency measures to protect the banking system, such as bank holidays or nationalization; the fiscal cost of the bank rescue was at least 2 percent of GDP; or non-performing loans reached at least 10 percent of bank assets.	Marginal impact of banking crises on the annual growth rate of sectoral value added	Growth rate is 1.1 percentage points lower in sectors with highly dependent on external finance.