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A User's Guide to Banking Crises[*]

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I. Introduction

The last 25 years have seen the resurgence of a problem of long historical standing: banking crises. While the general presence of a "banking system safety net" has typically prevented these modern crises from turning into the kinds of banking panics observed historically, they are nonetheless events of great significance. Caprio and Klingebiel (1997) identify 86 separate episodes of large scale bank insolvency or worse that have occurred since 1974. And, many of these episodes are of staggering enormity. For example, in the early 1980s, Argentina and Chile spent amounts equaling 55% and 42% of their GDP, respectively, on banking system bailouts. And, current estimates are that, in Thailand today, 60-70% of all loans are non-performing.[1]

The frequency and severity of these crises makes it essential to pose four questions.

(1) What causes banking crises?

(2) What can be done to prevent them or, at least, to mitigate their severity?

(3) What are the macroeconomic consequences of banking crises, and of the large bailouts that are often associated with them?

(4) What are the social costs associated with the occurrence of a banking crisis? And what social costs or benefits are derived by injecting resources into banking system bailouts?

This paper is an attempt to address these questions.

There are a number of candidates for the causes of banking crises. One simple view is that they are just the inevitable "fallout" of other macroeconomic events. Indeed, it may be that banking crises are often merely reflections of other macroeconomic problems, and that these crises play no causal role in the recessions that frequently accompany them.[2]

Another view, and perhaps an "opposing" one, is that banking crises are largely due to self-fulfilling prophecies or "sunspots." This is a common approach to the understanding of historical banking panics,[3] and it raises the possibility that banking crises can occur in the absence of any shocks to "fundamentals." And, in this view, it is quite possible that banking crises are the "causes" of the recessions that occur along with them.

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[1] The figures on the costs of the bailouts in Argentina and Chile are from Caprio and Klingebiel (1997). The figure on non-performing loans in Thailand is from The Economist, September 4, 1999; p.71.

[2] See Gavin and Hausman (1996) for some discussion of this view.

[3] See Bryant (1980) and Diamond and Dybvig (1983) for the original theoretical articulations of this view. However, this view is not unchallenged. See, for instance, Champ, Smith and Williamson (1996) and the references they cite.

Finally, many believe that the severity of banking crises is due to the poor design of the banking system safety net.[4] In this view the underpricing of deposit insurance, and/or the failure to introduce an appropriate "risk-based" element into deposit insurance pricing, induces banks to take on socially excessive amounts of risk. Some have gone further and argued that banking crises follow in the wake of "credit booms:" presumably episodes of "excessive" credit extension—possibly fostered by the "bad incentives" associated with the structure of the safety net. As a result, episodes of large scale bank losses are the inevitable consequence of the incentive effects associated with an improperly designed safety net.

Each of these views suggests alternative answers to the question of what can be done to reduce the frequency or mitigate the severity of banking crises. If banking crises are a consequence, and not a cause of macroeconomic problems, then perhaps their severity can be reduced by better conduct of stabilization policy. If banking crises are the result of a transition between multiple equilibria, then eliminating them requires eliminating conditions conducive to the existence of indeterminacies and excess volatility. And, if the design of the banking system safety net is at fault, then there is the issue of redesigning it. Along these lines there is a large literature on the feasibility and desirability of the actuarially fair pricing of deposit insurance, and/or the introduction of risk-based deposit insurance premia.[5]

Finally, what are the macroeconomic costs and consequences of banking crises? As we will see, the macroeconomic consequences of banking crises can be quite different in different banking environments. Thus, all banking crises are most definitely not alike. And what are the consequences of banking system bailouts? We find that these have few notable macroeconomic consequences, with one exception. Higher expenditures on banking system bailouts, at least in countries that have experienced only a single banking crisis, are associated with higher rates of M2 growth *while* a crisis is in progress. This effect on the growth rate of a broad monetary aggregate does seem to have its own implications for rates of real GDP growth, rates of inflation, and real rates of return on a variety of assets.

With respect to the costs of a banking crisis, we estimate that countries undergoing only a single crisis experience an average loss in the (expected) discounted present value of current and future production of about 10-20%, when a crisis occurs. However, few individual countries have an "average" crisis experience. A majority of the economies considered have output losses from a crisis of substantially less than 10% of the expected discounted present value of current and future production. A significant minority of countries, on the other hand, experiences output losses exceeding 20%, in the same discounted present value sense. Very few countries have output losses between 10% and 20% of the (expected) discounted present value of current and future production. Finally, we find that incremental expenditures on banking system bailouts in an amount equal to

[4] There are many potential references here. Two obvious ones are Kane (1989) and Hellman, Murdock, and Stiglitz (1998).

[5] Nice examples of this literature include Chan, Greenbaum, and Thakor (1992), Freixas and Rochet (1998), or Kane (1989).

1% of GDP imply no gains in the (expected) discounted present value of production, and may imply losses of as large as 1.0-1.6%.

A. Some Theoretical Considerations

In order to address the issues just discussed, it is useful to have a theoretical framework for thinking about them. In sections II and III of the paper we describe several recent theoretical developments that—to our knowledge—do something new. They provide a *general equilibrium framework* for analyzing bank failures, and how the design of the banking system safety net affects their frequency and severity. The theory we describe has the following implications.

(1) Banking crises (episodes of significant increases in bank failure or loss rates) can be caused either by shocks to fundamentals, or by sunspots. Multiple equilibria that differ according to bank failure rates can easily exist, even in (and, perhaps, most easily in) the presence of deposit insurance.

(2) Independent of their causes, episodes of high rates of bank failure should be associated with real rates of interest on deposits that exceed some threshold value.

(3) The frequency or severity of banking crises cannot be reduced--or can be reduced very little--by changing the manner in which deposit insurance is priced.

(4) Even large scale bailouts of the banking system may have no—or only minor--macroeconomic consequences. However, depending on how they are financed, the knowledge that large scale bailouts can occur may be conducive to the existence of multiple equilibria. That is, they may allow sunspot equilibria to exist.

(5) Large scale bailouts can be heavily monetized with minimal consequences for the rate of inflation.

(6) An inflationary environment is conducive to the kinds of equilibrium indeterminacies that allow sunspots to matter. Such an environment is also likely to lead to excessive macroeconomic volatility. And, even predictable inflation is unhealthy for the financial system.

One obvious policy implication of these results is that it is important to keep the rate of inflation low. Another is that a commitment to injecting significant resources into bank bailouts may be conducive to the kinds of indeterminacies of equilibrium that allow for the occurrence of banking crises. Finally, the results hold out little hope that much can be accomplished by changing the nature of deposit insurance pricing.

B. Empirical Results

What do the data tell us about the issues described above? First, as we have noted, all banking crises are not created equal. We focus on a subset of economies that have

experienced banking crises, and for which a sufficient quantity of equity market data is available. Among these countries, what happens before, during, and after a crisis is very different across countries that have experienced only one banking crisis in the last 25 years (single crisis countries) and countries that have had repeated crises (multi-crisis countries). Second, among the single crisis countries, no more than 30% experience any unusual movements in important macroeconomic aggregates (real GDP growth, inflation, the real value of equity, or aggregate credit extension) within even three years prior to the onset of the crisis. No more than 40% experience significant movements in any of these aggregates within a five year window preceding the crisis. Among multi-crisis countries, no more than half experience unusually large movements in any of these aggregates within even five years before their first crisis. Combined with the results of Demirguc-Kunt and Detragiache (1997a,b,c, 1998, 1999), these findings suggest that it is more the exception than the rule that there are any unusual macroeconomic events that are candidates for the causes of banking crises. In our view, it therefore seems very likely that banking crises are often the outcome of a "bad realization" in a sunspot equilibrium.

Third, crises tend to occur in environments of relatively high inflation. And, in single crisis countries inflation usually falls during the crisis, and then almost always falls even further when the crisis ends. In multi-crisis countries inflation typically rises during the first two crises, and is not generally reduced following the first crisis. Thus relatively high rates of inflation appear to be conducive to the occurrence of banking crises, and a failure to reduce inflation during and after a crisis seems to be a recipe for having subsequent crises. In addition, theory suggests that high inflation is conducive to multiple equilibria and is bad for the financial system. The evidence seems consistent with this prediction.

Fourth, suppose that the government has substantial discretion regarding the quantity of resources it will inject into a banking system bailout when a crisis occurs. (That this is, in fact, the case is argued in some detail below.) The data suggest that higher expenditures on bank bailouts may be associated with some statistically significant increases in the rate of inflation. Increased bailout expenditures may also have some effects on real rates of return. And, in some empirical specifications, they have some relatively weak effects on real GDP growth. Finally, increased expenditures on banking system bailouts may have the effect of increasing the (expected) discounted present value of production losses associated with the occurrence of a banking crisis.

To summarize, then, it is hard to dismiss "a sunspots view" of banking crises on the basis of existing evidence. However, this does not mean that nothing can be done to predict banking crises, reduce their potential severity, or even prevent their occurrence. What can be done along these lines? First, and most obviously, an environment of low inflation is conducive to the health of the banking system. Second, given the fit between the theory and the data, it seems plausible that a commitment by the government to large resource injections in the event of a crisis is—at least under some schemes for financing deposit insurance shortfalls—conducive to the existence of multiple equilibria, and hence to the occurrence of crises. In combination with the evidence that there may be real output losses associated with larger expenditures on bank bailouts, this argues for keeping

bank bailout expenditures as low as possible. Third, given the fit between the theory and the data, and given the experiences of countries with different deposit insurance schemes during crises, it seems unlikely that substantial gains can be realized by redesigning deposit insurance pricing.

The remainder of the paper proceeds as follows. Sections II and III outline some recent developments that bear on the causes and consequences of banking problems, on how these problems are affected by the design of the banking system safety net, and on how they are affected by the inflationary environment. They also lay out some predictions that are amenable to empirical investigation. Section IV reviews existing empirical evidence that bears on the theory. Section V describes the data set used in this investigation. Sections VI, VII, and VIII of the paper discuss what happens before, during, and after banking crises in single and multi-crisis countries. They also give an informal description of how these events are related to the magnitudes of government bailouts of the banking system. Section IX then undertakes a more formal empirical analysis of the relationship between bank bailout costs, and macroeconomic aggregates of interest. Section X provides some "ballpark" estimates of the social costs associated with the occurrence of a banking crisis, and of the incremental resource losses deriving from injecting additional funds into bank bailouts. Section XI reviews what we infer from the analysis of sections II through X, and Section XII constitutes a brief summary.

II. Some Background

There are two points of departure for our analysis of banking crises. One is theoretical: the deposit insurance model of Boyd, Chang, and Smith (1999) and its subsequent extensions [Boyd, Chang, and Smith (2000), Sleet and Smith (1999), Kwak (1999)]. However, these models allow inflation and monetary conditions to play no, or at most a limited role in affecting the status of the banking system. Since inflation appears to be of considerable importance for the health of the banking system, we therefore supplement the background provided by Boyd, Chang, and Smith (henceforth BCS) with some analysis of the impact of inflation on the financial system. This analysis is empirical, and it is based on work by Boyd, Levine, and Smith (1999).

A. The BCS Model

1. Environment

The basic BCS model has the following structure. There are four sets of agents: borrowers, (potential) bankers, depositors, and a government deposit insurer. Borrowers are endowed with investment opportunities, but lack the funds to operate them. Depositors are endowed with funds, but lack investment opportunities. Funds are channeled from depositors to borrowers by banks that take deposits, make loans, and service these loans as necessary. BCS restricts these banks to enter into debt contracts with borrowers.[6] In addition, banks can enter into borrowing/lending relationships with

[6] See Boyd, Chang, and Smith (1998) for a consideration of some other contractual forms between banks and borrowers in this context.

only a finite number of borrowers, so that each bank faces some risk of failure. As a result, risk-averse borrowers will wish to have their deposits insured, and this deposit insurance is provided by the government. BCS considers only the case where deposits are 100% insured.

Borrowers in the model are endowed with two types of indivisible investment opportunities. One (type 1 projects) has a relatively high expected return, but requires a large initial input of funds. The other (type 2 projects) requires a smaller investment, and also has a lower expected return. If borrowers receive funding that allows them to operate a type 1 project, then it is assumed that their choice of investment project is unobservable to external investors. And, if borrowers receive enough funds to operate a type 1 project but choose to operate a type 2 project, the residual (uninvested) funds are diverted to private uses whose returns cannot be appropriated by external investors. As a result, there is a moral hazard problem in lending: if banks lend any agent enough to operate a type 1 project, funds diversion can take place.

We assume that there are two mechanisms available to banks for addressing this moral hazard problem. One is "interim monitoring:" after an investment has been made, but before it yields a return, a bank can monitor the choice of investment (at some cost), and call the loan if it is determined that there has been a diversion of funds. The other mechanism is to limit the amount of credit extended. If a borrower receives only enough funds to operate a type 2 project, no funds diversion is possible. Finally, BCS assume that the return yielded on any investment is freely observable only to the operator of the project. The presence of this costly state verification problem creates a role for intermediation in lending [Diamond (1984), Williamson (1986)], as well as some presumption that debt is not an inferior contractual form. It also creates the possibility that credit will be rationed, as in Williamson (1986, 1987). In fact, BCS focuses on the case where credit is rationed.

In this framework, the presence of the moral hazard problem between banks and borrowers also gives rise to a moral hazard problem between banks and the deposit insurer. In particular, the manner in which banks address the moral hazard problem will affect the expected costs associated with deposit insurance provision, thereby allowing banks to shift risk--if they so desire—from themselves to the deposit insurer. In addition, the costly state verification problem applies to the deposit insurer as well as to the bank, so that costs must be incurred to directly observe any bank's return on its portfolio.

In the BCS model, agents make the following decisions in the following order. First, the government decides how to price deposit insurance. Its decision variables here may include what kinds of premia to charge[7]--including whether or not to charge risk-based premia—or the expected discounted present value of its future losses associated with deposit insurance provision. These variables are related through the government budget constraint, as we describe below. In addition, BCS assumes that any deposit insurance

[7] If a zero premium is charged, this has an interpretation as a system where there is no explicit provision of deposit insurance. However, the government still implicitly stands behind the banking system.

losses are made up from general revenue, which in their model takes the form of lump-sum taxes imposed on various agents. In general it matters to some extent who bears this tax; we expand on how this matters below.

Second, after deposit insurance premia and the value of lump-sum taxes on various agents are determined, agents with the ability to operate banks decide whether or not to do so. There is free entry into banking so that, in equilibrium, banks earn "normal" economic profits. Those agents who do form banks have the following choices to make: how much to lend to each borrower, and what rate of interest to charge. If only a relatively small amount is lent, funds diversion will be impossible and the cost of interim monitoring will be avoided. However, the return on the borrower's investment will be low—on average—thereby implying a relatively high probability of loan default. If a larger amount is lent funds diversion will be possible, and the bank must engage in interim monitoring with a probability that is sufficiently high so as to deter the diversion of funds. Interim monitoring is costly, but this strategy has the benefit that the risk of loan default will typically be lower if borrowers operate projects with more advantageous return distributions.

The existence of credit rationing implies that banks will charge interest rates on loans that maximize their own expected return on funds lent, inclusive of the monitoring costs implied by the lending strategy the bank chooses.[8] Since this expected return is unaffected by the nature of the premium on deposit insurance, or by the implied losses on deposit insurance incurred by the government, the rate of interest charged on loans will be also be independent of these objects.

What determines which lending strategy a bank should choose? The extension of large loans implies that the bank needs to raise a relatively large volume of deposits. Thus the relative cost of each lending strategy depends on the cost of raising deposits, which has two components. One is the rate of interest paid on deposits, and the other is the deposit insurance premium. High deposit rates of interest, and/or high deposit insurance premia increase the cost of raising funds. Thus high deposit rates of interest, and high deposit insurance premia make it expensive to make large loans. It follows that, if the cost of deposits, inclusive of insurance premia, is below some threshold, banks will follow the strategy of lending large amounts and engaging in interim monitoring. This enables borrowers to invest in the high productivity type 1 projects. Alternatively, if the cost of deposits inclusive of deposit insurance premia is above this threshold, banks will be deterred from making large loans. The access of borrowers to credit will be restricted, and it will only be possible for them to invest in relatively low return type 2 projects.

The behavior of borrowers is simple. They get funds if they can, and invest in the type of project that yields them the highest possible expected payoff (inclusive of the benefits derived from funds diversion, if this is feasible). The behavior of depositors is equally simple; since their deposits are fully insured, they deposit funds with whatever bank (or banks) offers the highest rate of interest on deposits.

[8] See Williamson (1987) for a further discussion.

2. Properties of Equilibrium

Given this set of interactions among agents, which variables are endogenous depends on what the government sets. The rate of interest charged on loans and the rate of interest paid on deposits are always endogenous variables. And, if the government sets deposit insurance premia, the expected discounted present value of the losses associated with the provision of deposit insurance is also an endogenous variable. Alternatively, the government can be viewed as setting the (expected) discounted present value of its losses as a deposit insurer, in which case deposit insurance premia become endogenous variables.[9] As we have noted, the rate of interest charged on loans is the rate that maximizes the lender's expected return. The rate of interest paid on deposits, and whichever policy variable is endogenous, are determined by two conditions: that banks earn no rents, and that the government's budget is balanced.

What results emerge from this model?

(1) If a flat rate deposit insurance premium is imposed on banks, then the size of this premium is irrelevant to the value of any variable that affects the welfare of any agent. The level of the premium is related to the expected discounted present value of the losses of the deposit insurer, and the rate of interest on deposits. However (and of special importance for our purposes) it is not related to the probability that any given bank will fail.

(2) If the government charges risk-based premia for deposit insurance, then the level of these premia will, in general, affect the threshold cost of funds that determines whether banks make larger or smaller loans. However, deposit insurance premia affect no other variables that matter for agents' welfare. This result has an immediate corollary: unless the equilibrium cost of funds to banks equals the threshold value—so that banks are indifferent between making large versus small loans—local variations in risk-based deposit insurance premia will have no effect on the values of equilibrium variables that affect agents' welfare. They will also have no effect on the probability that any bank will fail. In short, small changes in risk-based deposit insurance premia are—generically speaking—irrelevant.

(3) It does matter who exactly is taxed to make up any shortfall in the funds of the deposit insurer. If only depositors are taxed, then the expected discounted present value of deposit insurer losses is irrelevant, from the perspective of any agent's welfare. If borrowers are taxed as well as depositors, then the expected discounted present value of deposit insurance losses affects the threshold value at which banks are indifferent between making large versus small loans. It affects no other equilibrium quantity that matters from a welfare perspective. And, even in this situation, unless banks are indifferent—in equilibrium—between making

[9] The results we summarize in this section apply to either description of government behavior. However, in some of our empirical work we take the stance that the government chooses the expected discounted present value of the losses associated with deposit insurance provision. We expand on why such a stance is necessary, and on why we think it is justified, in section III.

large and small loans, local variations in the expected discounted present value of deposit insurance losses affect no equilibrium quantity that matters for agents' welfare. Nor do such variations affect rates of bank failure. Of course this need not be true with respect to large variations in deposit insurance losses.

(4) The probability (or frequency) of bank failures depends on which lending strategy (funding type 1 versus type 2 projects) banks follow in equilibrium. This lending strategy can be affected by fundamental shocks to the economy. However, if there are multiple equilibria—which is quite possible—then the equilibrium lending strategies of banks can be altered by self-fulfilling prophecies--or sunspots.[10] Banks can follow lending strategies that imply high (or low) failure rates simply because agents in the economy believe that they will do so.[11]

(5) Episodes of high rates of bank failure will involve banks making small loans for the purpose of funding type 2 investment projects. Banks will opt to do this if and only if the cost of deposits exceeds the appropriate threshold. If the deposit insurance premium is held fixed (or if the structure of risk-based premia is held fixed), this implies that bank failure rates will be high if and only if the real rate of interest on deposits exceeds some threshold level.

What makes various aspects of the pricing of deposit insurance so unimportant in the BCS model? Under the assumption that credit is rationed, banks set rates of interest on loans to maximize their own expected return to lending. Since this return is independent of the way in which deposit insurance is priced, it follows that no aspects of the deposit insurance system affect lending rates.

What determines the optimal lending strategies of banks? As we have noted, banks' optimal behavior is determined by the cost of raising the funds required to make loans of different sizes. Any bank's optimal strategy, then, depends on the total cost of funds, which is a function of deposit insurance premia and deposit rates of interest. Banks do not care about the composition of these costs, they only care about their total value.

What happens in this framework if there is a change in deposit insurance premia? If the rate of interest on deposits simply changes so as to leave the total cost of funds to banks unchanged, then the optimal behavior of banks cannot be affected by alterations in these premia. Nor can their profits. Thus changes in deposit insurance premia will leave bank behavior unaltered. Of course changes in deposit insurance premia do affect the government's income, and hence they have implications for the government's budget constraint. If the government makes up any shortfalls associated with deposit insurance provision out of general revenue, changes in deposit insurance premia obligate it to change its level of lump-sum taxation. But, independently of who these taxes are levied on, they essentially amount to transfers from the depositors of failed banks to the

[10] See Shell (1977), Azariadis (1981), and Cass and Shell (1983) for early developments of the theory of sunspot equilibria, where economic fluctuations are driven by self-fulfilling prophecies. Bryant (1980) and Diamond and Dybvig (1983) applied this notion to banking panics.

[11] In contrast to Diamond and Dybvig (1983), this is true even though deposits are fully insured.

depositors of successful banks. Such transfers are just an alternative way of providing deposit insurance. Thus, changes in deposit insurance pricing must be largely irrelevant, as are changes in the discounted present value of the government's deposit insurance losses.

B Extensions of the BCS Model: Reserve Requirements and Monetizing the Costs of insuring Deposits

Virtually all economies either do now, or have historically imposed reserve requirements on banks. And in many economies (for example Latin American economies) these reserve requirements have at times been quite high. How does the introduction of money into the economy, along with the imposition of reserve requirements on banks, affect the conclusions of the BCS model?

Boyd, Chang, and Smith (2000) consider exactly this issue. They modify the basic BCS model to incorporate money, and they allow banks to hold cash reserves to satisfy a binding reserve requirement. Incidentally, the introduction of money also permits the consideration of an additional issue: in a monetary model, one can allow the government to finance any shortfalls associated with the provision of deposit insurance either out of general tax revenue, or by printing money. As a result, Boyd, Chang, and Smith (2000) can ask how it matters whether or not the government monetizes some portion of the costs of banking system bailouts.

Once banks face binding reserve requirements, so that they hold more of some asset (cash) than they would choose to hold voluntarily, it is no longer true that the choice of a deposit insurance premium is irrelevant. In essence the bank now faces not only a set of real returns on its loans and its deposits; it also faces a real rate of return on its reserve holdings (which is related to the inverse rate of inflation). In general, not all of these returns can adjust in such a way so as to "undo" the consequences of changes in deposit insurance premia or bank bailout costs. Thus the level of deposit insurance premia—or the costs associated with banking system bailouts-- will now affect rates of bank failure, as well as the welfare of different agents. However, there is no presumption that an increase in the level of deposit insurance premia—or a reduction in bank bailout costs-- will have a salutory effect on the rate of bank failure or distress, even if the initial deposit insurance premium is quite low. Nor need changes of this type be beneficial from a welfare perspective. And, if bank reserve holdings are small enough, and they are typically fairly small in developed economies, then any changes in deposit insurance pricing or the magnitude of bank bailout costs will have only a "small" impact on any endogenous variables.

Finally, as we noted above, one can ask how it matters if the government monetizes some portion of the costs of banking system bailouts. Interestingly, Boyd, Chang, and Smith (2000) find that—in general—rates of bank failure will be lower if some portion of these costs is financed out of seigniorage revenue. Of course one might object that monetizing the costs of bank bailouts is inflationary, and we have already argued that inflation is detrimental to the banking system. However, Boyd, Chang, and Smith (2000)

also show the following. Suppose that no deposit insurance premium is levied on banks.[12] Then an increase in the fraction of deposit insurance costs (or losses) that are monetized has *no effect* on the equilibrium rate of inflation. Intuitively, the alternative to monetization is an increase in general tax revenue. In the Boyd-Chang-Smith (2000) model, an increase in general tax revenue reduces the level of deposits, bank reserve holdings, and real balances. Since a reduction in real balances is also inflationary, it turns out not to matter whether bank bailout costs are monetized, or funded out of general revenue. Of course this irrelevance result applies only if the deposit insurance premium is zero. However, continuity suggests that it should be approximately true when deposit insurance premia are quite small, as they usually are in practice.

C. The Role of Inflation

A large body of theoretical literature now suggests that it is possible for changes in the rate of inflation—even changes that are perfectly predictable—to have a strong effect on the health of an economy's financial system.[13] The common mechanism at work in this literature is as follows. First, the financial system operates in the presence of some frictions—adverse selection, moral hazard, or costly state verification—whose severity is endogenous. These frictions give rise to the rationing of credit. Second, the informational friction becomes more severe as real rates of interest decline. It is easy to understand why this might be the case: low real returns reduce the attractiveness of saving and increase the attractiveness of borrowing. Hence a decline in real rates of return is associated with a smaller pool of savings, and an increase in the pool of potential borrowers. If the expansion in the pool of potential borrowers is associated with a reduction in its quality (as would be the case if the decline in real interest rates converted some "natural savers" into borrowers), then the lower real rate of interest is accompanied by a decline in the "average" creditworthiness of borrowers. When this decline occurs simultaneously with a reduction in the real rate of interest, credit must be rationed more tightly so that low real returns have the effect of increasing the severity of credit market frictions.

How is this story related to the level of inflation? If some agents hold, either voluntarily or out of necessity, some assets whose nominal returns are fixed, then higher rates of inflation reduce the real return on this class of assets. Obviously, banks hold cash reserves whose nominal return is fixed (typically at zero). Thus banks see a reduction in the rate of return on—at a minimum—their reserves when inflation rises. Moreover, if this reduction is passed along to depositors, higher rates of inflation will imply lower real rates of interest on deposits as well. Since deposits compete with many assets, a lower real rate of interest on deposits is likely to imply that real returns on a broad class of assets fall when inflation rises. And, as an empirical matter, higher rates of inflation are very strongly associated with lower real returns on a variety of assets, including deposits,

[12] This would obviously be the case if an economy had no explicit deposit insurance system in place, but deposits were implicitly insured instead.

[13] Some references are Azariadis and Smith (1996), Boyd, Choi, and Smith (1997), Boyd and Smith (1998), Schreft and Smith (1997,1998), and Huybens and Smith (1999).

government bonds, and equities.[14] In any event, there are theoretical reasons to believe that higher rates of inflation will aggravate the severity of any frictions that affect an economy's credit markets.

What is the empirical evidence about the relationship between inflation and an economy's financial depth? Boyd, Levine, and Smith (1999) find that higher rates of inflation are, on average, associated with a pronounced decline in the volume of credit extension to the private sector by banks, a significant decline in the volume of bank liabilities outstanding, and a marked reduction in the volume of trade in equity markets. They also find that, except in economies with sustained high rates of inflation, increases in inflation tend to reduce the real rate of return on equity, and to increase the volatility of equity returns. Thus the empirical evidence suggests that sustained increases in the rate of inflation are detrimental to the health of the financial system and that, by the same token, sustained reductions in the rate of inflation are beneficial to banks and to the financial system as a whole. We will see that there is, in fact, a strong connection between the rate of inflation and the frequency with which banking crises occur or recur.

III. Our Approach

The discussion in section II suggests two alternative ways of thinking about the relationship between the costs of bailing out the banking system--when banks fail--and other equilibrium quantities. (a) If the government exogenously sets deposit insurance premia, then the cost incurred by the government in the wake of bank failures is an endogenous variable. This cost depends on other endogenous quantities such as the real rate of interest on bank deposits. (b) If the government exogenously determines the amount it is willing to spend—over and above the funds raised through deposit insurance premia—on bailing out the banking system in the wake of failures, then deposit insurance premia are endogenous. Which of these ways of thinking about the costs of bank bailouts is adopted does not matter from a theoretical perspective in the BCS model. In particular, the approaches have the same implications for all other endogenous variables.

In our empirical work, we intend primarily to examine the relationship between the magnitude of bank bailout costs and various other macroeconomic quantities. We do this in two ways. First we engage in a relatively informal investigation of how bank bailout costs are related to things like the real rate of GDP growth , the inflation rate, the real rate of return to savings, and the degree of financial depth before, during, and after a banking crisis. This aspect of our empirical work does not require us to take a stand on which way of thinking about bank bailout costs is "correct." In particular, it does not obligate us to take a position on whether the costs of bank bailouts are exogenously or endogenously determined.

Second, though, we engage in a regression analysis of how the magnitude of bank bailout costs is related to macroeconomic performance. In these regressions we do adopt

[14] For a discussion of the empirical relationship between inflation and asset returns see Barnes, Boyd, and Smith (1999) and the references they cite. Evidence of an inverse relationship between asset returns and inflation is also presented in section IX below.

the stance that the magnitude of bank bailouts is exogenously determined by the government. This view merits some discussion. Logically speaking, we think it is quite plausible that there is a large exogenously chosen component of the costs of bank bailouts. Indeed, when a banking crisis occurs the government has many choices to make. Should it entirely recapitalize the banking system, or should it completely stand aside and let troubled banks fail? Of course the government could choose to do either, or to adopt an intermediate position. Should the government incur costs to prevent uninsured depositors from losing money in a crisis? Again, it could fully cover the losses of uninsured depositors, not cover them at all, or do anything in between. And, finally, one might take the view that the government would at least have to cover losses incurred by insured depositors, and that the magnitude of these losses is endogenous. But even this component of the costs of bank bailouts has, in our view, a large exogenously chosen component. In particular, the government could wholly or partially default on its obligations to insured depositors, as several state bank deposit insurance systems did historically in the U.S. And, while it may be regarded as implausible that a modern government would explicitly default on its deposit insurance obligations, it could implicitly default on these obligations—to the extent that they are nominally denominated--by engineering an inflation. And, the value of insured obligations denominated in foreign currency units can also be affected by exchange rate manipulation. In practice, both things have occurred in the aftermath of at least some banking crises. Therefore, in our view, it is quite reasonable to take the position that the quantity of real resources expended by the government on bank bailouts has a large exogenous component.

A. Empirical Predictions

The sharpest empirical predictions that emerge from the analysis of section II are as follows.

(1) The magnitude of (expected) losses associated with banking system bailouts is either irrelevant to the determination of equilibrium variables that affect agents' welfare or, if it does matter, it matters only insofar as the magnitude of the bailout is above or below some threshold.

(2) The level of deposit insurance premia (in a flat rate system) is similarly irrelevant. In a risk-based system the same statement applies to local variations in deposit insurance premia.

(3) Environments with high rates of inflation are conducive to banking system problems; environments with low rates of inflation are beneficial to the banking system.

(4) Episodes of temporarily high rates of banking distress should be associated with real rates of interest on deposits or competing assets exceeding some threshold.

(5) Banking crises can easily be associated with "sunspots." Or, in other words, they can easily occur for nonfundamental reasons.

(6) A substantial portion of bank bailout costs can be monetized with little or no impact on the rate of inflation.

There is a great deal of information, compiled by Caprio and Klingebiel (1997), about the magnitude of banking system bailout costs associated with various banking crises. There is also a data set compiled by Demirguc-Kunt and Huizinga (1999) laying out the structure of deposit insurance premia in a variety of countries. Much of our analysis will be oriented around how various economic conditions before, during, and after banking crises are related to the costs involved with bailing out the banking system. However, before we move on to our own empirical investigation, we review how existing empirical evidence relates to the implications of the theory.

IV. Existing Empirical Evidence

To what extent is the existing empirical evidence on banking crises consistent with the implications of the theory laid out in sections II and III? First, the BCS model has the feature that episodes of discrete increases in the rate of bank failure (or, more generally, "distress") occur when the real rate of interest on deposits rises above some threshold level. Demirguc-Kunt and Detragiache (1997a, abstract) find that "high real interest rates are clearly associated with systemic banking sector problems," and that (1997c, p.4) "crises tend to erupt when real interest rates and inflation are high…." Of course the association between high real interest rates and the incidence of banking crises is consistent with the BCS model. The association between inflation and the occurrence of crises is consistent both with the theoretical considerations described above, and with the Boyd, Levine, Smith (1999) finding that inflation is detrimental to the health of the banking system. Demirguc-Kunt and Detragiache (1997c, p.19) also find that "values of the real interest rate above a certain threshold cease to affect the probability of banking problems." This is quite consistent with the prediction of the BCS model that there will be a discrete increase in the rate of bank failures as the real rate of interest on deposits crosses some threshold.

The BCS analysis also predicts that variations in the deposit insurance premium (in a flat rate system, or local variations in a risk-based system) will have no effect on the probability of bank failures. And, in fact, Demirguc-Kunt and Huizinga (1999, p.7) find that "there appears to be no relationship between the deposit insurance premium and actual bank risk."

What kinds of events are associated with the occurrence (or increased probability of occurrence) of a banking crisis? Demirguc-Kunt and Detragiache (1997a,b) find that crises are associated with contemporaneous—but not with leading—declines in the growth rate of GDP.[15] Of course the coincidence of banking crises and recessions is to be expected, but—according to this finding—declines in the growth rate of GDP are not

[15] Kaminsky and Reinhart (1999) find that output tends to peak about 8 months prior to the onset of banking crises.

strong predictors of future banking crises. Demirguc-Kunt and Detragiache (1997a) also find that movements in the terms of trade are not a strong predictor of future banking crises. And, they further find (p.3) that, when one controls for changes in the rate of growth of GDP and changes in the rate of inflation, "neither the rate of currency depreciation nor the fiscal deficit are significant" predictors of future crises.

Some have argued that banking crises tend to occur in the wake of so-called "credit booms." However, Caprio and Klingebiel (1997) question this conclusion and Demirguc-Kunt and Detragiache (1997b, p. 24) find that "credit to the private sector enters with a positive sign [in empirical relations designed to forecast banking crises],…but it is not significant in the specification [of these relations] that excludes [a dummy variable indicating whether or not a] deposit insurance [system is in place]." To summarize, changes in (leading) GDP growth, the exchange rate or the terms of trade, the government's fiscal position, or the volume of bank lending are poor predictors of the occurrence of future banking crises.

Recall that, in the BCS model, an increase in the incidence of banking failure can be caused by an exogenous shock. In fact, a small shock that pushes banks "over the threshold," so that they shift from financing type 1 investment projects to type 2 projects, can result in a large increase in the rate of bank failure. However, it is also the case that simple shifts in agents' beliefs can have the same effect. This can occur in the absence of any exogenous shocks. In our view the relative scarcity of candidates for exogenous shocks that seem to predict banking crises is consistent with the possibility that transitions into banking crises are driven by sunspots. Of course, models based on sunspots or based on exogenous shocks are both likely to predict that banking crises will be associated with contemporaneous recessions, and both are consistent with inflation rendering the banking system more vulnerable to problems.[16]

Given the broad consistency of existing evidence with the predictions of the BCS model, we now use this model to motivate an empirical investigation of the events that occur before, during, and after banking crises.

[16] Azariadis and Smith (1996), Boyd, Choi, and Smith (1997), Schreft and Smith (1997), and Boyd and Smith (1998) all focus on the possibility that high rates of inflation are conducive to multiple equilibria and tend to render the properties of equilibria more sensitive to agents' beliefs.

V. Data Description

This study employs data for 23 countries which experienced a single banking crisis and for 13 countries which experienced multiple banking crises. The sample data cover the period 1970 through 1998, although not all countries have data in all years. The dating of banking crisis years and the estimates of bank bailout costs are taken from Caprio and Klingebiel (1997). Table 2 gives a list of all the countries included in our sample, and their crisis dates.

Although Caprio and Klingebiel provide crisis dating for over eighty countries, we limit the scope of our analysis to a subset of those countries, generally the more developed ones. Specifically, we exclude any economies that lack stock market data for a sufficiently long period. In our view, this imposes a requirement that any country we consider has a market mechanism in place for allocating capital. The result is the exclusion of all the transitional economies of Eastern Europe, and the poorest economies in Africa and South America. Our logic is that banking and financial conditions in those nations are likely to reflect a number of factors other than those present in economies with well-established financial market institutions.

All macroeconomic data, as well as stock prices and interest rates, were taken from the International Monetary Fund's IFS data base. Banking variables were provided by Thorsten Beck at the World Bank.[17] Descriptions of deposit insurance systems by country were provided by Asli Demurgic-Kunt, also of the World Bank. A list of all variables employed in the study, their source, and their IFS line number (where appropriate) are given below.

Table 1 displays summary statistics for countries experiencing banking crises. Included in the sample are 53 banking crises, of which 23 are in single crisis countries and 30 are in multiple crisis countries. The former have an average duration of 5.1 years, the latter an average duration of 3.2 years. For single crises countries we have a total of 690 observations (23 countries for 30 years) including both crisis and non-crisis years. For multiple crisis countries, we have a total of 390 observations (13 countries for 30 years) including both crisis and non-crisis years.

Caprio and Klingebiel differentiate between "systemic" and "non-systemic" crises. According to their study, 27 of the crises we examine in the present work were "systemic", whereas 26 were "non-systemic." Besides this classification scheme, they provide the following quantitative data in some, but not all, of the countries. In some instances they report a banking system bailout cost, as a fraction of bailout year GDP. In other instances they report the fraction of total banking system loans that was in default. (These data are shown in Table 3.) We will extensively employ the banking system bailout cost data reported by Caprio and Klingebiel: this variable is called *BAILOUT* below.

[17] A description of these data appear in Levine, Loyaza, and Beck (2000).

For other variables employed we use the following definitions.

(1) *R-GDP*. Growth rate in real GDP, per capita. (IFS line 99B)

(2) *R-rate*. Rate of interest on money market instruments divided by the percentage change in the consumer price index. (IFS lines 60B and 64)

(3) *Infl*. Percentage rate of change in the consumer price index. (IFS line 64)

(4) *R-eqr*. Percentage rate of change in domestic stock price index (not inclusive of dividends) divided by percentage change in consumer price index.[18] (IFS lines 62 and 64)

(5) *P-cred*. Total loans (to the private sector) made by private banks and private financial intermediaries divided by GDP. (Levine, Loyaza, and Beck, 2000)

(6) *M2*, and GM2. This is the standard measure of M2, along with its growth rate. (IFS lines 34 and 35)

(7) *BR*, and *GBR*. Bank reserves, and the growth rate of bank reserves. (IFS line 20)

(8) *BAILOUT*. Measure of bailout size as percentage of GDP. (Caprio and Klingebiel, 1997)

(9) *DUM*. A dummy variable that takes on the value one in crisis years, and zero otherwise.

(10) *DUMA*. A dummy variable that takes on the value 1 in years after a crisis (in single crisis countries, or after the last crisis in multi-crisis countries), and zero otherwise.

(11) *DUMMI*. A dummy variable that takes on the value 1 in years between two crises, and zero otherwise. Obviously *DUMMI* is relevant only for countries that experience more than one crisis.

(12) *MEAS*. The variable *BAILOUT* multiplied by the variable *DUM*. *MEAS* takes on nonzero values only while a crisis is in progress.

(13) *MEASA* is the variable *BAILOUT* multiplied by the variable *DUMA*. *MEASA* takes on nonzero values only in years after a crisis (or after the last crisis, in multi-crisis countries).

[18] Clearly it would be better to have a measure of equity returns that reflects dividend payments. But such a measure is available for only a small subset of the countries we consider. Many studies using U.S. data suggest that, for the kinds of analyses we will be undertaking, real equity returns inclusive of dividends and real equity returns exclusive of dividends behave similarly enough so that we feel the omission of dividends is not a serious problem. On this point see, for instance, Schwert (1981).

(14) *MEASMI* is the variable *BAILOUT* multiplied by the variable *DUMMI.*

(15) *I-wealth*. Real per capita GDP in 1969, expressed in U.S. dollars. (Levine, Loyaza, and Beck, 2000)

VI. What Happens Before a Crisis?

In the next three sections we describe what happens before, during, and after a banking crisis. As we will see, all banking crises are not created equal. In particular, it will become clear that countries that have suffered from repeated crises differ in many ways from their counterparts that have managed to have only one crisis in the past 25 years. Therefore we describe the events that occur prior to banking crises in "single crisis" and in "multi-crisis" countries separately.

A. Single Crisis Countries

1. A Summary of Events

There are several common threads joining different economies in their pre-crisis experiences. For example, in 22 of the 23 single crisis countries the growth rate of per capita real GDP declined in at least one of the three years prior to the crisis.[19] In 22 countries where we examined the behavior of inflation, the inflation rate rose in at least one of the three years preceding the crisis 19 times.[20] And in 21 countries where we examined the individual behavior of real share values,[21] 15 countries exhibited a decline in share index values relative to the general price level in at least one of the three years prior to the crisis.

Clearly these statements are quite "weak." That's because it rarely happens that the immediate pre-crisis changes in the growth rate of real GDP, inflation, or the real value of equity outstanding are particularly large. For instance, in only 7 of the single crisis countries was the cumulative decline in the growth rate of real GDP especially large in the three years prior to the crisis.[22] And, for 14 of the 23 countries there are at least two separate pre-crisis episodes where the cumulative decline in the per capita growth rate of real GDP is larger than that observed in the three years before the crisis.[23] Similarly, in only 5 of the 22 countries examined is there an episode of an unusually large increase in the rate of inflation in the three years leading up to the crisis. In the other 17 countries there are at least two episodes of larger cumulative increases in the rate of inflation

[19] The remaining country, Zimbabwe, experienced a very large reduction in its real growth rate between the fourth and the third year preceding the crisis.

[20] We lack pre-crisis inflation data for Hong Kong. And, while the figure of 19 countries that experienced increases in their inflation rates is literally correct, in many of these countries the increase is quite small. Parenthetically, in only 9 of these countries was the level of inflation relatively high—by the pre-crisis historical standards of that country--in any of the three years before the crisis.

[21] We lack pre-crisis data on equity prices for Hong Kong and Peru.

[22] For Jamaica and Zimbabwe there was a large reduction in real GDP growth within four years prior to the occurrence of the crisis.

[23] Here our "sample" always runs from 1970 until the onset of the crisis, as dated by Caprio and Klingebiel (1997).

between 1970 and the beginning of the crisis.[24] And, of 21 countries examined, only 4 exhibit an especially large decline in the real value of equity outstanding in the three years before the crisis: 16 of these countries experienced at least one substantially larger decline in real equity values between 1970 and the three years preceding the crisis.[25]

It is often asserted that banking crises are preceded by "credit booms." Levine, Loyaza, and Beck (2000) found that the "best" measure available of bank lending to the private sector is the ratio of private credit to GDP that they construct. We examined the ratio of private credit to GDP for 22 single crisis countries.[26] In only 6 of them does this ratio display an unusual rate of growth in even one of the three years prior to the crisis.[27] And, in 2 of these 6 countries, there is at least one episode of a much larger increase in this ratio than that exhibited in the three years before the crisis. Indeed, in 10 out of the 21 countries there is at least one pre-crisis period in which the ratio of private credit to GDP grows at an unusually rapid rate with no crisis occurring in the subsequent three years. Thus there is not typically an unusually high rate of credit growth observable near the onset of a crisis.

Typically, then, only 20% to 30% of the single crisis economies exhibit unusually large changes in per capita GDP growth, inflation, or real share values within three years preceding the occurrence of a crisis. To what extent do the same economies share unusual movements in all three variables? Extending our window a little bit, 8 countries (out of 21) display relatively large declines in the per capita growth rate of real GDP, substantial increases in the rate of inflation, and large declines in real share values within three to five years before a crisis occurs. These countries are Canada, Columbia, Finland, Israel, Jordan, Spain, Sweden, and Zimbabwe.[28] Thus less than 40% of the sample has the property that all three signs of macroeconomic distress are present at any point within even five years before the crisis. And, parenthetically, of these 8 countries, only 4 (Columbia, Spain, Sweden, and Zimbabwe) show an unusual rate of growth in the ratio of private credit to GDP within this same time frame.

2. The Relationship between Bailout Costs and Macroeconomic Conditions

The BCS model predicts that any anticipations of (the discounted present value of) bank bailout costs will either have no consequences for pre-crisis economic performance, or will have consequences only in so far as the level of bank bailout costs is above or below some threshold level. We therefore consider the following thought experiment. Obviously, before any banking crisis occurs, agents know that there is some probability that such a crisis will happen. And, presumably, these same agents can form expectations

[24] Of these countries Zimbabwe experienced accelerating inflation for several years prior to its banking crisis, but the increases in the last three years before the crisis were not unusually large by the standards of its historical experience.
[25] Zimbabwe had a very large decline in the real value of equity four years before its banking crisis.
[26] Again, we lack pre-crisis data on this variable for Hong Kong.
[27] As before, in Zimbabwe there is a large increase in the ratio of private credit to GDP four years prior to the crisis.
[28] And, we are somewhat suspicious of the GDP data for Israel.

about the costs that will be incurred in bailing out the banking system, if a crisis is observed. Suppose that agents can form unbiased estimates of (the discounted present value) of these costs.[29] How would these cost expectations affect macroeconomic performance? To get a crude answer to this question, Figure 1 plots the average pre-crisis rate of growth of per capita GDP versus the cost of the bailout of the banking system (this value is not discounted), where a measure of this cost is available.[30] Figure 2 plots the average pre-crisis rate of inflation versus the actual bailout cost. As is clear from Figure 1, there is a weak *positive* relationship between the magnitude of the bailout cost and the average pre-crisis rate of real GDP growth. As is evident from Table 6, this relationship is statistically significant. However, it is also economically small. The slope of the bailout cost-real growth relationship suggests that an increase in bank bailout costs by an amount equal to 1% of GDP leads to a 0.02 percentage point increase in the average pre-crisis rate of real GDP growth (if Israel is excluded from the calculations). Thus, if agents are forecasting high bailout costs in countries that actually incur them, these forecasts do not appear to be injurious to real GDP growth. In fact, these forecasts appear to have a small but positive effect on real growth rates, prior to the crisis. Moreover, as is evident from Figure 2 (and Table 6), there is no apparent relationship between the average pre-crisis rate of inflation and the level of bank bailout costs—at least for countries whose bailout costs are less than 15% of GDP. And, even when countries that do have bailout costs in excess of 15% of GDP are taken into account, the relationship between the average pre-crisis rate of inflation and the bailout cost is not statistically significant. Finally, Figure 3 plots the average level of the pre-crisis real rate of return on equity versus the bailout cost. Table 6 indicates that the very weak positive association between bank bailout costs and the average level of real returns observed there is not statistically significant.

In short, consistent with the predictions of the BCS model, there is no strong relationship between the costs of bailing out the banking system, to the extent that these are accurately forecast, and pre-crisis GDP growth or inflation. And, to the extent that there is a relationship, this is driven by countries whose bailout costs exceed some threshold (15% of GDP).

[29] With a few exceptions, the dating of the crisis in single crisis countries is similar enough that discounting should not greatly affect the perceptions of the cost. And, of the three countries with the highest bailout costs, two had their crises relatively early in the period. Thus, if we were to take discounting seriously, the expected discounted present value of bailout costs in these countries would exceed similar costs in other countries by even more than we report.

[30] Table 6 reports the results of running four regressions associated with many of the figures. One regression takes the variable on the vertical (horizontal) axis as the dependent (independent) variable, and another takes the variable on the horizontal (vertical) axis as the dependent (independent) variable. We are thus agnostic as to which of the variables should be regarded as exogenous. T-statistics are then used to assess the significance of the correlation between the two variables plotted. Finally, table 6 reports the results of running the same pair of regressions, but with Israel excluded from the sample. As will be apparent, Israel is often a huge outlier.

3. Explicit versus Implicit Deposit Insurance Systems

An interesting question concerns whether economies with explicit systems of deposit insurance perform better or worse than economies that lack such systems. We undertake a preliminary look at the pre-crisis, crisis, and post-crisis experiences of economies that do, and do not have explicit deposit insurance systems in place. Of course many countries have put an explicit insurance system in place either after a crisis began, or when a crisis was clearly looming on the horizon. To attempt to eliminate any biases induced by this fact, we classify economies as having had an explicit system of deposit insurance in place only if this was in place at least three years prior to the onset of the crisis.

For economies with explicit systems of deposit insurance existing at least three years before the beginning of their banking crises, the average rate of real GDP growth, per capita, is 2.65%. For economies lacking such systems, the average rate of real GDP growth is 3.29%. Thus countries having explicit insurance of deposits appear to grow, on average, more slowly before crises than countries that do not explicitly insure deposits. However, the average pre-crisis rate of inflation in countries with explicit deposit insurance is 7.79%. The corresponding average inflation rate in countries without explicit insurance of deposits is 15.64%. Thus there is a quite pronounced difference in the inflation experiences of countries with and without explicit systems of deposit insurance. On the bases of these two simple comparisons, we conclude that countries that explicitly insure deposits do not have pre-crisis economic performances that are either uniformly better, or uniformly worse than countries that do not provide explicit deposit insurance.

B. Multi-Crisis Countries

As we just saw, in single crisis countries it is more the exception than the rule that there are dramatic macroeconomic events within a three year window prior to the onset of the crisis. This is also true for the period preceding *the first banking crisis* in multi-crisis countries. Among the 13 multi-crisis countries, 10 have the property that the growth rate of real per capita GDP drops in at least one of the three years immediately prior to the crisis. Inflation rises in at least one of the three years prior to the first crisis in 8 out of 11 countries examined. And, a decline in the value of a share price index relative to the general price level occurred in 8 out of 10 countries considered.[31]

As in the case of the single crisis countries, the magnitude of the movements in real GDP growth, inflation, and the real value of the share price index is not necessarily particularly large. For example, in only 7 of the 13 countries was the cumulative decline in the rate of GDP growth unprecedented in the pre-crisis experience (since 1970) of the country in question. And in only one country, Turkey, was the increase in inflation prior

[31] We do not have share price data for the other three multi-crisis countries in the period preceding their first crisis.

to the crisis without precedent (again since 1970).[32] Finally, only two countries exhibited a decline in the real value of equity outstanding that was particularly large in the three years prior to the onset of the first crisis.

If we expand the window leading up to the crisis somewhat, we find that Argentina, Chile, Malaysia, Mexico, South Africa, Taiwan, and Thailand had relatively large—although, again, not necessarily unprecedented—cumulative increases in their rates of inflation in the five years prior to their first crisis. And, Argentina, Brazil, Great Britain, the Philippines, South Africa, and Thailand had relatively large reductions in the real value of equity outstanding within five years before their first crisis. Within five years in advance of their first crisis, Argentina, Brazil, Chile, South Africa, Taiwan, and Turkey experienced substantial reductions in GDP growth, and either high (by historical standards) or increasing rates of inflation. This is less than half of the sample.

With respect to the ratio of private credit to GDP, this displayed unusual growth in at least one of the three years leading up to the first crisis in only 2 of the 13 countries (Argentina and Brazil). Thus few of the initial crises experienced by the multi-crisis countries seem to be preceded by anything resembling a credit boom.

In short, then, only about half of the multi-crisis countries display any obvious macroeconomic candidates that might have caused their first crisis. And, when there are candidates, one often has to look for them several (more than three) years in advance of the crisis. Therefore it seems to be the case that in multi-crisis, as in single crisis countries, it is difficult to rule out sunspots as a cause of many banking crises.

VII. What Happens During a Crisis?

A. Single Crisis Countries

1. A Summary of Events

In our sample there are 23 countries that experienced one crisis. Among these countries, the average duration of a crisis is 5.1 years.

There are a number of features that are quite common in countries undergoing a crisis. One is that the rate of growth of real per capita GDP declines. Figure 4 plots the average rate of real per capita GDP growth during a crisis against the average rate of real per capita GDP growth prior to the crisis. 14 of the 20 countries represented experience a reduction in their average real growth rate while the crisis is going on. And, indeed, the mean (median) pre-crisis real rate of growth of per capita GDP is 2.8% (2.7%) per year, while the mean (median) real rate of growth during a crisis is 0.1% (1.1%) per year. (All summary statistics of this type appear in Table 1.) In our view the median is the more "meaningful" statistic, as the mean rate of growth during a crisis is unduly influenced by the huge reduction in real growth Jordan experienced during its banking crisis. Thus a

[32] However, South Africa experienced a lengthy episode of accelerating inflation that ended only one year prior to the occurrence of its first crisis. Thus there was a large pre-crisis increase in the rate of inflation in South Africa, although increases in inflation were not unusually large in the last three years before the crisis.

relatively "typical" experience is that the real rate of growth in per capita GDP falls by about 1.6 percentage points during a crisis. Interestingly, the standard deviation of real per capita GDP growth is virtually the same in the pre-crisis period as it is during a crisis.[33]

It is usually the case that the rate of inflation declines during a banking crisis. Figure 5 plots the average pre-crisis rate of inflation for 19 countries versus their average rate of inflation during the crisis period.[34] As is clear from the Figure, the rate of inflation falls with the onset of a crisis in 12 of the 19 countries (in 12 of 20 if Peru is included). And, the median rate of inflation in our sample declines from 9.4% in the pre-crisis periods to 6.5% during a crisis.[35]

The real rate of interest observed in money markets usually rises during a crisis, as is predicted by the analysis of BCS. Figure 6 plots the average real rate of interest in the money market before the onset of a crisis versus the average real rate of interest during a crisis for 13 countries.[36] 11 out of 13 countries experience an increase in the real rate of return once a crisis begins. Moreover, the average increase in the real rate of interest is quite large: the mean (median) pre-crisis real rate of interest is 1.33% (1.73%), while the mean (median) real rate of interest during a crisis is 3.74% (4.19%). Interestingly, the standard deviation of the real rate of interest declines in crisis periods, from 4.9 before crises to 3.65 during crises.

We do not regard it as accidental that during a crisis the rate of inflation typically declines while the real rate of interest rises. As shown by Barnes, Boyd, and Smith (1999) and Boyd, Levine, and Smith (1999), reductions in inflation typically have a large positive impact on real rates of return, at least in countries with average rates of inflation below 15% per year.

Figure 7 plots the average real rate of return on equity in each country before a crisis against the average real rate of return on equity during a crisis. 13 of 20 countries[37] have a lower average real rate of return on equity during the crisis than they had before it. The mean (median) rate of return on equity in our sample in the pre-crisis period is 4.1% (-1.6%), while the mean (median) rate of return on equity during the crisis is -0.9% (-2.3%). Note that the equity premium declines substantially during a crisis. Interestingly, the volatility of the real return on equity does *not* rise during crises (nor does it fall substantially).

With respect to the real value of equity, 7 out of 15 countries examined individually have real equity values that are generally declining during the crisis. In particular, these

[33] This suggests that the reduction in the mean or median rate of growth gives a fairly good sense of what happens to the entire distribution of real GDP growth during a crisis.
[34] Peru is omitted from the Figure because of the enormous increase in its inflation rate that occurred during its banking crisis.
[35] We do not report the sample means, as these are massively influenced by the experiences of the high inflation economies, and hence are not meaningful here.
[36] We do not have data on money market rates for all countries.
[37] We are missing pre-crisis data for three countries.

countries have lower real equity values coming out of the crisis than they did entering it. In contrast, 8 of these 15 countries have generally rising or constant real equity values during the crisis, and leave the crisis with real equity values equal to or above the level that obtained at the onset of the crisis

It is *not* the case that banks typically curtail their lending activity (appropriately scaled) during crisis episodes. The mean (median) ratio of private credit to GDP is 0.57 (0.48) before crises occur, and is 0.74 (0.69) during crises. In other words, bank lending expands relative to real activity during banking crises.

2. The Relationship Between Bailout Costs and Macroeconomic Conditions

Figure 8 plots the average rate of real GDP growth during crisis episodes against the cost of the bailout. As Figure 8 and Table 6 indicate, there is essentially no relationship between the cost incurred in bailing out the banking system and the average rate of real GDP growth in an economy during a crisis.

Figure 9 repeats this experiment for the rate of inflation. Evidently, at least for countries whose bailout costs are less than 30% of GDP[38], there is not much of a relationship between the average rate of inflation during crisis episodes and the magnitude of the bailout of the banking system.

Figure 10 shows the average real rate of return on equity during a crisis plotted against the magnitude of the banking system bailout. Once again (see Table 6), there is not much association between the average real return during the crisis and the size of the bailout.

How is the magnitude of the reduction in per capita real GDP growth during a crisis related to the bailout cost? A crude first pass at this question is represented in Figure 11. In this figure the ratio of average real per capita GDP growth during the crisis episode to average real per capita GDP growth prior to the crisis is plotted for each country against the size of the bailout. The Figure illustrates a very weak negative relationship between the decline in the rate of real GDP growth during a crisis and the magnitude of the bailout cost. However, Table 6 indicates that this relationship is not a statistically significant one.

How is the decline in the rate of inflation during a crisis related to the magnitude of the bailout of the banking system? Figure 12 plots the ratio of the average rate of inflation during a crisis divided by the average pre-crisis rate of inflation against the size of the bailout for each country. This relationship is positive: the higher the bailout cost the smaller the reduction in inflation during a crisis. However, it is also clear that for economies with bailout costs of less than 30% of GDP this relationship is fairly weak. And, indeed there is no statistically significant relationship between these variables if Israel is excluded from the sample.

[38] The country whose bailout costs are 30% of GDP is Israel. Israel has an inflation experience that is very unrepresentative of single crisis countries.

Figure 13 shows the ratio of the average real rate of interest in the money market during crises divided by the average pre-crisis real rate of interest plotted against the bailout cost for each country. Evidently there is not much relationship between these variables, indicating that the increase in the real rate of interest that accompanies a crisis is not at all strongly related to the size of the banking system bailout.

In Figure 14 we display the ratio of the average real return on equity during a crisis to the average real return on equity before a crisis, and plot it against the cost of the bailout. If we ignore the effect of Israel (whose bailout cost is 30% of GDP), there is a very weak negative relationship between these variables: one that Table 6 indicates is not statistically significant. Thus higher bailout costs are not generally associated with any particular change in the real rate of return on equity.

3. The Length of the Crisis

How is the length of a crisis related to its severity? Figure 15 shows the ratio of the average rate of real GDP growth (per capita) during a crisis divided by the average rate of growth before a crisis, plotted against the length of the crisis. As is clear from the Figure, there is basically no association between the average change in the rate of growth and the length of a crisis. Thus longer crises do not necessarily imply larger reductions in average GDP growth, although clearly any reductions are incurred for a longer period.

Figure 16 plots the length of a crisis against the injection of resources by the government in the associated bailout. The plot hints at a positive relationship between the magnitude of the bailout and the length of the crisis, but this relationship is very weak and is not statistically significant.

4. The Role of Explicit Versus Implicit Insurance of Deposits and Risk-Based Premia

We now briefly examine how it matters whether or not there is an explicit deposit insurance system in place while a crisis is underway. In addition, if there is such a system, we examine differences between countries that do and do not have risk-based pricing of deposit insurance. As before, and for the same reasons as previously, we classify economies as having had an explicit system of deposit insurance in place only if this was in place at least three years prior to the onset of the crisis.

With this categorization, we find that the average bailout cost for economies with explicit deposit insurance systems is 7.3% of GDP. The average bailout cost for economies without explicit systems is 12.76% of GDP. And, of course, to the extent that the government chooses the magnitude of bank bailout costs, it may be the case that governments inclined towards greater resource injections during banking crises are also inclined towards implicit systems of deposit insurance. We also computed the ratio of the average rate of growth of real per capita GDP during crises to the average pre-crisis growth rate for each country. In countries with explicit deposit insurance systems the average value of this ratio is 0.994; for economies without explicit insurance of deposits

the average value of this ratio is 0.964. Finally, we computed the ratio of the average rate of inflation during crises to the average pre-crisis rate of inflation. For economies with explicit deposit insurance systems in place the average value of this ratio is 0.965; for economies lacking explicit systems the average value of this ratio is 0.997 (with Israel and Peru deleted). Thus economies with explicit deposit insurance systems in place on average had lower costs associated with bailing out their banking systems,[39] and they also experienced smaller average reductions in real growth rates and larger average reductions in inflation during crises. In short, during a crisis, it seems clearly preferable to have a system of explicit deposit insurance in place.

With respect to whether or not risk-based deposit insurance premia were imposed, the average bailout cost for countries without risk-based premia is 8.5% of GDP. The average bailout cost for countries with risk-based deposit insurance pricing is 7.1% of GDP. The ratio of average real per capita GDP growth during the crisis to average growth prior to the crisis for countries without risk-based premia is 0.985; the average value of this ratio for economies with risk-based premia is 0.977. And, the ratio of average inflation during the crisis to the pre-crisis average rate of inflation in countries without risk-based insurance pricing is 0.977 (with Israel and Peru excluded). For countries with risk-based insurance premia the average value of this ratio is 0.953. Thus countries with risk-based deposit insurance pricing have somewhat lower bailout costs, on average, and a larger average reduction in the rate of inflation during a crisis. They also have, on average, larger recessions when crises do occur. Thus we cannot identify a clear uniform advantage to having a system of risk-based deposit insurance pricing in place during a crisis.

B. Multi-Crisis Countries

In our sample there are 13 countries that experience more than one banking crisis. In this set of countries the average duration of a crisis is 3.2 years.

As is the case for single crisis countries, economies that experience multiple crises nearly always exhibit a reduction in the growth rate of per capita real GDP during a crisis. The mean (median) rate of growth prior to the occurrence of the first crisis within this group of economies is 3.3% (3.5%). The mean (median) rate of growth during a crisis is -0.2% (0.0%). Thus, typically, economies that experience more than one crisis have more severe recessions during the crisis than their single crisis counterparts. However, as is also true of single crisis countries, the standard deviation of real per capita GDP growth is very similar before, during, and between crises. Thus the volatility of real growth is not changed by the occurrence of a crisis.

With respect to inflation, of 11 countries we examined individually, 7 had an average rate of inflation during their first crisis that was similar to or above their average rate of inflation prior to the first banking crisis. And, either this is also true during the second banking crisis or, at a minimum, inflation is high in absolute terms during the second

[39] And, as we have argued, this may well have been the result of a conscious choice.

crisis. However, for countries that experience more than two crises (of which there are 4 in our sample), only one (Mexico) has a relatively high rate of inflation in its third or fourth crises. In any event, this presents a marked contrast with single crisis countries, where inflation generally declines during a banking crisis. And, the mean (median) rate of inflation in multi-crisis countries prior to the first crisis is 51.3% (10.5%), while the mean (median) rate of inflation during crises is 147% (13.9%). Thus, not only does inflation tend to rise rather than fall during crises, but the typical situation in multi-crisis countries is that the rate of inflation is substantially higher in general than it is in single crisis countries. Finally, the standard deviation of inflation is much higher during banking crises than it is either prior to the occurrence of any crisis, or between crises. Thus the onset of a crisis is not only associated with higher average rates of inflation, it is associated with higher inflation variability as well.

Another interesting contrast with single crisis countries arises in the behavior of the real rate of return on equity. In single crisis countries this return falls during a crisis. In multiple crisis countries the real equity return *rises* during a crisis. Indeed, in multi-crisis countries the increase in this return is fairly large. The mean (median) real rate of return on equity in multi-crisis countries as a group is 0.5% (-5%) before the first crisis. The mean (median) real rate of return during crises is 9% (-1.4%). Interestingly, the mean (median) rates of return on equity are even higher between crises than they are during crises, equaling 12% (10.4%). Thus, a representative multi-crisis country sees its average real return on equity increase by several percentage points during its first crisis, and by several additional percentage points once the first crisis is over. And, finally, the volatility of equity returns is higher during crises than it is either prior to the first crisis, or between crises.[40]

As is true of single crisis countries, it is *not* the case that the volume of bank lending, appropriately scaled, declines during crises. The mean (median) value of the ratio of private credit to GDP is 0.286 (0.262) before the first crisis. It is 0.500 (0.421) during crises, and 0.546 (0.474) between crises. Of course these values are small relative to their counterparts for single crisis countries suggesting that, on average, the economies that have avoided multiple crises have deeper financial systems than the economies that have not. Finally, it is interesting to note that the standard deviation of the ratio of private credit to GDP is about twice as high during or between banking crises as it is prior to the first crisis. Thus crises do seem to be associated with greater volatility in the (scaled) volume of bank lending to the private sector.

It will be recalled that in single crisis countries there was basically no relationship between the during-crisis decline in the growth rate of real GDP and the length of the crisis. Figure 17 depicts the same relationship for multi-crisis countries (here the average rate of growth during the *first* crisis is compared with the pre-crisis growth rate). There is a weak negative association, but not one that is statistically significant. This fact indicates that, for multi-crisis countries, longer crises are also not associated with more

[40] Boyd, Levine, and Smith (1999) find that higher inflation is generally associated with more volatile equity returns.

severe declines in the average rate of real growth. Figure 18 depicts the same relation but where the average real rate of per capita GDP growth *between* the first and second crisis is divided by the pre-crisis average rate of growth, and then plotted against the length of the crisis. Here a slight positive association emerges,[41] but again there is no statistically significant connection between these variables. Thus the recovery between crises is no weaker or stronger for countries that experience longer (first) crises.

VIII. What Happens After a Banking Crisis?

A. Single Crisis Countries.

1. Summary of Events

Figure 19 plots the average rate of growth of real GDP, per capita, in the period following a crisis against the average rate of real GDP growth prior to the crisis. As is clear from the figure, 6 of the 16 countries represented[42] have higher average rates of GDP growth after the crisis than they did before it, while 10 countries have average post-crisis rates of growth that are similar to or below their average pre-crisis rates of real GDP growth. The mean (median) pre-crisis rate of growth in single crisis countries is 2.8% (2.7%), while the mean (median) post-crisis rate of growth is 2.1% (2.35%). Interestingly, the rate of real output growth is substantially less volatile after crises than it is before them: the standard deviation of the growth rate of per capita GDP after crises is about 60% of its pre-crisis value.

Figure 20 shows the average post-crisis rate of inflation for each country plotted against the average pre-crisis inflation rate. Of the 15 countries represented in the figure, 12 have lower rates of inflation after the crisis than they did prior to the crisis. The median pre-crisis rate of inflation in our sample is 9.4%, while the analogous post-crisis value is 4.0%. Based on the sample medians, we conclude that the average rate of inflation following a crisis is typically substantially lower than the average rate of inflation prior to a crisis. And, indeed, based again on the sample medians, the average rate of inflation after a crisis is also well below the average rate of inflation during a crisis.

As we have noted, the volume of bank lending (relative to GDP) typically rises—in fact dramatically—during banking crises. Once a crisis ends, the volume of bank lending (the ratio of private credit to GDP) continues to rise, but only very slightly. The mean (median) ratio of private credit to GDP during crises is 0.739 (0.691), while after crises it is 0.758 (0.756). And the standard deviation of this ratio changes very little relative to its pre-crisis level.

The average real rate of interest prevailing in money markets before and after a crisis has occurred are plotted in Figure 21. Evidently, 8 of the 10 countries represented in the

[41] Especially if we focus on countries where the crisis is less than 7 years long.
[42] For the remaining seven countries in the sample, either we do not have pre-crisis data, or the banking crises had not ended as of the last date for which we have data.

Figure have a higher real rate of interest after the crisis than they did before the crisis. Moreover, the mean (median) ex post real rate of interest in the money market was 1.33% (1.7%) before the beginning of a crisis, while it was 3.55% (3.48%) afterwards. Thus the average real rate of return is substantially higher after crises than before crises. However, the standard deviation of the real interest rate declines in the post-crisis period relative to the pre-crisis period, so that real rates of interest are less volatile. Notice also that average real rates of interest are very slightly lower in the post-crisis period than they are during the crisis.

With respect to real returns on equity, Figure 22 shows their average pre-crisis and average post crisis values. Apparently, all of the countries shown in the figure have real equity returns that are substantially higher in the post-crisis than in the pre-crisis period. The mean (median) real return on equity before a crisis is 4.1% (-1.6%), while after a crisis these values are 13% (10.1%). Since the standard deviation of real equity returns is essentially the same before and after crises, this huge increase does not appear to represent a compensation for increased risk. And, based on the results of Barnes, Boyd, and Smith (1999), these observed increases in real equity returns are higher than can be accounted for based on the observed reductions in inflation alone. Finally we note that the increase in average real equity returns is well above the average increase in other real rates of interest (money market rates), so that the equity premium rises after a crisis.

The real value of outstanding equity also typically rises after a crisis. Of 21 countries examined individually, 13 have the real value of their stock price index return to or exceed the highest level that obtained prior to the crisis. Only two countries (Italy and Spain) have a real value of their stock-price index that never returns to its pre-crisis level.[43] And, the recovery of the stock market typically does not take very long. 10 of the 15 countries for which we have post-crisis data have real equity values that return to their pre-crisis level within three years after their banking crisis begins.

An important issue concerns how long it takes for the real value of the stock market to re-attain its *trend* level following the occurrence of a crisis. The reason that this is important is as follows. Equity is, of course, a claim to current and future corporate profits. Under the simplest interpretation, then, the real value of equity is simply the (expected) discounted present value of current and future corporate returns. If the value of corporate profits bears a fairly stable relationship to GDP, as it does in the U.S., then the real value of equity outstanding is roughly proportional to the (expected) discounted present value of current and future production. It is therefore the case that we can use the behavior of the real value of equity to estimate how long it takes for an economy to recover from the effects of a banking crisis. In particular, when real equity values re-attain the level suggested by their pre-crisis trend rate of growth, we can conclude that the (expected) discounted present value of current and future production has also returned to the level suggested by its pre-crisis trend. That is, when equity values return to their pre-crisis trend levels, the economy has fully recovered from the effects of a banking crisis.

[43] For the other countries we have no after-crisis data.

In order to determine the "trend value" of real equity prices, we proceed as follows. We compute the sample average pre-crisis real rate of stock market appreciation for all single crisis countries. This is 4.13% per year, and we assume that this rate of appreciation would—in the absence of a banking crisis—apply to equity prices in all single crisis countries.[44] We then establish a pre-crisis "base value" for real stock prices in each country. We do this by taking the average of real equity values five, four, and three years before the crisis begins. The choice of a base period is clearly somewhat arbitrary, and ours is chosen to avoid the possibility that stock prices are already being influenced by the anticipation of a banking crisis. Finally, we project future real equity prices for each country by allowing for compound growth at the 4.13% annual rate, for as many periods into the future as necessary.

The results of these calculations are reported in Table 4. First, notice that Denmark, Finland, Israel, Norway, and the United States all surpassed projected stock market levels *during* the banking crisis period itself.[45] A number of other countries experienced stock market declines during their entire banking crises, but then strongly rebounded a few years later. Such countries include France, New Zealand, and Sweden. This accounts for 8 of the 15 countries for which some post-crisis data is available. Finally, there are 6 countries that do not re-attain the trend value for share prices within the sample: Australia, Canada Germany, Italy, Jordan, and Spain. However, two of those countries have no more than four years of data following the termination of their crisis, and Australia was within 1% of achieving its trend stock market level at the end of the period for which we have data (nine years after the onset of the crisis). Thus only three of the fifteen countries—Canada, Germany and Spain--display any indication that their banking crises may have had a long-term, or permanently detrimental effect on stock market performance.

From these observations we conclude the following. Counting Australia as having recovered from its banking crisis within ten years following its occurrence, 9 out of 15 countries have their real equity values re-attain their pre-crisis trend level within 10 years after their banking crisis began. And, conditional upon re-attaining the trend level of equity values within the sample period, the mean amount of time this takes is 5.8 years. Finally, the longest period any country in our sample goes without re-attaining its pre-crisis trend level is 18 years. Assuming that *all* of the five countries that do not re-attain their trend level of equity values within the sample *would* take 18 years to do so, it is still the case that the mean economic recovery time in our sample is less than 10 years following the beginning of a crisis. Thus it seems safe to conclude that a typical economy recovers from its banking crisis within 6 to 10 years after the crisis starts.

[44] Extrapolating individual country stock market trends is difficult and unreliable with the small number of data points available for many sample countries.

[45] If a country has equity values that exceed trend in just the first year of its banking crisis, and then has equity values below trend for the remainder of the crisis, we proceed as if equity values were below trend throughout the crisis period. Some discussion as to why we proceed in this way appears in section X below.

2. The Relationship Between Bailout Costs and Macroeconomic Conditions

How is post-crisis macroeconomic performance related to the cost of bailing out the banking system? In Figure 23 we plot the cost of bailing out the banking system versus the rate of average real GDP growth (per capita) after the crisis for each country. The average post-crisis rate of real GDP growth is positively related to the magnitude of the bailout, if we ignore countries with bailout costs in excess of 30% of GDP (Israel). However, this relationship is very weak, and the regressions in Table 6 indicate that it is not statistically significant.

Figure 24 shows the average post-crisis rate of inflation plotted against the cost of the banking system bailout. For economies with bailout costs below 30% of GDP there is clearly not much of a relationship between these variables.

Figure 25 represents the average real rate of return on equity after crises and the costs of bank bailouts. Higher bailout costs are associated with higher average real equity returns. However this relationship is not statistically significant if Israel is excluded from the sample.

In Figure 26 we plot the cost of bank bailouts versus the ratio of average post-crisis real GDP growth to average pre-crisis real GDP growth. For economies with bailout costs less than 15% of GDP this ratio has a very slight negative correlation with the size of bank bailouts. But again, this correlation is not significantly different from zero.

The ratio of the average post-crisis inflation rate to the average pre-crisis inflation rate is plotted against bank bailout costs in Figure 27. For economies with bailout costs less than 30% of GDP there is clearly not much of a relationship. Thus the magnitude of the decline in inflation after the crisis relative to before it does not seem to be strongly correlated with the costs of bailouts.

Figure 28 shows bailout costs and the ratio of average post-crisis real returns (in the money market) to average pre-crisis real returns. This ratio appears to be negatively related to the cost of bank bailouts, so that higher bailout costs are apparently associated with a smaller post-crisis increase in the real rate of interest.

Figure 29 repeats this experiment for the real rate of return on equity. The increase in the real rate of return on equity in the post-crisis period relative to its level in the pre-crisis period is essentially unrelated to the magnitude of bank bailout costs.

3. Length of the Crisis

How does the length of an economy's banking crisis affect its post-crisis recovery? The answer appears to be, not very much. Figure 30 plots the ratio of the average post-crisis rate of real GDP growth to the average pre-crisis rate of real GDP growth against the length of the crisis. Evidently, this ratio is essentially unrelated to the length of the banking crisis. Thus the recovery in real GDP growth following a crisis, at least in an average sense, does not seem to depend on how long the crisis lasts.

4. Explicit versus Implicit Deposit Insurance Systems, and Risk-Based versus non-Risk Based Insurance Premia

For economies that have explicit deposit insurance systems in place, the ratio of average real GDP growth after the crisis to average GDP growth before the crisis takes on a mean value of 0.998. For economies that do not have explicit deposit insurance systems in place, the mean value of this ratio is 0.993. And, for economies that have explicit deposit insurance, the ratio of the average post-crisis rate of inflation to the average pre-crisis rate of inflation takes on a mean value of 0.947. For economies that lack an explicit system of deposit insurance, the average value of this ratio is 1.025. Thus, in the post-crisis period, economies having explicit deposit insurance perform better than economies that do not. This is also the case during a crisis, so that it seems there is a clear advantage to having a system of explicit deposit insurance in place once a crisis begins. However, we have seen that economies with explicit deposit insurance do, on average, grow more slowly before a crisis begins than do economies lacking explicit deposit insurance.

When risk-based deposit insurance premia are charged, the ratio of the average post-crisis rate of real GDP growth to the pre-crisis rate of GDP growth has a mean value of 1.01. When deposit insurance premia are not risk-based, the mean value of this ratio is 0.993. When risk-based deposit insurance premia are charged, the ratio of the average post-crisis rate of inflation to the average pre-crisis rate of inflation is 0.94. For economies without risk-based premia, the average value of this ratio is 0.91. Thus, as is the case during a crisis, economies with risk-based deposit insurance pricing do better than other economies on some dimensions, but they do less well on others.

B. Multi-Crisis Countries

As we have noted previously, there are dramatic differences between the way in which single and multi-crisis countries behave. This is also true of their performance following their last (observed) crisis.[46]

In the previous section it was seen that, in single crisis countries, the average rate of real per capita GDP growth after a crisis tends at best to return to its pre-crisis level. This is not the case in multi-crisis countries. In these countries, the mean (median) average rate of growth prior to their first crisis is 3.3% (3.5%). The mean (median) average rate of growth after their final crisis is 4.9% (5.3%). Thus multi-crisis countries tend to experience markedly higher average rates of growth after the conclusion of their final crisis than they did prior to the onset of their first crisis. It is also true that real volatility declines after the final crisis: the standard deviation of real GDP growth is clearly smaller after all crises are concluded than before any crises have occurred.

[46] It is important to note that we have relatively few post-crisis observations for multi-crisis countries. This fact suggests that caution should be exercised in interpreting the apparent differences between single crisis and multi-crisis countries in their post-crisis periods.

For inflation matters are less clear cut. The mean (median) average rate of inflation before the original crisis is 51.3% (10.5%) in multi-crisis countries. The mean (median) average rate of inflation after the final crisis is 30.5% (19.5%). However it is true that the volatility (the standard deviation) of inflation declines dramatically after the final crisis relative to what it had been in the period before the first crisis.

The average real rate of interest on a relatively safe asset (the money market rate) was shown to rise after a crisis, relative to its pre-crisis level, in single crisis countries. In multi-crisis countries this real rate of return, on average, declines dramatically relative to its pre-crisis level. The mean (median) real rate of interest in multi-crisis countries before their first crisis is 97.5% (0.25%), while after the final crisis the corresponding average values are -5.7% (-4.11%). For average real rates of return on equity, however, this pattern is entirely reversed and, therefore, resembles the pattern observed in single crisis countries. For multi-crisis countries the mean (median) average real return on equity prior to the first crisis is 0.5% (-5.1%). After the final crisis the corresponding mean (median) average value is 22.2% (18.9%).

To summarize, the behavior of real GDP growth, safe real rates of interest, and possibly inflation are much different after the last crisis in multiple crisis countries than they are after a crisis in single crisis countries. Arguably this could be because, in many of the multi-crisis countries, the period after the last crisis is not a genuine post-crisis episode, but instead is just a period between the last observed crisis and the next crisis yet to come. However, we have observed that in terms of their behavior before and during crises single crisis and multi-crisis countries also display substantial differences. This seems consistent with the possibility that the observed behavior of these economies after their final (observed) crisis does reflect genuine post-crisis differences between single and multi-crisis countries. In any event, it seems clear that there are dangers inherent in assuming that all crises have the same general flavor.

IX. Bailout Costs: a Multivariate Analysis

As the preceding sections demonstrate, the simple correlations between expenditures on bank bailouts and either real GDP growth, inflation, or real returns on various assets are generally small, in absolute value. Moreover, these correlations are only rarely significantly different from zero. Indeed, the one statistically significant correlation we found is that bank bailout costs are slightly positively correlated with *pre-crisis* rates of growth in single crisis countries.

In this section, we supplement the relatively informal analysis of the previous three sections with a more formal analysis of the partial correlations between resources expended in bailing out the banking system and general economic conditions. In doing so, obviously, we are able to control for other factors that almost certainly have their own macroeconomic impacts.

In addition, in this section we take on two questions that we have not previously addressed. The first is, how are bank bailout costs typically paid for? Are they often monetized, or are they generally financed by some other means? The second is, how are

bailout costs related to the amount of lending that banks are able to engage in during and after a crisis, and how are these costs related to the outstanding value of bank liabilities? As we have seen, bank credit extension typically does not fall in crises. But, does bank lending rise more or less in countries that inject more resources into their banking system during a crisis, other things equal? The answer to this question is of considerable importance, as we know from the work of Levine, Loyaza, and Beck (2000) that bank credit extension to the private sector is a strong predictor of future real growth. And, we will also examine how bailout expenditures are related to the volume of outstanding bank liabilities, which—as we will show—has its own consequences for real economic performance.

In this section we employ a regression methodology which pools all single crisis countries for all years into a single panel, and similarly for multiple-crisis countries. As we have argued, countries falling into these two groups should clearly be treated separately. In each regression the explanatory variables include a complete set of time and country dummy variables, and (initial) real per capita GDP in 1969, expressed in U.S. dollars (*I-Wealth*). These variables are standard controls in the kinds of cross-country regressions that we perform. To economize on space, we do not report the coefficient estimates on time dummies, country dummies, or *I-Wealth*.

Because it potentially matters how bank bailout costs are financed, as shown by Boyd, Chang, and Smith (2000), we begin by discussing the degree to which they appear to be monetized.

A. The Monetization of Bank Bailout Costs

Since a measure of the monetary base is not available for all countries in our sample, here we regress the rate of growth in bank reserves (GBR) on our usual control variables, including bank bailout costs. Bank reserves can be regarded as a proxy for the monetary base, and thus the regression performed allows us to form an estimate of the extent to which bank bailout costs are monetized. Moreover, the relation between bank bailout costs and bank reserves is of interest in and of itself, as it allows us to determine the extent to which bank bailouts are used to augment bank reserves. Equation (1) reports the results for single crisis countries. Here and throughout, we report the coefficients on the during and after crisis dummies (*DUM* takes on the value one during a crisis and zero otherwise; while *DUMA* takes on a value one after the end of a crisis and zero otherwise). We also report the estimated effects of expenditures on banking system bailouts during and after the crisis. These are represented by the coefficients on *MEAS*, which is the bailout cost multiplied by *DUM*, and on *MEASA*, which is the bailout cost multiplied by *DUMA*. The regression utilizes 521 observations. T-statistics are in parentheses, and the adjusted R^2 of the regression is 0.038.

$$(1)\quad \underset{}{GBR} = \underset{(0.666)}{(0.1584)DUM} + \underset{(1.520)}{(0.3886)DUMA} - \underset{(0.035)}{(0.0006)MEAS} - \underset{(1.700)}{(0.0244)MEASA}$$

$$+\ OTHER\ TERMS$$

Evidently, governments do not on average inject reserves into the banking system during a crisis—or, if they do, they inject only enough to offset any reserve losses due to the crisis itself. There is also some weak evidence of increases in bank reserves once a crisis terminates. Finally, it is clear that there is no relation between the growth in bank reserves and magnitude of bailout costs while a crisis is in progress. This suggests first that bank bailout costs are typically not monetized, and second that bank bailouts are not correlated with injections of reserves into the banking system, if any, while a crisis is in progress. Indeed, there is some evidence of a post-crisis decline in bank reserves in countries that have higher bailout costs, ceteris paribus.

Relative to the theoretical results of Boyd, Chang, and Smith (2000), these findings suggest that bank bailout costs almost certainly should be monetized to a greater extent than they typically are. Boyd, Chang and Smith show that some monetization of bank bailouts will generally reduce bank failure/distress rates. And, in addition, they show that the inflationary impact of monetizing bank bailout costs will be only slightly greater than the impact of these costs on inflation when they are not monetized.[47] Thus, assuming that these bailouts are going to occur in any event, in our view the argument for monetizing them to a greater extent is a strong one.

B. Bank Bailout Costs and Bank Activities

King and Levine (1993a,b), Demirguc-Kunt and Levine (1996), and Levine, Loyaza, and Beck (2000) find strong evidence that bank lending to the private sector, in particular, and the quantity of bank liabilities—to a lesser degree—are strongly associated with long-run real performance. Before we look at the impact of bank bailouts on macroeconomic conditions, therefore, it is useful to look at their impact on bank balance sheets.

Equation (2) reports the results of regressing the ratio of private credit extension to GDP (*P-Cred*), as reported by Levine, Loyaza, and Beck, on our usual control variables, for single crisis countries. There are 518 observations for this regression, its adjusted R^2 is 0.865, and t-statistics appear in parentheses.

$$(2)\quad \underset{}{P-Cred} = \underset{(3.15)}{(0.1284)}DUM + \underset{(1.65)}{(0.068)}DUMA + \underset{(1.09)}{(0.0032)}MEAS - \underset{(0.53)}{(0.0013)}MEASA + OTHER\ TERMS$$

As we know from the behavior of the sample means and medians, private credit extension by banks tends to *rise* during a crisis, and it remains above its pre-crisis level when a crisis ends. Bank bailout costs do not appear to affect credit extension by banks to the private sector: the coefficients on *MEAS* and *MEASA* are small in absolute value, and are not statistically significant. We conclude that, in single crisis countries, injecting more resources into the banking system during a crisis encourages no additional lending by banks, at least to the private sector.

[47] This result depends on deposit insurance premia being small, as they are in most countries.

Equation (3) reports analogous results for multiple-crisis countries. Here there are 241 observations, and the adjusted R^2 of the regression is 0.554. In addition, because these are multiple-crisis countries, there are two additional regressors. *DUMMI* is a dummy variable taking on the value 1 in a period between two crises, and zero otherwise. And, *MEASMI* is the bailout cost, multiplied by *DUMMI*.

(3)
$$P-Cred = \underset{}{(0.138)}DUM + \underset{(4.51)}{(0.304)}DUMMI + \underset{(0.23)}{(0.031)}DUMA + \underset{(1.85)}{(0.004)}MEAS - \underset{(2.53)}{(0.005)}MEASMI$$
$$+ \underset{(3.40)}{(0.0072)}MEASA + OTHERTERMS$$

Again, as with the sample means, we see a tendency for bank credit extension to rise during the initial crisis, and then to rise even further between the first and second crisis. In addition, for multiple-crisis countries, there is a significant positive association between bank bailout costs and bank credit extension to the private sector, both during crises, and after the final crisis. Injections of resources into bank bailouts appear to impede private credit extension between crises. However, the estimated effects are economically small: an increase in bank bailouts costs equal to 1% of GDP in magnitude raises the ratio of private credit to GDP by about 0.004 in a crisis—only $1/70^{th}$ of its pre-crisis sample mean (0.28). This value is also only about $1/40^{th}$ of the pre-crisis standard deviation of *P-Cred*. Thus, while bank bailouts seem to do more to stimulate private credit extension in multiple-crisis countries than they do in single crisis countries, they do not appear to do a great deal.

Equation (4) reports the results of regressing the growth rate of M2, *GM2* on our usual control variables for single crisis countries. There are 495 observations for this regression, and its adjusted R^2 is 0.225.

(4)
$$GM2 = \underset{(-2.31)}{-(0.280)}DUM + \underset{(1.41)}{(0.182)}DUMA + \underset{(6.09)}{(0.0532)}MEAS + \underset{(0.52)}{(0.004)}MEASA$$
$$+ OTHER\ TERMS$$

Evidently, the rate of growth of M2 falls with the onset of a crisis. There is some very weak evidence that this growth rate recovers to some extent after the crisis ends. In addition, the more resources that are injected into banking system bailouts, the higher the rate of M2 growth tends to be. Moreover, the coefficient estimates are not only statistically significant; they are quite large economically. An increase in bailout costs equal to 1% of GDP raises the rate of M2 growth by about 5 percentage points during a crisis. This is about 25% of the mean rate of M2 growth in the sample. And, the coefficient estimates suggest that, other things equal, bailout expenditures equal to about 5-6% of GDP are required to prevent the rate of money growth from declining during a banking crisis.

We now display the analogous regression for multiple crisis countries. Here there are 255 observations, and the adjusted R^2 of the regression is 0.27.

$$GM2 = -(1.398)DUM - (2.052)DUMMI - (0.767)DUMA$$
$$\qquad\qquad (3.00) \qquad\quad (3.92) \qquad\quad (0.87)$$

$$+ (0.012)MEAS + (0.565)MEASMI - (0.055)MEASA + OTHERTERMS$$
$$\qquad (0.93) \qquad\quad (3.67) \qquad\quad (2.25)$$

As is the case in single crisis countries, the growth rate of M2 falls—here very dramatically—when a crisis is underway, and it falls even further between crises. However, in contrast to what happens in single crisis countries, expenditures on bank bailouts do not appear to stimulate M2 growth while a crisis is underway. Such expenditures do appear to stimulate money growth between crises, and they appear to depress the rate of money growth in post-crisis episodes.

To summarize, private credit extension tends to rise rather than fall during a crisis. And, it does not return to its pre-crisis level when a crisis ends. Thus, there appears to be no general reason that any special government interventions are required during a banking crisis in order to prevent banks from contracting credit. It is the case that the growth rate of M2 tends to fall with the onset of a crisis, in the absence of some government action. And, bank bailout expenditures are strongly positively associated with the rate of M2 growth in single, but not in multiple crisis countries. We will now examine the relationship between the occurrence of crises, the magnitude of resource injections into the banking system, and macroeconomic conditions.

C. The Effects of Bank Bailouts on Macroeconomic Conditions.

1. The Growth Rate of Real GDP

We begin by investigating the direct and indirect consequences of crises, and of expenditures on banking system bailouts, on real rates of GDP growth (*R-GDP*). Equation (5) reports the result of regressing the rate of real GDP growth on *DUM*, *DUMA*, *MEAS*, *MEASA*, and *GM2* (the growth rate of M2) for single crisis countries. There are 456 observations for this regression, and its adjusted R^2 is 0.20.

(5)

$$R-GDP = -(0.105)DUM - (0.0011)DUMA - (0.001)MEAS + (0.002)MEASA + (0.0437)GM2$$
$$\qquad\qquad (0.867) \qquad\quad (0.075) \qquad\quad (0.791) \qquad\quad (1.01) \qquad\quad (2.50)$$
$$+ OTHER\ TERMS$$

Note that, with the exception of the coefficient on *GM2*, none of the estimated coefficients in this regression are significantly different from zero. Thus, equation (5) is consistent with the notion that, if the growth rate of M2 were held constant, the growth rate of real GDP would not change significantly either during or after a crisis. Moreover,

equation (5) indicates that expenditures on banking system bailouts have no direct effect on real output growth (that is, they have no effect on the growth rate of production if the growth rate of M2 is held constant).[48] However, the higher is the rate of M2 growth, the higher is the rate of real GDP growth, other things equal.

We know from the previous sections that the reduction in the mean rate of real GDP growth during crises—in single crisis countries—is about 2.7 percentage points. The coefficient on *DUM* in equation (4), and the coefficient on *GM2* in equation (5), taken together, suggest that roughly half of this reduction is attributable to the reduction in the growth rate of M2 associated with entering a crisis.

As we have already noted, equation (4) suggests that an increase in bank bailout expenditures equal to 1% of GDP increases the growth rate of M2 by about 5 percentage points. Combined with estimated coefficient on GM2 in equation (5), this indicates that an increase in bailout costs by an amount equal to 1% of GDP increases the rate of real GDP growth, *during a crisis*, by about 0.2 percentage points. Of course this entire effect derives from the fact that higher bailout expenditures reduce the decline in the rate of M2 growth. If reductions in M2 growth could be prevented by other means—as they almost certainly could in practice--equation (5) suggests that bank bailout expenditures would have no salutary growth consequences. Finally, note that equations (4) and (5) indicate that higher bailout expenditures have no significant effects—either directly or indirectly--on the post-crisis growth rate of real GDP.

In fact, of course, we know from section VII (see especially Figures 8 and 11) that there is no significant correlation between bailout costs and the rate of real GDP growth during banking crises (in single crisis countries).[49] This may be because there are other, to us unobserved factors that are correlated with bailout costs, and that tend to negate the relatively small effect of higher bailout expenditures on the growth rate of M2 and, hence, on the growth rate of real GDP. Or, it may be because the predicted change in the real rate of GDP growth associated with larger bank bailouts (an increase in the growth rate of 0.2 percentage points associated with additional bailout expenditures equal to 1% of GDP) are quite small relative to the sample standard deviation of real GDP growth (0.045). Nonetheless, our regression results suggest that we need to entertain the possibility that higher expenditures on bank bailouts do have some mild effects on real growth rates through their effects on the growth rate of M2. We pursue this point in greater detail below.

Equation (6) repeats the regression of equation (5) for multi-crisis countries. Here the sample size is 245, and the adjusted R^2 is 0.37.

[48] The coefficients on *DUM*, *DUMA*, *MEAS*, and *MEASA* remain insignificant if *GM2* is omitted from the right-hand-side of equation (5).

[49] It is also true that there is no correlation between bank bailout costs and the initial reduction in the level of real GDP with the onset of a crisis.

(6)

$$R-GDP = (0.0043)DUM + (0.0279)DUMMI + (0.0307)DUMA - (0.0007)MEAS$$
$$\qquad\qquad (0.38) \qquad\quad (2.15) \qquad\quad (1.30) \qquad\quad (2.03)$$

$$- (0.003)MEASMI + (0.0014)MEASA - (0.0025)GM2 + OTHERTERMS$$
$$\qquad (0.68) \qquad\quad (2.06) \qquad\quad (1.55)$$

According to the coefficient estimates in equation (6), real GDP growth does not drop with the onset of a crisis, other things equal. Nor is it high in post-crisis periods. However, the growth rate of real GDP does tend to be high between crises. Moreover, incremental expenditures on banking system bailouts tend to have a small but significant *adverse* affect on the growth rate of real GDP while crises are in progress. However, such expenditures also have a small positive effect on real GDP growth in post-crisis periods. Finally, note that higher rates of M2 growth do not have expansionary real effects in multiple crisis countries.

The sample mean of real GDP growth drops by nearly 3 percentage points during a crisis in multi-crisis countries. While this is a large reduction, it is only about 70% of the sample standard deviation of real GDP growth for these countries. Equation (6) suggests a lack of statistical significance to this observed mean reduction in real GDP growth during crises.

2. Inflation

Equation (7) reports the results of regressing the rate of inflation, in single crisis countries, on the same set of regressors as previously. There are 485 observations for this regression, and its adjusted R^2 is 0.54.

(7)

$$INF = -(0.008)DUM + (0.054)DUMA + (0.009)MEAS + (0.008)MEASA + (0.3)GM2$$
$$\qquad\quad (0.15) \qquad\quad (0.95) \qquad\quad (1.59) \qquad\quad (2.74) \qquad\quad (14.6)$$

$$+ OTHER\ TERMS$$

Evidently, neither the beginning nor the end of a crisis—in and of themselves—tend to affect the rate of inflation directly.[50] However, we know that the growth rate of M2 tends to fall with the onset of a crisis, and equation (7) indicates that this should have the effect of bringing down the rate of inflation. Indeed, the relevant coefficient estimates in equations (4) and (7) suggest that these effects should reduce the rate of inflation by about 8 percentage points when a crisis begins. This exceeds the median reduction in the rate of inflation between pre-crisis and during-crisis periods. Thus, as with real growth, it seems

[50]If the growth rate of M2 is omitted as a regressor, the coefficients on DUM and DUMA are estimated to be negative, and significantly different from zero. The coefficient on MEAS is estimated to be very similar to that reported in equation (7), and the coefficient on MEASA is estimated to be positive.

that the reduction in the rate of M2 growth has strong effects on the rate of inflation while a crisis is in progress.

Equation (7) also indicates that expenditures on bank bailouts have a very modest direct effect on the rate of inflation. There is mild evidence that an increase in bailout costs in the amount of 1% of GDP raises the rate of inflation, during a crisis, by about 0.9 percentage points. And, there is stronger evidence that a similar increase in bailout costs raises the rate of inflation by about 0.8 percentage points after the crisis ends, other things equal. Of course these "direct" effects of bank bailouts hold the growth rate of M2 constant.

However, bank bailout expenditures also raise the rate of M2 growth, which exerts a further positive effect on the rate of inflation. Equation (4) indicates that increasing bailout expenditures by 1% of GDP leads to an increase of 5 percentage points in the rate of M2 growth, and equation (7) suggests that this is associated with about a 1.5 percentage point increase in the rate of inflation. Thus, taken together, the direct and indirect effects of greater resource injections in a banking crisis—in the amount of 1% of GDP--lead to an increase in the rate of inflation, other things equal, of in excess of 2 percentage points. Or, in other words, larger bailouts of the banking system have decidedly non-negligible effects on the rate of inflation.

A somewhat different pattern emerges in equation (8), which considers multi-crisis countries. For this regression there are 235 observations, and the adjusted R^2 of the regression is 0.78.

$$
\begin{aligned}
(8)\quad INF = {} & \underset{(2.6)}{(0.785)}DUM + \underset{(1.44)}{(0.501)}DUMMI + \underset{(1.17)}{(0.739)}DUMA - \underset{(0.98)}{(0.009)}MEAS \\
& + \underset{(0.73)}{(0.007)}MEASMI - \underset{(0.51)}{(0.009)}MEASA + \underset{(20.74)}{(0.963)}GM2 + OTHERTERMS
\end{aligned}
$$

Here notice that inflation rises significantly with the onset of a crisis, a phenomenon that is also apparent in the behavior of the sample means and medians for multiple crisis countries (Table 1). Equation (8) provides some weak evidence that inflation is also higher between crises than it is prior to the first crisis experienced. Rates of inflation are not significantly different in post-crisis periods and in pre-crisis periods. As we have observed, this failure to bring down the rate of inflation is suggestive that not all of our "post-crisis" observations are genuinely the end of a sequence of crisis episodes. Some of them may simply be preludes to further crises.

Equation (8) also indicates that expenditures on bank bailouts have no direct effect on the rate of inflation, either during a crisis, between crises, or in post-crisis periods. Finally, changes in the growth rate of M2 exert almost a one-for-one effect on the rate of inflation in multiple crisis countries. By and large, these are also countries with high average rates of inflation.

3. Real Rates of Return

We conclude this section by investigating the effects of bank bailouts on real rates of return. Equation (9) reports the results of regressing the real rate of return on equity (*R-EQR*) on *DUM*, *DUMA*, *MEAS*, *MEASA*, and *INF* for single crisis countries. There are 476 observations for this regression, and its adjusted R^2 is 0.184.

(9)

$$R-EQR = -(0.19)DUM + (0.15)DUMA + (0.006)MEAS - (0.004)MEASA - (0.367)INF$$
$$\qquad\qquad (2.43) \qquad (0.18) \qquad (0.89) \qquad (0.89) \qquad (1.81)$$
$$+ OTHER\ TERMS$$

As indicated by equation (9), real equity returns decline—quite dramatically--when a banking crisis starts. And, increasing expenditures on banking system bailouts has no direct effect on the real rate of return on equity—that is, higher expenditures would have no effect if the rate of inflation were held constant. However, higher rates of inflation do have the effect of reducing real returns on equity.[51] Indeed, we have seen that the direct and indirect effects of increasing bailout expenditures by 1% of GDP are to increase the rate of inflation by more than 2 percentage points. According to the estimated coefficient on INF in equation (9), this should lead to roughly a 75 basis point reduction in real equity returns.

Equation (10) repeats this exercise for the real rate of return in the money market (*R-rate*). Here there are 293 observations, and the adjusted R^2 of the regression is 0.62.

(10)

$$R-RATE = -(0.014)DUM - (0.025)DUMA + (0.001)MEAS + (0.002)MEASA - (0.390)INF$$
$$\qquad\qquad (1.21) \qquad (1.91) \qquad (0.58) \qquad (1.43) \qquad (9.40)$$
$$+ OTHER\ TERMS$$

Clearly the qualitative patterns in equations (9) and (10) are very similar, although equation (10) indicates that—other things being equal—the real rate of return on money market funds tends to fall with the end of a banking crisis. This is not true for the real return on equity.

Equations (11) and (12) reproduce similar regressions for multi-crisis countries. Equation (11) is estimated with 107 observations, and has an adjusted R^2 of 0.09.

[51] This effect has been found by a number of authors. See Barnes, Boyd, and Smith (1999) and Boyd, Levine, Smith (1999), as well as the references they cite.

(11)

$$R-EQR = \underset{}{(0.10)}DUM - \underset{(0.25)}{(0.28)}DUMMI + \underset{(0.46)}{(2.476)}DUMA - \underset{(2.15)}{(0.018)}MEAS + \underset{(0.40)}{(0.091)}MEASMI - \underset{(0.66)}{(0.07)}MEASA - \underset{(1.22)}{(1.37)}INF + \underset{(1.82)}{OTHERTERMS}$$

Equation (11) suggests that real equity returns rise after the end of the observed crisis episodes. In addition, it indicates that higher bailout expenditures do not have a direct effect on real equity returns in multi-crisis countries. Finally, higher rates of inflation reduce the real return on equity. With the exception of the positive coefficient on *DUMA*, all of these results roughly parallel those for single crisis countries.

Equation (12) estimates the same regression with rates of return earned in money markets. It is based on 119 observations, and the adjusted R^2 is 0.73.

(12)

$$R-RATE = \underset{}{-(0.01)}DUM - \underset{(0.03)}{(0.05)}DUMMI - \underset{(1.08)}{(0.09)}DUMA + \underset{(1.10)}{(0.0013)}MEAS + \underset{(1.11)}{(0.0044)}MEASMI + \underset{(2.73)}{(na)}MEASA + \underset{(na)}{(0.09)}INF + \underset{(6.70)}{OTHERTERMS}$$

For money market rates, higher bailout costs appear to have a small positive effect in periods between crises. In addition, for multi-crisis countries higher rates of inflation appear to have a small positive effect on real rates of return. Otherwise, the pattern of estimated coefficients is very similar to that observed for the real rate of return on equity.

To summarize, for single crisis countries, real rates of growth would not be significantly affected, either by the beginning or the end of a crisis, if M2 growth were held constant. However, since the growth rate of M2 tends to decline when crises occur, so do real growth rates. In single crisis countries the rate of inflation would also not tend to change much with either the onset, or the termination of a crisis if M2 growth remained unchanged. However, since M2 growth tends to fall with the onset of a crisis, so does the rate of inflation. And, higher bailout expenditures have small positive (direct) effects on the rate of inflation, both during and after a crisis.

The occurrence of a crisis dramatically reduces the real rate of return on equity. If other factors remained constant, the end of a crisis would tend to restore equity returns to about their pre-crisis levels. However, inflation does not tend to remain constant: it falls during a crisis—which tends to partially offset the decline in equity returns. Inflation also falls further when crises end, which tends to raise the real return on equity above the return observed prior to the occurrence of a crisis. For money market rates, these would tend to remain roughly constant, ceteris paribus, with the onset of a crisis, and they would tend to fall slightly when a crisis is over—if the rate of inflation remained unchanged. But again, changes in inflation exert a strong effect on these returns, and the effects observed are very similar to those seen for equity returns.

X. The Social Costs of Banking Crises, and The Social "Benefits" of Banking System Bailouts

What is the social cost of a banking crisis? And, what is the social cost—or, possibly, the social benefit—associated with injecting a larger quantity of resources into a bailout of the banking system? While precise quantitative answers to these questions are too much to hope for, in this section we attempt to provide some upper and lower bounds delineating the possible magnitudes of these costs and benefits. Given that there is much more data available for single than for multiple crisis countries, and given that the conceptual issues involved for single crisis countries are much simpler than for multiple crisis countries, in this section we confine our attention to economies that have had only a single banking crisis.

There are several methods that could be used to provide bounds on the costs and benefits of banking crises and their associated bailouts. In this section we explore three of them. These are delineated in the next three sections.

A. A Crude "Calibration"

In this section we attempt a crude calibration exercise to ascertain the costs of a banking crisis, and the costs/benefits of banking system bailouts. In order to do so we proceed as follows. For each single crisis country, we compute the average rate of pre-crisis real GDP growth to extrapolate a "trend" level of output for each country. We then compute the amount by which output is below "trend" for each year from the onset of the crisis until either the first year in which real GDP re-attains its trend level (the effects of the crisis are over), or the end of the sample (we run out of data). In each year, this difference is expressed as a percentage of the trend level of output. Next, we divide by either the number of years between the onset of the crisis and the first year in which the trend level of real GDP is re-attained or (if this level is not re-attained in the sample) the number of years between the beginning of the banking crisis and the end of the sample. This gives us an average annual percentage deviation from the pre-crisis trend level of output for each country.

As we have noted, for several countries there is no reduction in real GDP associated with the occurrence of a crisis. For these countries we enter a zero for the average amount by which GDP is below trend. We then record the average amount by which real GDP is below its trend level for each country and plot this against the cost of bailing out the banking system. Figure 31 displays the results.

Proceeding in this way almost certainly overstates the true output losses associated with banking crises. Once the banking crisis is over, real GDP starts to move back towards its trend level. However, in many of the countries we examine the post-crisis sample is too short for the trend level of GDP to be re-attained. If we had longer samples for these countries, we would have more observations later in the post-crisis period—observations in which real GDP was closer to its trend level. Thus our "average" loss measures are too large.

To supplement Figure 31, we regress the average percentage deviation of output from trend on a constant, and on bailout expenditures. The results are as follows:

(13) *AVERAGE % DEVIATION FROM TREND* =

$$\underset{(1.03)}{0.3963} + \underset{(2.89)}{(0.0887)}\,BAILOUT$$

The adjusted R^2 of the regression is 0.45, and there are 10 observations.

Clearly equation (13) has a positive intercept, although the intercept is not significantly different from zero. The value of the intercept, however, does give us an estimate of the average percentage deviation of output from trend—following a crisis—in the absence of any expenditures on bailouts whatsoever. Obviously this deviation from trend is quite small.

As is clear from equation (13) and Figure 31, higher bailout costs are definitely associated with higher average output losses measured in this way. Roughly speaking, equation (13) suggests that an increase in the cost of bailing out the banking system by an amount equal to 1% of GDP is associated with an increase in the average deviation of output from trend equal to 0.089 percentage points. We now ask two questions: (1) how large is the implied discounted present value of lost output associated with a banking crisis, and (2) how large an additional output loss is incurred if an additional 1% of GDP is spent on bailing out the banking system?

To do these calculations, imagine a "representative" country having real per capita GDP growth equal to 2.8% (the pre-crisis sample mean real growth rate for single crisis countries) in its pre-crisis period. We also use a real rate of return on equity of 5.2% (the overall sample mean return for single crisis countries) to discount.[52] The last remaining question is the following: how long does it take for real GDP to re-attain its trend level following a crisis? As we have discussed, for several countries this takes no time, and for others the average pre-crisis level of real GDP is not re-attained within our sample. Therefore we proceed as follows. As we know from the discussion in section VIII, the stock market of a "typical" single crisis country recovers within 6 to 10 years following the onset of a banking crisis. Taking the view that stock market values are roughly proportional to the discounted present value of current and future production, these figures can be used as estimates of the general length of time it takes for real output to re-attain the (expected) discounted present value it would have had, based on pre-crisis trends, in the absence of a crisis. Thus we assume that it takes either 6 years, as a lower

[52] The evidence reported in sections VII, VIII, and IX indicates that this return is not strongly affected by the magnitude of the bailout cost incurred, at least directly. However, for the reasons discussed in section IX, larger bailout expenditures may have a non-negligible effect on the rate of inflation, which will lower real returns, ceteris paribus. In this section we do not do anything to allow for the latter effect, as it lasts only until the end of the crisis. The implied effect on discounted present values of output losses that might result from allowing bailout costs to affect the rate of return cannot be very large, so we do not think that this is a cause for too much concern.

bound, or 10 years, as an upper bound, for a "representative" economy to fully recover (in terms of real production) from a banking crisis.[53]

For the values just described, and assuming that it takes 6 (10) years for an economy to recover from a banking crisis, the estimated intercept of equation (13) suggests that a banking crisis—with no associated bailout expenditures—results in a loss of about 5% (7.3%)of the (expected) discounted present value of current and future real production.[54] Of course the estimated intercept in equation (13) is not significantly different from zero, so we may also seriously entertain the notion that there are no significant output losses, in a discounted present value sense, from banking crises that are not accompanied by some bailout expenditures. In addition, the estimated coefficient on BAILOUT in equation (13) suggests that, if it takes 6 (10) years to recover from a crisis, the (expected) discounted present value of lost real GDP increases by 1.1% (1.6%)for each additional expenditure of 1% of GDP on bank bailouts.[55] Given that the median level of bank bailout expenditures for single crisis countries is about 10% of GDP, these numbers imply that the median country experiences a loss in the discounted present value of current and future GDP roughly equal to 16% (23.3%)—based on the point estimate of the intercept in equation (13)—or 11% (16%), if we take the intercept of equation (13) to be zero. As before, all of these numbers are based on the assumption that it takes 6 (10) years to recover from a crisis.

Of course lost production does not equate with losses in welfare. Over and above changes in production these losses may come from several sources. The data suggest that increases in bailout costs are, on average, associated with higher rates of inflation, ceteris paribus, and possibly with some changes in real rates of return on savings. Of course changes in real interest rates affect different agents within the same economy differently, and hence have redistributive rather than obvious welfare consequences. Moreover, the data are consistent with the view that such changes are very small. So, we do not expect any particular adverse welfare consequences from this source. Higher rates of inflation should be associated with greater welfare losses, however, since inflation is a distorting "tax." And, for the reasons discussed in section IX, additional expenditures on bank bailouts equal to 1% of GDP may raise the rate of inflation by about two percentage

[53] Notice that we implicitly assume that the length of a crisis, or the length of time it takes to recover from a crisis, is unrelated either to the severity of the crisis, or to the magnitude of banking system bailouts. As we have seen, these assumptions are in accordance with observation.

[54] This value is obtained as follows. Let x be the gross rate of real GDP growth divided by the gross real return on equity. Then, if it takes 6 years to recover from a crisis, the output loss is the average percentage deviation of output from trend multiplied by the factor $x(1-x^6)/(1-x)$. Here x=1.028/1.052=0.9772. The figure obtained is then divided by the (expected) discounted present value of output that "would have obtained," in the absence of a crisis.

[55] Of course there is some uncertainty associated with our estimate of the slope of the relationship between the cost of bank bailouts and the average percentage deviation of output from trend. Suppose we replace our estimated slope coefficient of 0.0887 by its estimated value plus one standard error. Then the discounted present value of the output lost due to increasing bank bailout costs by 1% of GDP is equal to 1.5% (assuming that it takes 6 years to recover from the crisis). On the other hand, if we replace our estimated slope coefficient by its estimated value minus one standard error, then this value is replaced by 0.74%.

points per year, during the life of the crisis, and by nearly one percentage point per year after the crisis ends. Of course many estimates of the welfare losses from even a permanent increase in the rate of inflation are very small.[56] However, we have demonstrated that a failure to bring an economy's rate of inflation down during and after a banking crisis is an invitation to further crises. Given the costs of banking crises, this suggests that the welfare cost of inflation literature is likely to vastly understate the costs of a failure to reduce the rate of inflation while a banking crisis is either underway, or after it ends. Of course at this point we have no simple way of estimating the true costs of higher inflation in a crisis or post-crisis environment.

To conclude, this rough calibration exercise suggests that banking crises would results in losses of between 5% and 7.3% of the (expected) discounted present value of current and future output, in the absence of any bailout expenditures. And, for each additional 1% of GDP expended on bailing out the banking system, this loss may increase by between 1.1% and 1.6%--even if higher rates of inflation are not accounted for.

B. Estimates of Costs Using Stock Market Data

An alternative approach is to use stock market values as indicators of the decline in the expected, present discounted value of corporate returns associated with the onset of a crisis. Then, as we have noted, if corporate profits represent a relatively constant fraction of total output (as is true, for example, in post-war U.S. data), any decline in the real value of stock prices observed when a crisis occurs will—in percentage terms—be approximately equal to the decline in the present discounted value of total output.[57] This method also automatically takes account of any changes in expected future interest rates, and expected future growth rates that might occur as result of—or contemporaneously with—a crisis. Thus, if market participants believe that a banking crisis will result in a permanent change in the real growth rate of the economy, that effect will be reflected in real securities prices. Similarly, if government expenditures on banking system bailouts have an effect on the discounted present value of current and future production, this effect will also be reflected in equity values. Thus, in this section, we look at the effects of both crises, and of bailout expenditures, on the value of the stock market.

In addition, we use two approaches to computing these effects. One is to directly compute the change in securities prices associated with the onset of a crisis. We can then use this change as an estimate of the percentage reduction in the discounted present value of current and future production observed when a crisis occurs. We can also relate this change to the magnitude of bank bailout expenditures. The second approach uses the regression results of section IX to obtain analogous information. We begin with the first methodology.

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[56] See Fischer (1981), Lucas (1981), and Cooley and Hansen (1989).

[57] This, of course, abstracts from any changes in the risk premium attached to equity prices that might occur as a result of a banking crisis. However, at least in single crisis countries, the variance of equity returns is virtually identical before, during, and after a crisis. Hence this is unlikely to be an important consideration, especially for the kind of rough "ballpark" calculations done here.

1. Changes in Equity Values

We begin by looking at the change in real securities prices that occurs when a crisis begins. However, having said this, one question remains. For purposes of computing the decline in stock prices due to a banking crisis, what constitutes a reasonable last date "before the crisis," and what constitutes a reasonable "first date" at which information about the crisis is reflected in stock prices? This is an intrinsically difficult question. Therefore, we employ three different methods for assigning a date to when the onset of a crisis is reflected in equity values. Table 5 reports the results using these different dating conventions. In the first column, the "before-crisis" value of the stock market is the average of its value in the two years before a crisis begins [according to Caprio and Klingebiel (1997)]. The value of the stock market at "the beginning" of the crisis is defined as the average of stock price in the first two years after the onset of the crisis. In the second column, "before" and "during" are similarly defined, except that the data are averaged over three-year, rather than two-year periods. Finally, the third column attempts to account for the fact that the stock market may anticipate the crisis and decline in advance of it. Thus, in column 3, the "beginning of the crisis" period includes the last year before the crisis and the first crisis year. The "before" period includes the two years prior to that. As will be apparent, for most countries the dating convention doesn't seem to make an enormous difference. For each dating convention, what is presented is the percentage decline in the real value of the stock market index, between the "before" and the "beginning of" crisis period.

We wish to determine two things using the data reported in Table 5. The first is the social cost of a banking crisis, as measured by the (expected) discounted present value of lost production. The second is how this cost might be affected by the magnitude of the resources devoted to bailing out the banking system. There are 19 single crisis countries for which we have enough data to make the necessary computations. The vast majority of them are fully developed nations, including France, Germany, Japan, and the United States.

The first thing to notice about Table 5 is that, in a number of nations, banking crises were associated with real stock market *gains*. This is the case, for instance, in Canada, Israel, Norway and the United States. Obviously, we do not want to attribute increases in either profits or output to the occurrence of a banking crisis. Therefore, as in the previous section, we treat these countries as having zero stock market losses (for our purposes). Thus, for example, in column 1 of the Table we regard 6 out of the 17 countries for which the necessary data is available as having had no output reductions (in discounted present value terms) associated with their banking crises.

A second striking feature of Table 5 is that the single crisis countries fall into two groups that differ dramatically in terms of their stock market declines. For example, in column 1, 9 out of 17 countries have declines in real equity values of less than 7%, and 10 out of 17 have equity values that fall by less than 10%. Among the remaining countries, the average value of the real decline in share prices is 28.4%. In column 2, 7 out of 15 countries have declines in share values of less than about 8%; among the

remaining eight countries the average decline in real stock prices is 36.4%. In column 3, 10 out of 19 countries have declines in real equity values of less than 4%, and 12 of the 19 countries have declines of less than 10%. The remaining countries experience an average decline in real share values of 22.4%. We can therefore conclude that banking crisis fall into two general categories: one where output losses are mild to non-existent, and one where there are very severe consequences as a result of the crisis.

The median percentage decline in real equity values, and hence in the (expected) discounted present value of future output, is 7% in column 1, is 15% in column 2, and is less than 4% in column 3. And, the mean decline in real stock prices—conditional on having a decline of less than 10%--is 2.6% in column 1, 1.85% in column 2, and 2.42% in column 3. We regard these as quite small numbers. Or, in other words, for economies that have mild banking crises, these crises turn out not to be very costly. However, for economies that have severe crises, these turn out to be hugely costly. As we have already noted, in each column the mean decline in real share values—conditional on experiencing a decline in excess of 10%--is at least 22%. Thus, even among single-crisis countries, there appear to be potentially huge costs associated with a severe crisis. Finally, to get a sense of overall averages, the last row of Table 5 reports the "average" (across countries) value of the stock market decline, in percentage terms. This value is in the range of 11.3-20.3%. Note the striking similarity between this value and the calibration of section A. That section suggests that a country experiencing a crisis and spending 10% of GDP bailing out its banking system would lose about 16-23% of the (expected) discounted present value of current and future output.

We now turn to our second question: how are the production losses associated with the occurrence of a banking crisis affected by the magnitude of the resources injected into banking system bailouts? In order to answer this question, we proceed as follows. We regress the different measures of the decline in the stock market reported in Table 5 (always replacing any negative value with a zero) on a constant, and the cost of the bailout. Equation (14) reports the result, using the data in column 2 of Table 5:[58]

$$\%LOSS = \underset{(1.28)}{16.92} + \underset{(0.36)}{(0.364)}BAILOUT \qquad (14)$$

Where *%LOSS* is the percentage decline in real equity values, and where *BAILOUT* is the bailout expenditure expressed as a percentage of pre-crisis real GDP. Notice that the coefficient on *BAILOUT* is 0.364, suggesting that an increase in bailout costs equal to 1% of GDP results in an additional decline in securities prices of about 36 basis points. However, it is also evident that there is no statistically significant correlation between the magnitude of banking system bailouts and the value of stock market losses, in real terms.

[58] Results using data from the other columns are qualitatively very similar. We have also run the regression reported in equation (14) instrumenting bailout costs. This also fails to affect our findings. Parenthetically, reasonable instruments for bailout costs appear to include lagged values of bank assets, lagged values of the ratio of private credit to GDP, a dummy variable taking on a value of one if an explicit deposit insurance system is in place and zero otherwise, and a dummy variable taking on a value of one if deposit insurance premia are risk-based, and zero otherwise.

Or, in other words, equation (14) does not allow us to reject the hypothesis that expenditures on banking system bailouts have no impact on lost production, and that they therefore generate neither direct welfare benefits nor direct welfare costs, in this form. Of course since increasing resource injections into the banking system does increase the rate of inflation, it does generate some welfare costs. We have already discussed the issue of welfare losses attributable to the increases in the rate of inflation associated with higher expenditures on bank bailouts.

2. Cost Estimates Using Regression Coefficients

We now estimate the costs of banking crises, and the costs of banking system bailouts, using the regression coefficients estimated in section IX. This is straightforward to do, since the real return on equity used in that section (*R-EQR*) excludes dividend payments—that is, it is the pure rate of change in real equity values. Thus the parameters estimated in section IX tell us directly how these values change with the onset of a crisis, and with increments to bank bailout costs.

The estimated coefficient on *DUM* in equation (9), -0.19, suggests that the real value of equity prices declines by 19% during a crisis. This, of course, includes the onset of the crisis. Thus, our estimated cost of a crisis—in the absence of any bailout expenditures—is a decline of about 19% in the (expected) discounted present value of current and future production. Note that this is very similar to the averages computed in the previous section.

We are, of course, also interested in how securities prices are affected by bank bailout expenditures. The coefficients on *MEAS* and *MEASA* in equation (9) are very small in absolute value and, in addition, they are not significantly different from zero. Thus bank bailout expenditures have no direct effect on real equity values. However, according to the estimates of section IX, spending an additional 1% of GDP on bailing out the banking system can increase the rate of inflation—during the life of the banking crisis—by about two percentage points. This has the effect of reducing the real rate of return on equity by about 75 basis points, ceteris paribus, during each year of the crisis.[59] This includes the initial year of the crisis, and it suggests a decline of about 0.75% in the (expected) discounted present value of production associated with an additional expenditure of 1% of GDP on bank bailouts. Note that this value is not very different in magnitude from those obtained in the "calibration" of part A of this section. It is also the same order of magnitude as the estimated coefficient on *BAILOUT* in equation (14). Finally, it should also be noted that the number "75 basis points" is the product of three regression coefficients: the coefficient on MEAS in equation (4), the coefficient on GM2 in equation (7), and the coefficient on inflation in equation (9). Thus, whether this number is significantly different from zero is quite difficult to assess.

To summarize, the results of this and the previous section imply that an economy spending 10% of GDP on banking system bailouts (the median among those considered)

[59] See the discussion of equation (9) in section IX.

loses, on average, between 10% and 26% of the (expected) discounted present value of current and future production. And, additional bailout expenditures equal to 1% of GDP generate additional output losses of between zero and 1.6% of the (expected) discounted present value of current and future output. However, it should be noted that these numbers mask the fact that half or more of all single crisis countries have production losses—in discounted present value terms—of substantially less than 10% of current and future output.

C. The Positive Case for Expenditures on Banking System Bailouts

The calculations of sections A and B suggest that there is no positive rationale for the government to invest resources into bailing out the banking system in a crisis. At best, according to those calculations, such investments have no significant effect on production losses, in discounted present value terms. And, at worst, spending money on bank bailouts actually exacerbates the output losses deriving from a banking crisis. In addition, expenditures on bank bailouts are inflationary, and higher rates of inflation have their own adverse welfare effects.

Is it possible, then, to construct a positive case for the government to inject resources into bailing out the banking system when a crisis occurs? In our view, such a case would have to proceed as follows. We know that the rate of M2 growth tends to fall when a banking crisis occurs. We also know that this reduction in the growth rate of M2 tends to depress the rate of real growth while a crisis is underway. Finally the estimates of section IX suggest that an increase in expenditures on bailing out the banking system by an amount equal to 1% of GDP raises the rate of M2 growth by about 5 percentage points. Thus banking system bailouts might be defended because they act to offset the effects of a crisis on the growth rate of the money supply.[60] And, these effects are detrimental to real economic growth.

While this argument is valid, so far as it goes, in our view it constitutes a relatively weak rationale for the government to invest in bank bailouts. In particular, bailing out the banking system is clearly far from the only mechanism available for stimulating M2 growth. Thus, an argument that bank bailouts are desirable as a means of increasing the growth rate of the money supply really requires showing not only that bailouts do this, but that they are the most "cost-effective" way of increasing the growth rate of the money supply. We would be interested to see the basis for such a case.

Moreover, it is our opinion that the extent to which bank bailouts can be used to stimulate M2 growth in a crisis would be very limited, for the following reason. Recall that higher M2 growth also tends to promote inflation. In addition, expenditures on bank bailouts have some direct inflationary impacts of their own. This is true both during and after a crisis. Finally, recall that a failure to have the rate of inflation fall during and after a crisis is a formula for a repetition of a banking crisis. The costs of a second crisis

[60] Recall that it is not possible to argue that expenditures on bank bailouts can be used to increase the volume of bank credit extension during a crisis. Hence, this cannot be part of a positive argument for bailing out the banking system when a crisis occurs.

obviously can be high. Thus any bailout of the banking system should be conducted in such a way that the rate of inflation does not rise, either during or after a crisis.

This observation suggests that there is a strict upper bound on the maximum desirable size of a bailout of the banking system, even assuming that a strong case for the benefits of such a bailout can be made. In particular, an increase in bank bailout expenditures by an amount equal to 1% of pre-crisis GDP will—according to the estimates of equation (4)—raise the rate of M2 growth by about 5 percentage points. This effect alone—according to the estimates of equation (7)—will raise the rate of inflation by about 1.5 percentage points. Moreover, equation (7) indicates that bank bailout expenditures may have the direct effect of raising the rate of inflation by almost 1 percentage point. Hence, each expenditure of 1% of GDP on banking system bailouts tends to raise the rate of inflation by nearly 2.5 percentage points.

The median single crisis economy has a pre-crisis inflation rate of about 9 percent per year (Table 1), and a median during-crisis inflation rate of about 6 percent per year. The median single crisis country also has bank bailout expenditures equal to about 10% of GDP. The estimates of the previous paragraph therefore suggest that the maximum increase in bailout expenditures that is consistent with preserving the decline in inflation is a little over 11% of GDP. Or, in other words, nearly half of the single crisis countries for which data is available have excessive expenditures on bank bailouts, from the standpoint of risking a during-crisis increase in the rate of inflation. And, a similar calculation with respect to the post-crisis rate of inflation suggests that this will not fall, relative to its during crisis level, if bank bailout expenditures are raised much above 12% of GDP. Thus, no matter what kind of case is made for the beneficial effects of banking system bailouts, countries that inject more than 11-12% of GDP risk having their during-crisis or post-crisis inflation rates rise relative to their pre-crisis rate of inflation. To do so runs the serious risk of a repetition of the banking crisis.

XI. What Do We Learn From All This?

In sections II and III we reviewed an extensive literature concerning the consequences of the inflationary environment, and the design of the banking system "safety net," for the "health" of the financial system. We have also presented considerable information about what happens before, during, and after banking crises (and in between crises, when more than one is observed in the sample). In addition, we have provided evidence from several different perspectives—all of which are motivated by the considerations described in section II--about how the performance of the banking system before, during, and after crises is related to the magnitude of the resources devoted to bailing out the banking system, and to other aspects of the deposit insurance system. We now take up several issues: (a) what does the evidence tell us? (b) How does the evidence bear on the theory presented in section II? (c) What conclusions can be drawn from the evidence in combination with the theory?

A. All Crisis Are Not Alike

Caprio and Klingebiel (1997) discuss 86 separate episodes of economy-wide banking problems since 1974. We have focused on less than two-thirds of these episodes. Many of the crises described by Caprio and Klingebiel occurred in economies in transition, and many others occurred in economies that are clearly not modern market economies. We opted to restrict our attention to economies that had suffered crises and that had one other characteristic—a certain amount of data on stock prices was available. In our view, that availability suggested that the economy met at least at least a minimal criterion indicating the established presence of a modern capital market structure for some significant length of time.

Even within the set of economies that satisfies this criterion, we have seen that all crises are most definitely not alike. In the economies that have experienced repeated crises, the recessions generally associated with the crisis are—on average—more severe than in single crisis countries. And, real rates of return and inflation, on average, behave much differently during and after a crisis than they do in single crisis economies.

What accounts for the differences between single and multi-crisis economies? One factor, in our view, is the inflationary environment. We describe this difference in more detail below. Another is the degree of financial development. Commonly used measures of financial development, like the ratio of private credit to GDP,[61] suggest that multi-crisis countries typically have much shallower financial systems than their single crisis counterparts. Given the list of multi-crisis countries, it is tempting to conjecture that this is due to several factors. One again is the inflationary environment. The mean (median) rate of inflation over our entire sample is 32.5% (8.2%) in single crisis countries. The analogous figures in multi-crisis countries are 79.2% (11.6%). Boyd, Levine, and Smith (1999) show that even moderate rates of inflation are highly detrimental to the depth of the financial system. A second factor is likely to be the presence of financial repression by the government, as described originally by McKinnon (1973) and Shaw (1973). And, a third factor is likely to be that—again on average—countries that have experienced recurring crises do not have supervisory and regulatory structures for banks whose quality is as good as those prevailing (on average) in single crisis countries. All of these conjectures would be interesting topics for further investigation.

B. The Role of Inflation

Recent theoretical developments suggest that inflation—even sustained and/or predictable inflation--is highly detrimental to the financial system. This is true both for the banking system, and for equity markets.[62] And, existing empirical evidence[63] also

[61] This variable has been shown to be strongly correlated with long-run real performance. See Levine, Loyaza and Beck (2000).

[62] Alan Greenspan has suggested that the existence of well-developed equity markets has often been a mitigating factor in the presence of shocks that adversely affect the banking system. See Greenspan's "Remarks Before the World Bank Group and the IMF," Washington D.C., September 27, 1999.

[63] Boyd, Levine, and Smith (1999).

suggests that sustained inflation affects long-run financial development in an adverse way.

The evidence we have reviewed here indicates that the inflationary environment may also be an important factor affecting banking crises. First, economies that have experienced repeated crises have had, on average, much higher pre-crisis rates of inflation than single crisis countries.[64] It therefore does not seem accidental that these economies also typically have a noticeably lower level of financial development than single crisis countries both upon entering a crisis, and upon coming out of one.

Moreover, in countries that have experienced only a single crisis two things typically happen. First, inflation falls during the crisis. And, second, the average post-crisis rate of inflation is substantially below the average pre-crisis rate of inflation. Indeed, the average post-crisis rate of inflation has been well-below the average during-crisis rate of inflation for single crisis countries. This is also true for inflation variability. In multi-crisis countries the inflation rate has typically *risen* during crises, and the average rate of inflation between crises has not come down relative to the average pre-crisis rate of inflation. Interestingly, following the final (observed) crisis in multi-crisis countries, there is some reduction in the average rate of inflation, and also in its variability.

These observations—along with the theory—suggest one obvious conclusion about how macroeconomic policy can be used to reduce the potential for banking crises to occur or to recur. Lowering the rate of inflation seems to be strongly associated with the avoidance of new crisis episodes.

Interestingly, some policymakers and economists have recently proposed that Japan should engineer an increase in its rate of inflation as a means of stimulating its economy. To the extent that Japan's recent weak real performance is associated with its banking problems, this may be poor advice.

C. The Costs of Banking Crises, and the Costs of Bank Bailouts

In section X we used three different methods to estimate the social cost of a banking crisis. In each case, we expressed the estimated social cost of a banking crisis in terms of the percentage reduction in the (expected) discounted present value of current and future production. The rough calibration exercise in section X.A suggested that, in a single crisis country that spends nothing on bank bailouts, the cost of a crisis is between 5%, and 7.3%, in discounted present value terms. In section X.B we used stock market data to estimate the cost of a banking crisis. Using raw changes in real share prices, we found that, on average, the cost of a crisis is about an 11-20% reduction in the (expected) discounted present value of current and future output. Using estimated regression coefficients, we computed this cost to be about a 19% reduction in the (expected) discounted present value of production, in a country that spends nothing on banking

[64] It should be noted that this fact is in no way inconsistent with our finding that it is rare to see large increases in the rate of inflation within the last few years preceding a crisis.

system bailouts. We also saw that, even among single crisis countries, economies fall into two very different groups with respect to the costs of a crisis. A majority of single crisis economies experiences losses of less than 10% of the (expected) present discounted value of production when a crisis occurs. At the same time, a non-negligible minority of single crisis countries experiences losses in excess of 20%, in the same terms. Few countries have costs of banking crises lying between these values.

We also saw that when governments inject resources into banking system bailouts, this does not reduce—and may well increase—the social losses associated with a banking crisis. Our calibration exercise indicated that, for each additional 1% of GDP expended on bailing out the banking system, the (expected) discounted present value of current and future production falls by an additional 1.1-1.6%. When we regressed raw changes in real share values on bailout costs, we obtained a point estimate suggesting that an increase in bailout expenditures by an amount equal to 1% of GDP reduces the (expected) discounted present value of current and future production by about 0.36%. However, this estimated coefficient was not significantly different from zero. Alternatively, using estimated regression coefficients from section IX, we found that increasing bank bailout expenditures by 1% of GDP increases the (expected) discounted present value of losses associated with a crisis by about 0.75%.

Finally, we saw that it is possible to argue that an increase in resource injections by the government in a crisis has some positive effect on the growth rate of real GDP. However, all such effects derived from a positive relationship between bank bailout expenditures and the growth rate of M2. Since there are obviously ways of stimulating M2 growth without bailing out the banking system, we do not regard this as a strong rationale for spending money on bank bailouts. Moreover, when expenditures on banking system bailouts are used as a method of stimulating M2 growth, this also tends to raise the rate of inflation. Thus a heavy reliance on this mechanism risks the repetition of a banking crisis. We have argued that a substantial fraction of single crisis countries have injected more resources into bank bailouts than is probably prudent, from this perspective.

To the extent that the government does make choices about the costs it will incur in bailing out the banking system, our results have strong implications for these choices. Increases in the resources devoted to bailing out the banking system will, on average, not imply any gains in the discounted present value of current and future production, and indeed they may imply production losses (in a discounted present value sense). Even if one regards these losses as small, why incur them? We find no evidence of any obvious offsetting benefits associated with larger bank bailouts.

In fact, even in the context of the most basic BCS model, while there may be no social costs associated with bank bailouts, there are also no social benefits. Even in this framework, then, it is difficult to give a positive justification for large government expenditures on bank bailouts. Thus neither the theory nor the data suggest any good reasons for large expenditures on bailing out the banking system.

D. The Theory and the Evidence

The basic BCS model predicts the absence of any relationship between the magnitude of the costs of bailing out the banking system and any endogenous variables that matter from the perspective of agents' economic well-being. When the basic BCS structure is embedded in a monetary economy in which banks hold base money as reserves, this conclusion must be modified [Boyd, Chang, and Smith (2000)]. In particular, here the costs associated with putting a safety net under the banking system can affect the rate of inflation, real rates of return on savings, and—presumably—output levels in a production economy.[65] However, an appeal to continuity suggests that if bank reserve holdings are small, the relationship between bank bailout costs and the kinds of variables we have examined should be similarly "small." Since for most of the countries that constitute single crisis economies bank holdings of base money reserves are probably not large, one can reasonably ask the question: is the effect of increasing bank bailout costs on endogenous variables "small"?

Our analysis of the raw data in sections VI, VII, and VIII indicated that government expenditures on bank bailouts display no statistically significant correlations with rates of inflation, or with real rates of return on various assets, either before, during, or after banking crises (in single crisis countries). Similarly, there was no evidence of a statistically significant relationship between costs of bank bailouts and rates of real GDP growth either while a crisis is in progress, or after a crisis has ended. We did find some evidence that pre-crisis rates of real GDP growth are positively correlated with bank bailout expenditures. However, when Israel is excluded from the sample, an increase in bailout costs by an amount equal to 1% of GDP is associated with an increase in the average pre-crisis growth rate of only 0.02 percentage points. This seems like a small effect.

In section IX we examined partial correlations. Here we found that expenditures on banking system bailouts have no direct effect on rates of real GDP growth in single crisis countries, and that they have only very small direct effects in multi-crisis countries. We also saw that these expenditures have relatively small effects on the rate of inflation. In particular, in single crisis economies, an increase in bailout expenditures by an amount equal to 1% of GDP has the direct effect of raising the rate of inflation by less than one percentage point. Moreover, increasing the quantity of resources devoted to banking system bailouts has no significant direct effects on real rates of return in single crisis countries, and has only very small effects in multiple crisis countries. Finally, in situations where we can assess the statistical significance of the relationship, we found no significant correlation between bank bailout expenditures and the (expected) discounted present value of current and future output losses associated with a banking crisis. All of this seems consistent with the predictions of the BCS model and its monetary extension.

We did find evidence that higher expenditures on bank bailouts do tend to increase the rate of M2 growth while a crisis is underway, although they do not appear to affect

[65] Boyd, Chang, and Smith (2000) consider only a pure exchange economy.

bank credit extension to the private sector. Moreover, higher rates of M2 growth are associated with higher rates of real growth. Thus a case can be made that injecting resources into banking system bailouts does tend to stimulate production during a banking crisis. However, this effect is probably not large: an increase in bailout expenditures equal to 1% of GDP increases the real growth rate—during the life of a crisis—by about 0.2 percentage points. Similarly, higher rates of M2 growth are associated with higher rates of inflation. An increase in bailout expenditures by 1% of GDP appears to increase the rate of M2 growth—during a crisis—by about 5 percentage points, and this effect, in turn, appears to result in an increase in the rate of inflation by about 2 percentage points, during the life of a crisis. Obviously this effect seems substantially larger, in economic terms. Finally, the implied increase in the rate of inflation does result in lower real returns on all assets, while a crisis is in progress.

Of course these calculations rely on multiplying several regression coefficients together. It is therefore difficult to assess the statistical significance of the figures in the last paragraph. If they are significantly different from zero, it is unclear why we observe no statistically significant simple correlations between bank bailout expenditures, output growth during a crisis, rates of inflation during a crisis, or real rates of return during a crisis.

Whether or not these estimated effects of bank bailout expenditures on M2 growth—and their implied consequences for the growth rate of production, inflation, and real returns—are consistent with a monetary version of the BCS model [Boyd, Chang, and Smith (2000)] requires an extension of that model in which output and M2 are endogenous variables. It is an interesting topic for future investigation as to whether the estimated effects of bailout expenditures on M2 growth would be consistent with such a model when banks hold cash reserves against deposits in a quantity similar to what we observe in the data.

Naturally, our interest in the consistency of the BCS model and its variants with the data derives from the fact that this model suggests the lack of any obvious benefits to be derived from changing the way in which deposit insurance is priced. Our rough reading of the evidence presented here is that the data do not appear to clearly refute this implication of the BCS analysis.

E. What Causes a Banking Crisis?

What factors appear to be conducive to the occurrence of banking crises? One, clearly, is relatively high rates of inflation. As we have seen, banking crises occur more frequently in relatively high inflation environments than in relatively low inflation ones. And, crises that occur in high inflation environments tend to be more severe than crises that occur in low inflation environments.

What other factors might contribute to banking crises? As we have seen, unusually large movements in output, inflation, real equity values, and real credit extension are relatively rare in the three years preceding a crisis. Within single crisis countries no more

than about a third of the sample displays an unusually large change in any of these variables in the three years prior to a crisis. Combining this observation with the findings of Demirguc-Kunt and Detragiache (see section IV), it seems that a case can be made that banking crises are often, although not necessarily always, driven by "sunspots." The fact that a relatively high rate of inflation is conducive to the occurrence of panics is consistent with this view. The theoretical literature reviewed in section II often has the feature that the indeterminacies necessary for the existence of sunspot equilibria are more likely to be observed in high than in low inflation environments.[66]

If banking crises are sunspot driven, can anything be done to predict or prevent them? The answer is yes. The possibility that banking crises occur in response to non-fundamental factors does not mean that they are impossible to predict or prevent. Prediction (in a probabilistic sense) is not impossible because the sunspot variable that drives panics can easily be correlated with exogenous or endogenous variables that are commonly followed by analysts. Prevention of crises (or a reduction in their frequency) may also be possible. As we have noted, an environment of low inflation is likely to be conducive to the relatively infrequent occurrence of systemic banking problems. And, even within the basic BCS model, certain methods of funding bank bailouts have the property that sunspot equilibria are more likely to be observed when large amounts of resources are devoted to bailing out the banking system in crises. This constitutes yet another argument as to why governments should be frugal with respect to such bailouts.

F. Monetizing Bank Bailouts

Interestingly, we find that—on average—single crisis countries do not appear to monetize the cost of bank bailouts. It is unclear to us why it is so rare to resort to the use of seigniorage revenue to pay for the costs of bailing out the banking system in a crisis. And, the results of Boyd, Chang, and Smith (2000) suggest that—if such bailouts are going to occur—there is a case for paying for them, at least in part, via money creation. It would be interesting to know more about why governments resist this method for financing bank bailouts.

XII. A Summary

What should we say by way of summary? First, it seems quite possible that banking crises are driven by sunspots. Even so (and second), a commitment to low rates of inflation is conducive to avoiding banking crises, and to reducing the severity of the recessions that accompany them. Third, expenditures on bank bailouts generate no obvious social benefits that cannot be obtained by other means, and they may well have non-trivial real costs. Thus, to the extent that the government makes choices about the magnitude of bank bailout costs, there is a case for minimizing them subject to whatever constraints a government might face. Fourth, if banking crises are sunspot driven, a commitment to small infusions of resources by the government in a crisis may (under

[66] The view that banking crises are sunspot driven is also not inconsistent with the notion that a weak supervisory or regulatory structure for banks is both conducive to crises occurring, and to crises being more severe when they do occur.

certain schemes for funding these infusions) make banking crises less likely. Both points three and four argue for keeping bank bailout costs as small as possible.

What about revisions to features of the banking system safety net? Are there gains to be had from introducing risk-based deposit insurance premia, for example?

The data seem to suggest that, if there are any such gains, they are probably small. And, for the reasons described in section XI.D, we think that---at a minimum--the BCS model, and its modifications [Boyd, Chang and Smith (2000)], are generally consistent with the data. And, those frameworks have the property that the introduction of risk-based deposit insurance premia, or small changes in the structure of such premia, can have at most relatively small effects when bank reserve holdings are not too large (as is the case in many developed economies). Now at most this constitutes an empirically plausible counterexample to the claim that there are large benefits to be derived from introducing or revising risk-based deposit insurance premia. But in our mind the advocates of such an approach should articulate their case, theoretically and empirically, in a way similar to what has been done here.

Of course there is considerable scope for more detailed research on the causes and consequences of banking crises and the way in which they are handled. Clearly it is not hard to envision a more sophisticated empirical approach to these issues than the first passes made here. It is also possible to explicitly examine the connection between the structure of deposit insurance premia and things like real rates of return in considerable detail. This would bear very directly on some of the predictions of the BCS model. And, as we have argued, crises in, say, transitional economies are likely to be quite different in nature from the crises studied here. As more data become available, a study of those crises, and one which does not lump them together with other crises, should be very informative.

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Table 1.
Sample Statistics

variable	group (# of countries)	type of years	# of observations	mean	median	standard deviation
R-GDP	all crisis countries(36)	all years	998	1.024221	1.0255	0.04482
		before years	549	1.029423	1.0291	0.045616
		during years	197	1.004409	1.0098	0.048475
		after years	151	1.025175	1.0255	0.029844
		middle years	101	1.033163	1.0386	0.040982
	multi-crisis	all years	361	1.025876	1.0309	0.043649
	countries(13)	before years	153	1.033405	1.0352	0.0395
		during years	86	0.99816	0.9999	0.04521
		after years	21	1.049476	1.0529	0.027621
		middle years	101	1.033163	1.0386	0.040982
	single-crisis	all years	637	1.023283	1.0242	0.045477
	countries(23)	before years	396	1.027884	1.02695	0.047727
		during years	111	1.00925	1.0113	0.050531
		after years	130	1.02125	1.0235	0.028385
Infl	crisis countries(36)	all years	975	1.494347	1.0908	3.265769
		before years	531	1.225092	1.0957	0.797128
		during years	192	2.371031	1.0966	6.960967
		after years	150	1.179895	1.0474	0.525591
		middle years	102	1.708258	1.09615	2.332594
	multi-crisis	all years	354	1.791777	1.1164	3.166911
	countries(13)	before years	144	1.512636	1.1051	1.487543
		during years	87	2.469223	1.1392	5.514935
		after years	21	1.304981	1.1948	0.308157
		middle years	102	1.708258	1.09615	2.332594
	single-crisis	all years	621	1.324798	1.0815	3.311376
	countries(23)	before years	387	1.118099	1.0938	0.101856
		during years	105	2.289671	1.065	7.989017
		after years	129	1.159533	1.0402	0.551131
R-rate	crisis countries(36)	all years	555	47.79186	2.83	599.6509
		before years	286	21.50416	1.335	296.112
		during years	116	137.8446	4.225	1215.771
		after years	84	3.006667	3.415	4.47072
		middle years	69	59.88058	3.36	207.1726
	multi-crisis	all years	188	136.7574	2.925	1026.26
	countries(13)	before years	60	97.48533	0.255	645.0029
		during years	54	291.8143	4.52	1778.198
		after years	5	-5.692	-4.11	9.564524
		middle years	69	59.88058	3.36	207.1726
	single-crisis	all years	367	2.218229	2.82	4.551021
	countries(23)	before years	226	1.332168	1.725	4.905799
		during years	62	3.741935	4.185	3.64783

variable	group (# of countries)	type of years	# of observations	mean	median	standard deviation
		after years	79	3.557215	3.48	3.379328
R-eqr	crisis countries(36)	all years	797	0.063986	0.018245	0.35615
		before years	405	0.036609	-0.01612	0.310795
		during years	166	0.034177	-0.02043	0.466781
		after years	140	0.142063	0.108732	0.279732
		middle years	86	0.123346	0.104288.	0.398645
	multi-crisis	all years	227	0.094118	0.048985	0.490278
	countries(13)	before years	52	0.00504	-0.05153	0.416733
		during years	71	0.091568	-0.01422	0.655473
		after years	18	0.221866	0.189357	0.254796
		middle years	86	0.123346	0.104288.	0.398645
	single-crisis	all years	570	0.051986	0.010144	0.285424
	countries(23)	before years	353	0.04126	-0.01605	0.292459
		during years	95	-0.00871	-0.02315	0.241168
		after years	122	0.130289	0.101323	0.28228
P-cred	crisis countries(36)	all years	964	0.560484	0.47753	0.3773
		before years	532	0.494284	0.402437	0.321049
		during years	185	0.63201	0.50928	0.474048
		after years	146	0.721332	0.716349	0.364661
		middle years	101	0.545656	0.474315	0.382734
	multi-crisis	all years	348	0.425512	0.316696	0.326796
	countries(13)	before years	143	0.286085	0.261736	0.158247
		during years	83	0.500387	0.421002	0.386849
		after years	21	0.501178	0.476538	0.296542
		middle years	101	0.545656	0.474315	0.382734
	single-crisis	all years	616	0.636734	0.608389	0.382777
	countries(23)	before years	389	0.57082	0.481234	0.331734
		during years	102	0.739114	0.691193	0.511929
		after years	125	0.758318	0.755896	0.362943
GBR	all crisis countries(36)	all years	977	1.657171	1.155251	3.859725
		before years	522	1.432291	1.180523	1.2812
		during years	198	2.490075	1.134952	7.946869
		after years	166	1.210983	1.058363	0.625349
		middle years	91	1.948813	1.228295	3.290687
	multi-crisis	all years	345	2.084691	1.239251	4.793118
	countries(13)	before years	141	1.807373	1.282599	1.988337
		during years	88	2.869592	1.160941	8.503746
		after years	25	1.380504	1.236467	0.435773
		middle years	91	1.948813	1.228295	3.290687
	single-crisis	all years	632	1.423793	1.114385	3.21925
	countries(23)	before years	381	1.293481	1.147063	0.849987
		during years	110	2.186462	1.112442	7.497389
		after years	141	1.180926	1.0379	0.649845

variable	group (# of countries)	type of years	# of observations	mean	median	standard deviation
GM2	all crisis countries(36)	all years	949	1.531699	1.168628	2.747422
		before years	506	1.327378	1.175675	1.006603
		during years	189	2.094731	1.136549	5.316439
		after years	163	1.20336	1.086835	0.476129
		middle years	91	2.086564	1.23233	3.600992
	multi-crisis	all years	345	1.86138	1.236424	2.719463
	countries(13)	before years	141	1.721579	1.259256	1.844463
		during years	88	2.000133	1.188511	3.184986
		after years	25	1.341777	1.235323	0.313702
		middle years	91	2.086564	1.23233	3.600992
	single-crisis	all years	604	1.343388	1.132541	2.747789
	countries(23)	before years	365	1.175097	1.155055	0.117559
		during years	101	2.177153	1.091464	6.655612
		after years	138	1.178285	1.078189	0.496688

Table 2
List of Crisis Countries and their crises dates[62]

Countries	**Crisis dates**			
A. Single-crisis Countries				
Australia		89-92		
Canada		83-85		
Columbia		82-87		
Denmark		87-92		
Finland		91-94		
France		94-95		
Germany		76-79		
Greece		91-95		
Hong Kong		82-86		
India		93-98		
Israel		77-83		
Italy		90-95		
Jamaica		94-98		
Japan		90-98		
Jordan		89-90		
Korea		97-98		
New Zealand		87-90		
Norway		87-93		
Peru		83-90		
Spain		77-85		
Sweden		91		
USA		84-91		
Zimbabwe		95-98		
B. Multiple-crisis Countries				
Argentina	80-82	89-90	95-97	
Brazil	90	94-98		
Chile	76	81-83		
England	74-76	84	91	95
Indonesia	94	97-98		
Malaysia	85-88	97-98		
Mexico	81-91	95-98		
Philliphines	81-87	98		
South Africa	77	89-98		
Taiwan	83-84	95	97-98	
Thailand	83-87	97-98		
Turkey	82-85	94		
Venezuela	78-86	94-95		
C. Summary Statistics				
	# of crises		**average # of years in crises**	
all countries	53		4	
single-crisis countries	23		5.09	
multiple-crises countries	30		3.17	

[62] Source, Caprio and Klingenheil (1997)

Table 3
Measures of Crisis Size

Crisis*	Systemic **	**bail-out cost*****	**non-performing loans********
Argentina1	1	55.3	.
Argentina2	1	.	27
Argentina3	1	0.3	.
Australia	0	1.9	6
Brazil1	1	.	.
Brazil2	1	2.4	15
Canada	0	.	.
Chile1	1	.	.
Chile2	1	41.2	19
Columbia	1	5	.
Denmark	0	.	.
Finland	1	11	.
France	0	.	.
Germany	0	.	.
Greece	0	.	.
Hong Kong	0	.	.
India	0	.	16
Indonesia1	0	1.8	14
Indonesia2	1	52.5	70
Israel	1	30	.
Italy	0	.	.
Jamaica	1	.	.
Japan	1	12.3	17.9
Jordan	0	10	.
Korea	1	20.3	35
Malaysia1	0	4.7	.
Malaysia2	1	20.5	30
Mexico1	1	.	.
Mexico2	1	15	.
New Zealand	0	3.2	.
Norway	1	8	.
Peru	1	.	.
Phillipines1	1	3	.
Phillipines2	1	6.7	12.4
South Africa1	0	.	.
South Africa2	0	.	.
Spain	1	16.8	.
Sweden	1	4	.
Taiwan1	0	.	.
Taiwan2	0	.	.
Taiwan3	1	11.5	15
Thailand1	1	1.5	14.1

Crisis*	Systemic **	**bail-out cost*** **	**non-performing loans**** **
Thailand2	1	42.3	46
Turkey1	1	2.5	.
Turkey2	0	1.1	.
UK1	0	.	.
UK2	0	.	.
UK3	0	.	.
UK4	0	.	.
USA	0	3.2	.
Venezuela1	0	.	.
Venezuela2	1	18	.
Zimbabwe	1	.	.

Notes

* If a country had more than one crisis, they are listed separately, in chronological order

** Value of 1 if the crisis is systemic, 0 if it is non-systemic.

*** Fiscal bail-out cost divided by GDP.

**** Non-performing loans divided by total loans.

Table 4.

Stock Market Peformance of Single Crisis Countries.

Stock Market Gains, relative to Pre-crisis Trend *

	Exceeded Trend During Crisis? (Years)	Exceeded Trend After Crisis? (Years After)	Years of Post Crisis data
Australia	Yes (1)	No	5
Canada	No	No	12
Columbia	No	Yes (7)	10
Germany	No	No	18
Denmark	Yes (3 through 5)	Yes (4 through 5)	5
Spain	No	No	12
Finland	Yes (4)	Yes (1 through 3)	3
France	No	Yes (2)	2
Greece	No	Na	0
Israel	Yes (6)	Yes (10)	14
Italy	No	No	2
Jamaica	Yes (1 through 2)	Na	0
Jordan	No	No	4
Japan	Yes (1)	Na	0
Norway	Yes (1 through 7)	Yes (1 through 4)	4
New Zealand	Yes (1)	Yes (6 through 7)	7
Sweden	No	Yes (4 and 6)	6
USA	Yes (2 through 8)	Yes (1 through 6)	6

* The pre-crisis average real rate of return on equity for the single crisis countries was 4.13 percent. This table indicates whether or not a country's stock market reached or exceeded that projected trend rate of appreciation during the crisis, after or never.
The number of years from the beginning of the crisis until the first year in which the trend is exceeded is as follows: Australia, 1, Canada , never, Columbia, 13, Germany, never, Denmark, 3, Spain, never, Finland, 4, France, 4, Greece, never, Israel, 6, Italy, never, Jamaica, 1, Jordan, never, Japan, 1, Norway, 1, New Zealand, 1, Sweden, 5, USA, 2.

Table 5
Welfare Loss Estimates Using Stock Market Data

Country	**Loss 1***	**Loss 2****	**Loss 3*****
Australia	16.9765	14.8572	9.7231
Canada	-8.0592	-0.5933	23.0834
Columbia	6.9999	33.0484	17.8470
Germany	-5.1159	0.0798	0.4506
Denmark	17.7936	8.0609	12.7362
Spain	60.9267	71.6297	51.9313
Finland	44.0029	36.6423	39.4214
France	3.3906	.	-8.6112
Greece	41.0630	48.1304	3.9619
Israel	-21.472	-4.7205	3.8909
Italy	8.6263	22.9638	1.7182
Jamaica	39.8310	39.2395	-25.9510
Jordan	-1.9681	.	9.3068
Japan	18.9953	24.5072	-11.6389
Korea	.	.	28.1508
Norway	-1.6776	-22.443	-16.1555
New Zealand	4.2405	4.8398	-52.4451
Sweden	.	.	12.0910
USA	-14.997	-26.856	-19.7189
Average*****	15.4616	20.2666	11.2796

* % decline in the average real stock index from the 2 year period right before crisis to the first 2 years of crisis. Formally, if R is the real stock index and time 0 is the first year of crisis, Loss 1 = (R-2 + R-1 - R0 - R1)*100/(R-2 + R-1)

** Loss 2 is the same as Loss1 except that it employs a 3 year window, i.e. Loss 2 = (R-3 + R-2 + R-1 - R0 + R1 + R2)*100/(R-3 + R-2 + R-1)

*** Loss1 shifted one year back, i.e. Loss 3 = (R-3 + R-2 - R-1 + R0)*100/(R-3 + R-2)

***** In computing these averages, we replaced any negative numbers with 0.

Table 6

Figure1	y= a+ b x	a=1.004	t=162.247	Figure 9	y= a+ b x	a=0.932	t=10.001
y= Avg.GDP growth rate pre crisis		b=0.003	t=6.871	y= Avg. inflation rate during crisis		b=0.022	t=3.101
x= Bail out cost (%)	x=c+d y	c=-255.492	t=-66054	x= Bail out cost (%)	x=c+d y	c=-15.55	t=-1.811
Y= y without ISR		d=256.299	t=6.878	***Y***= y without ISR		d=22.414	t=3.101
	Y= a+ b X	a=1.001	t=180.077		***Y***= a+ b X	a=1.091	t=0.0411
		b=0.003	t=4.017			b=-0.0003	t=-0.093
	X=c+d ***Y***	c=-296.919	t=-3.902		X=c+d ***Y***	c=11.555	t=0.377
		d=296.611	t=4.017			d=-2.624	t=-0.094
Figure2	y= a+ b x	a=1.081	t=46.55	Figure 10	y= a+ b x	a=-0.12	t=-0.786
y= Avg. inflation growth rate pre cri.		b=0.003	t=1.682	y= Avg. real equity return during cri.		b=0.0264	t=2.292
x= Bail out cost (%)	x=c+d y	c=-72.509	t=-1.468	x= Bail out cost (%)	x=c+d y	c=8.427	t=3.748
Y= y without ISR		d=74.628	t=1.682	***Y***= y without ISR		d=12.998	t=2.292
	Y= a+ b X	a=1.106	t=48.923		***Y***= a+ b X	a=0.128	t=1.517
		b=-0.0006	t=-0.0283			b=-0.008	t=-1.021
	X=c+d ***Y***	c=24.531	t=0.438		X=c+d ***Y***	c=9.405	t=4.845
		d=-14.3761	t=-0.283			d=-12.483	t=-1.021
Figure 3	y= a+ b x	a=0.101	t=4.814	Figure 11	y= a+ b x	a=0.984	t=73.55
y= Avg. real equity return pre crisis		b=0.002	t=1.289	y= GDP during crisis/ GDP pre crisis		b=-0.002	t=-1.905
x= Bail out cost (%)	x=c+d y	c=1.948	t=0.277	x= Bail out cost (%)	x=c+d y	c=143.57	t=2.054
Y= y without ISR		d=69.849	t=1.289	***Y***= y without ISR		d=-138.035	t=-1.905
	Y= a+ b X	a=0.0101	t=3.987		***Y***= a+ b X	a=0.977	t=62.592
		b=0.002	t=0.785			b=-0.001	t=-0.632
	X=c+d ***Y***	c=4.474	t=0.885		X=c+d ***Y***	c=52.193	t=0.757
		d=33.425	t=0.785			d=-44.87	t=-0.632
Figure 8	y= a+ b x	a=0.984	t=62.087	Figure 12	y= a+ b x	a=0.876	t=13.669
y= Avg. GDP growth rate during crisis		b=0.001	t=0.853	y= Inf. during crisis/ Inf. pre crisis		b=0.015	t=3.186
x= Bail out cost (%)	x=c+d y	c=-55.459	t=-0.717	x= Bail out cost (%)	x=c+d y	c=-23.364	t=-2.169
Y= y without ISR		d=65.925	t=0.853	***Y***= y without ISR		d=32.587	t=3.186
	Y= a+ b X	a=0.988	t=50.95		***Y***= a+ b X	a=0.984	t=32.99
		b=0.001	t=0.631			b=0.0003	t=0.01
	X=c+d ***Y***	c=-27.32	t=-0.478		X=c+d ***Y***	c=4.883	t=0.127
		d=36.07	t=0.631			d=3.865	t=0.01

Table 6

Figure 14	y= a+ b x	a=0.966	t=12.4	Figure 23	y= a+ b x	a=1.022	t=166.85
y= Equity during/ Equity pre crisis		b=0.001	t=0.203	y= Avg. GDP growth rate after crisis		b=0.0001	t=0.304
x= Bail out cost (%)	x=c+d y	c=7.109	t=0.425	x= Bail out cost (%)	x=c+d y	c=-68.478	t=-0.267
Y= y without ISR		d=3.437	t=0.203	***Y***= y without ISR		d=75.98	t=0.304
	Y= a+ b X	a=1.049	t=13.49		***Y***= a+ b X	a=1.017	t=132.36
		b=-0.01	t=-1.377			b=0.001	t=1.078
	X=c+d ***Y***	c=24.96	t=2.09		X=c+d ***Y***	c=-140.61	t=-1.627
		d=-16.95	t=-1.377			d=144.12	t=1.079
Figure 15	y= a+ b x	a=0.973	t=59.105	Figure 24	y= a+ b x	a=0.943	t=15.07
y= GDP during/GDPpre crisis		b=0.0005	t=0.181	y= Avg. inflation rate after crisis		b=0.017	t=3.52
x= Bail out cost (%)	x=c+d y	c=1.889	t=0.11	x= Bail out cost (%)	x=c+d y	c=-28.56	t=-2.62
Y= y without ISR		d=3.184	t=0.181	***Y***= y without ISR		d=34.13	t=3.524
	Y= a+ b X	a=0.9708	t=66.625		***Y***= a+ b X	a=1.057	t=21.869
		b=0.002	t=0.694			b=-0.001	t=-0.134
	X=c+d ***Y***	c=-8.798	t=-0.445		X=c+d ***Y***	c=10.511	t=0.403
		d=13.978	t=0.694			d=-3.328	t=-0.134
Figure 16	y= a+ b x	a=8.081	t=1.502	Figure 25	y= a+ b x	a=0.103	t=1.57
y= Bail out cost		b=0.47	t=0.503	y= Avg. real equity return after crisis		b=0.013	t=2.506
x= Length crisis	x=c+d y	c=4.533	t=3.288	x= Bail out cost (%)	x=c+d y	c=1.796	t=0.486
Y= y without ISR		d=0.052	t=0.504	***Y***= y without ISR		d=33.06	t=2.506
	Y= a+ b X	a=8.694	t=2.21		***Y***= a+ b X	a=0.169	t=2.150
		b=0.001	t=0.002			b=0.023	t=0.251
	X=c+d ***Y***	c=4.906	t=2.954		X=c+d ***Y***	c=6.306	t=1.915
		d=0.0003	t=0.002			d=3.773	t=0.251
Figure 17	y= a+ b x	a=0.989	t=49.9	Figure 26	y= a+ b x	a=1.016	t=123.73
y= GDP during 1st cri./GDP pre cri.		b=-0.002	t=-0.451	y= GDP after/GDP pre crisis		b=-0.0027	t=-4.169
x= Length crisis	x=c+d y	c=12.627	t=0.602	x= Bail out cost (%)	x=c+d y	c=254.51	t=4.326
Y= y without ISR		d=-9.621	t=-0.451	***Y***= y without ISR		d=-247.49	t=-4.16
Figure 18	y= a+ b x	a=1.01	t=60.454		***Y***= a+ b X	a=1	b=186.83
y= GDP between crises/GDP pre cri.		b=-0.002	t=-0.505			b=-0.0002	t=-0.255
x= Length crisis	x=c+d y	c=14.326	t=0.656		X=c+d ***Y***	c=63.595	t=0.287
Y= y without ISR		d=-10.98	t=-0.505			d=-56.613	t=-0.255

Table 6

Figure 27	y= a+ b x	a=0.88	t=23.61	Figure 30	y= a+ b x	a=0.994	t=66.006
y= Inflation after/Inflation pre crisis		b=0.011	t=3.83	y= GDPafter/GDP pre crisis		b=-0.0003	t=-0.01
x= Bail out cost (%)	x=c+d y	c=-46.082	t=-3.167	x= Length crisis	x=c+d y	c=7.68	t=0.293
Y= y without ISR		d=56.07	t=3.83	***Y***= y without ISR		d=-2.637	t=-0.01
	Y= a+ b X	a=0.953	t=41.77		***Y***= a+ b X	a=0.989	t=144.18
		b=-0.0005	t=0.003			b=0.002	t=1.37
	X=c+d ***Y***	c=15.72	t=0.316		X=c+d ***Y***	c=-68.49	t=-1.283
		d=-9.168	t=-0.175			d=73.57	t=1.375
Figure 29	y= a+ b x	a=1.127	t=23.50				
y= Equity after/Equity pre crisis		b=-0.0002	t=-0.043				
x= Bail out cost (%)	x=c+d y	c=10.867	t=0.298				
Y= y without ISR		d=-1.382	t=-0.0429				
	Y= a+ b X	a=1.127	t=17.268				
		b=0.001	t=0.126				
	X=c+d ***Y***	c=4.377	t=0.21				
		d=2.385	t=0.127				

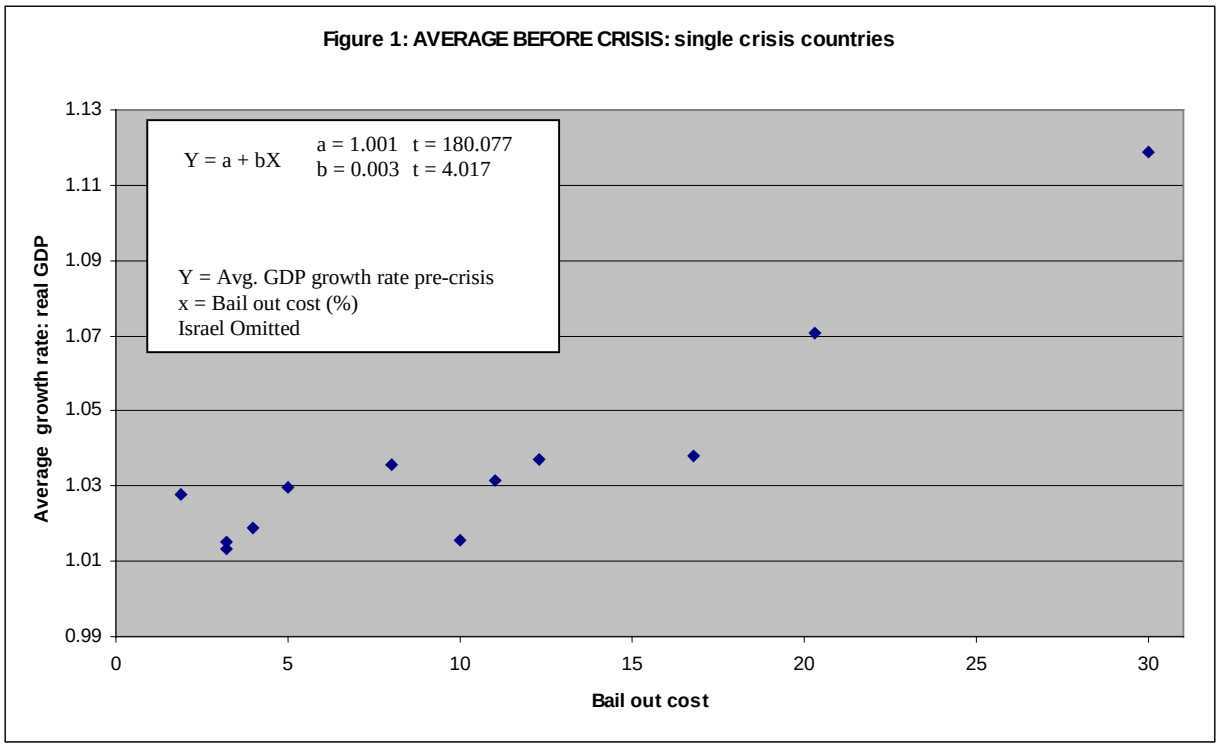


Figure 1: AVERAGE BEFORE CRISIS: single crisis countries
Y = a + bX
a = 1.001 t = 180.077
b = 0.003 t = 4.017
Y = Avg. GDP growth rate pre-crisis
x = Bail out cost (%)
Israel Omitted
Average growth rate: real GDP
1.13
1.11
1.09
1.07
1.05
1.03
1.01
0.99
0
5
10
15
20
25
30
Bail out cost

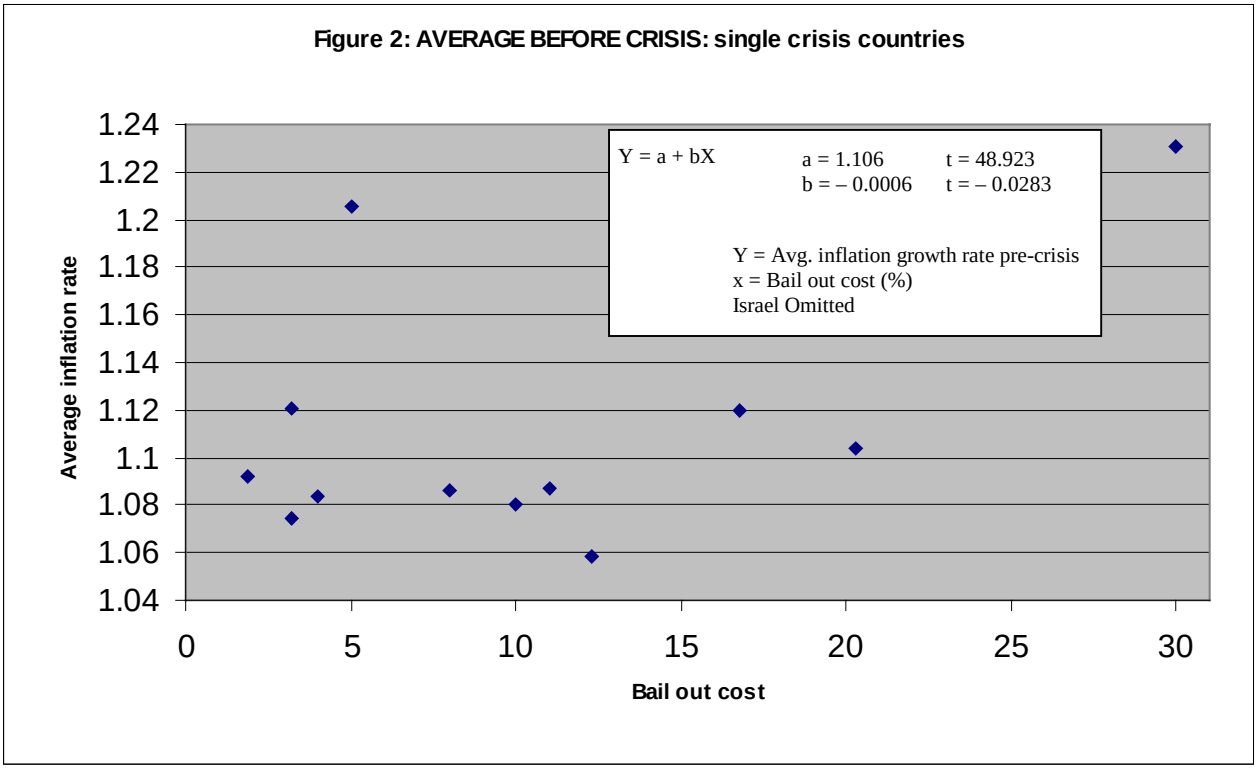


Figure 2: AVERAGE BEFORE CRISIS: single crisis countries
Y = a + bX
a = 1.106 t = 48.923
b = – 0.0006 t = – 0.0283
Y = Avg. inflation growth rate pre-crisis
x = Bail out cost (%)
Israel Omitted
Average inflation rate
1.24
1.22
1.2
1.18
1.16
1.14
1.12
1.1
1.08
1.06
1.04
0
5
10
15
20
25
30
Bail out cost

Figure 3: AVERAGE BEFORE CRISIS: single crisis countries

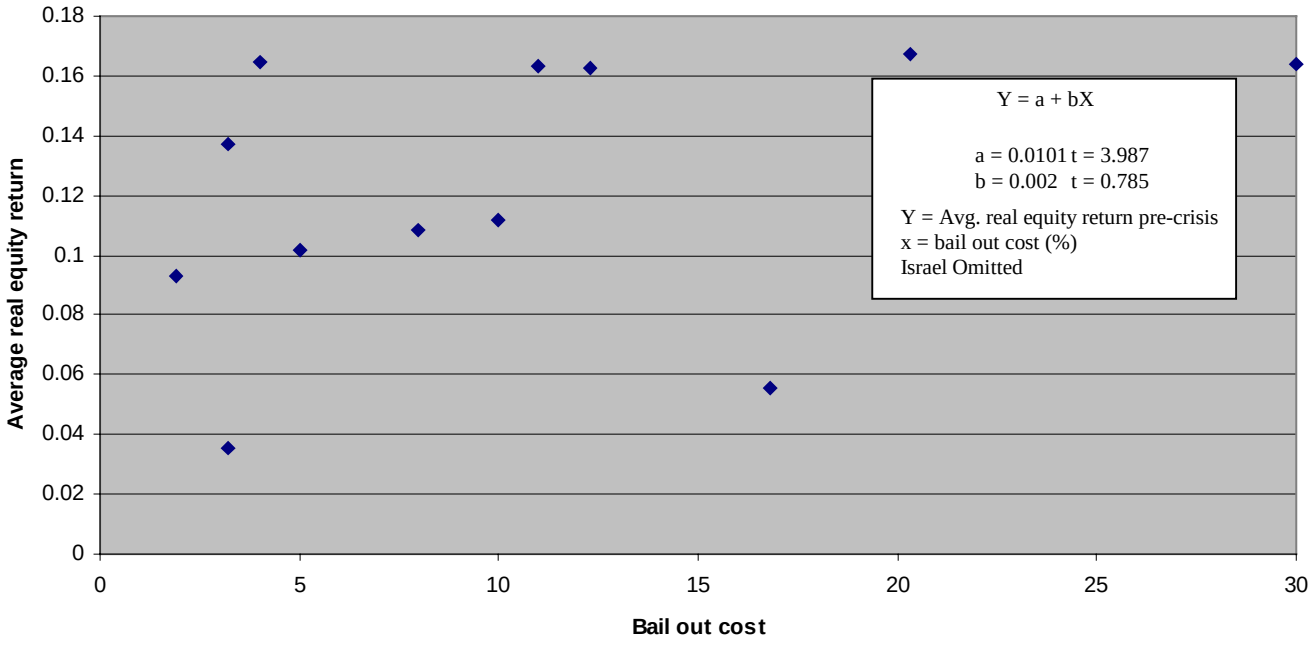
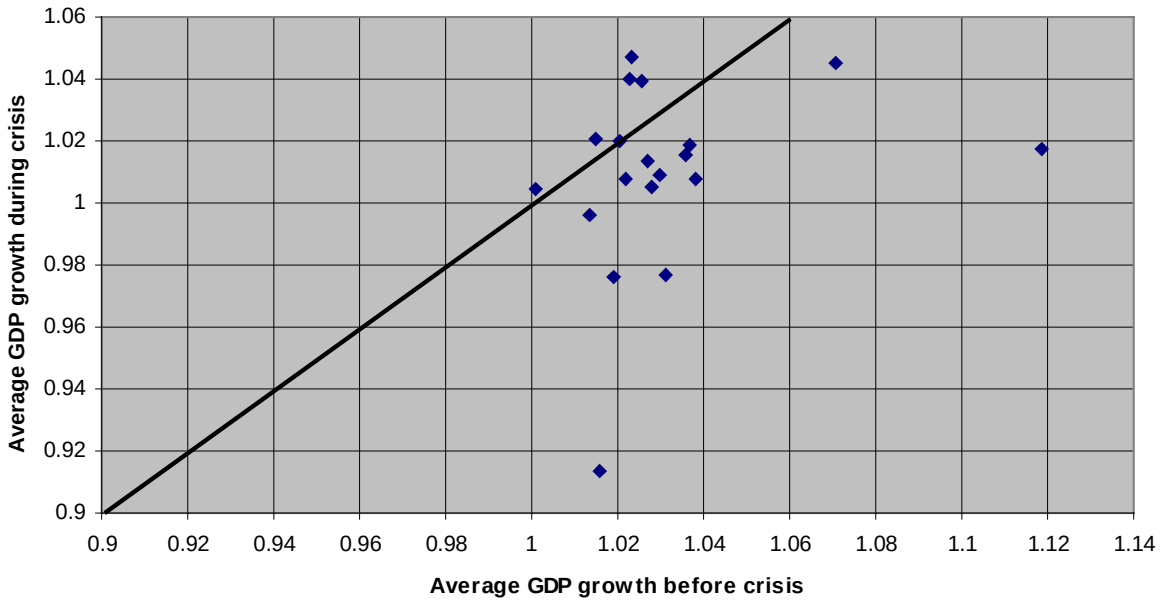


Figure 4: SINGLE CRISIS COUNTRIES



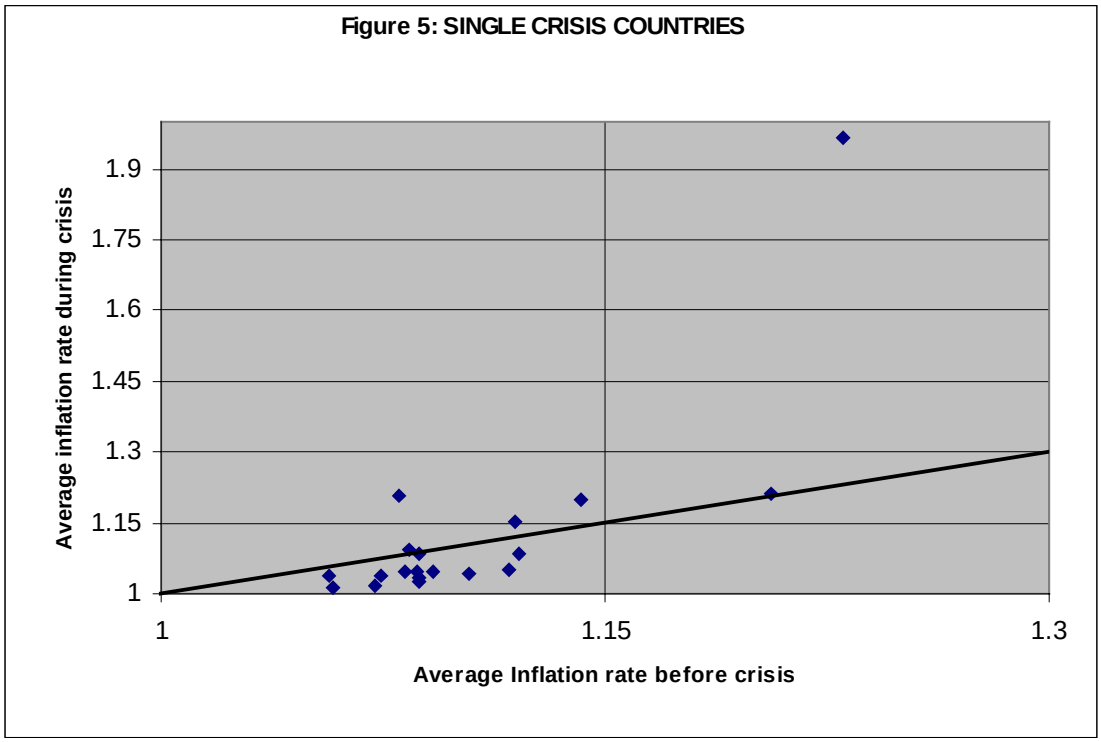


Figure 5: SINGLE CRISIS COUNTRIES
Average inflation rate during crisis
1.9
1.75
1.6
1.45
1.3
1.15
1
1
1.15
1.3
Average Inflation rate before crisis

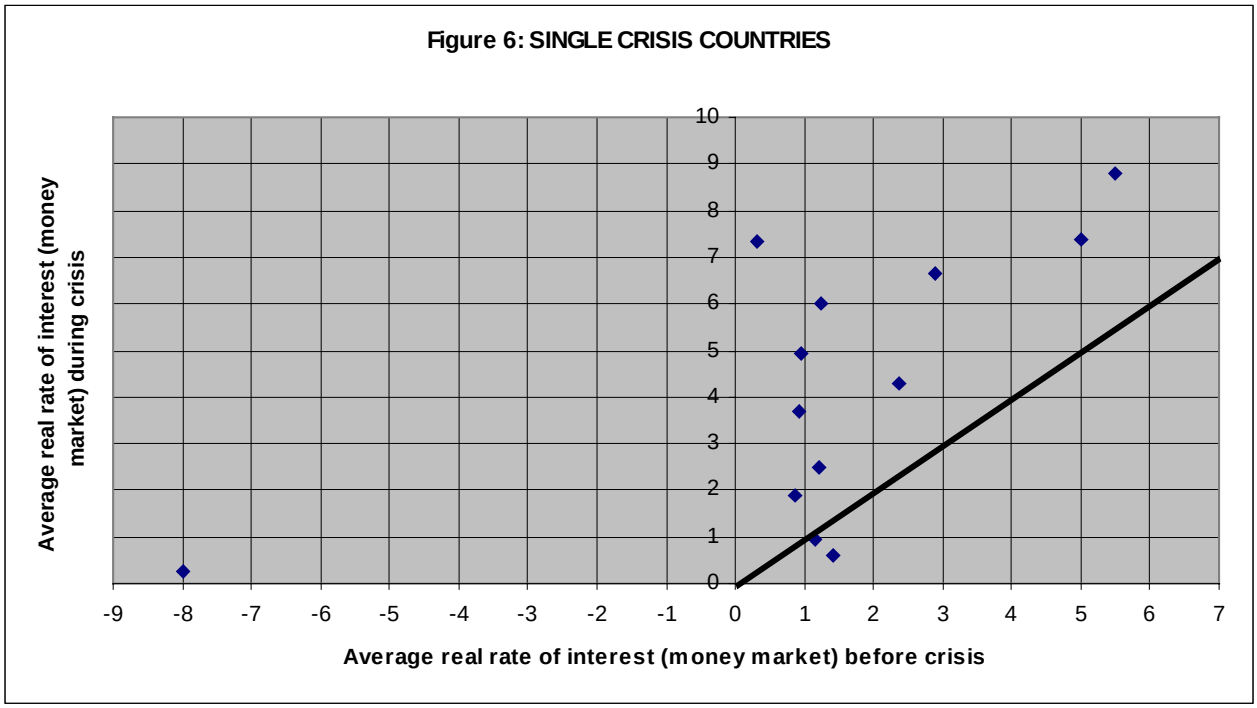


Figure 6: SINGLE CRISIS COUNTRIES
Average real rate of interest (money market) during crisis
10
9
8
7
6
5
4
3
2
1
0
-9
-8
-7
-6
-5
-4
-3
-2
-1
0
1
2
3
4
5
6
7
Average real rate of interest (money market) before crisis

Figure 7: SINGLE CRISIS COUNTRIES

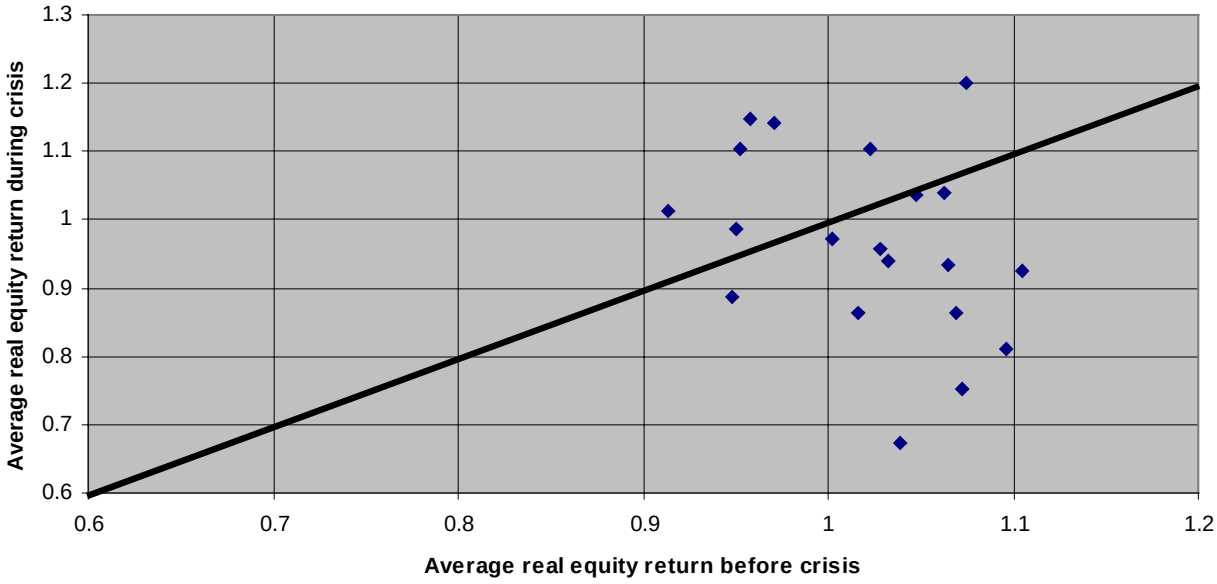


Figure 8: AVERAGE DURING CRISIS: single crisis countries

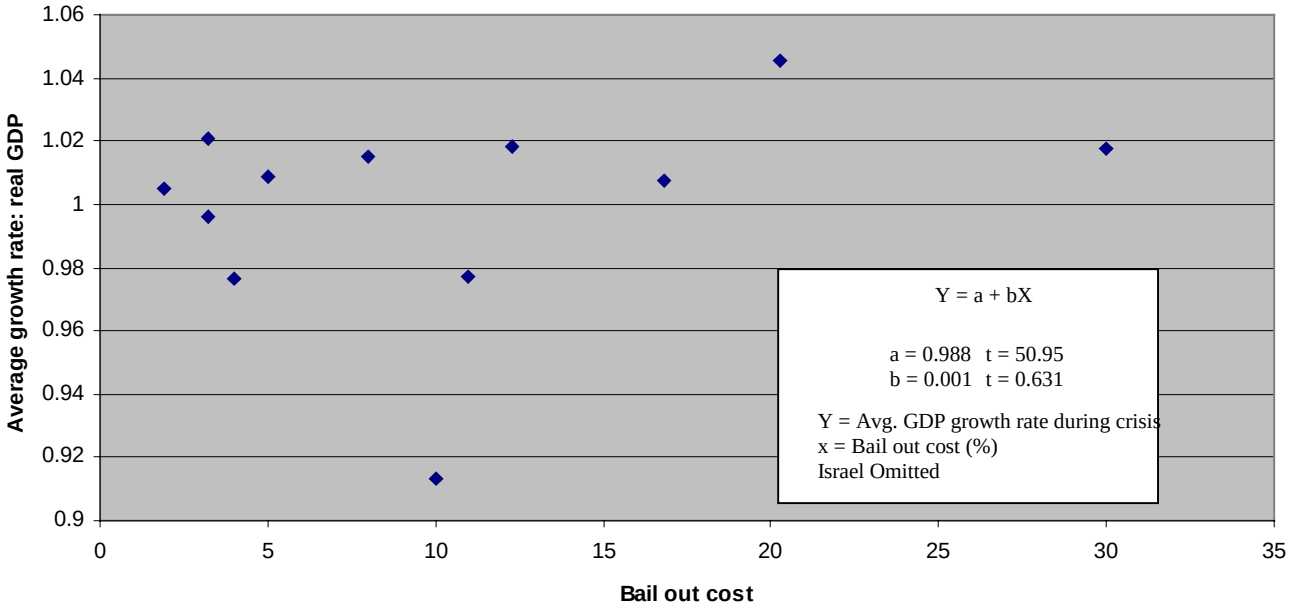


Figure 9: AVERAGE DURING CRISIS: single crisis countries

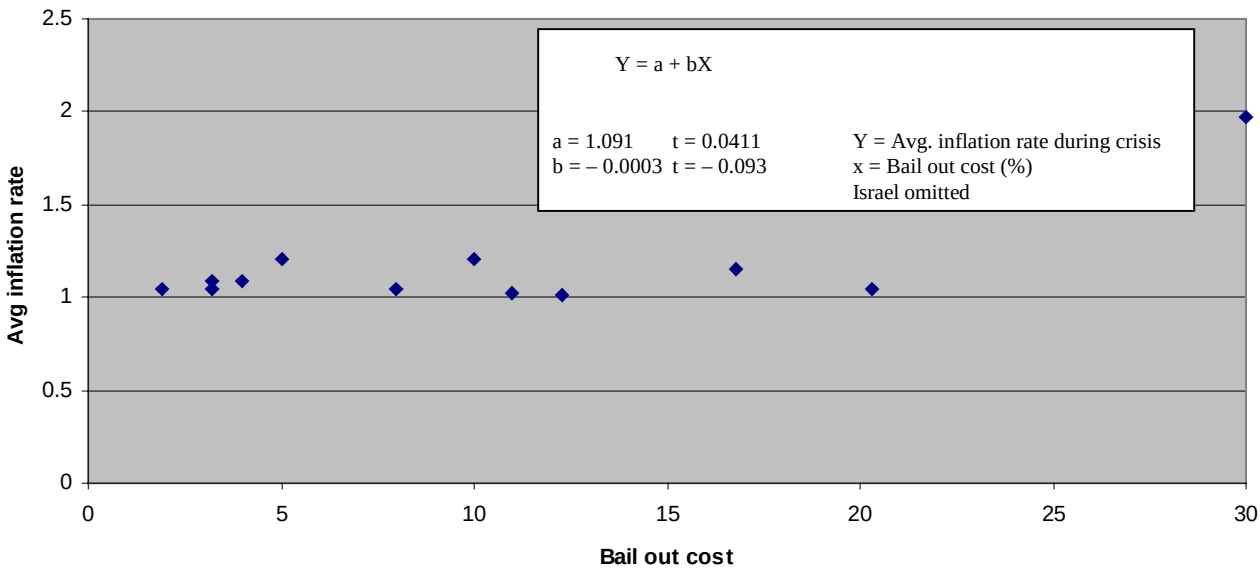


Figure 10: AVERAGE DURING CRISIS: single crisis

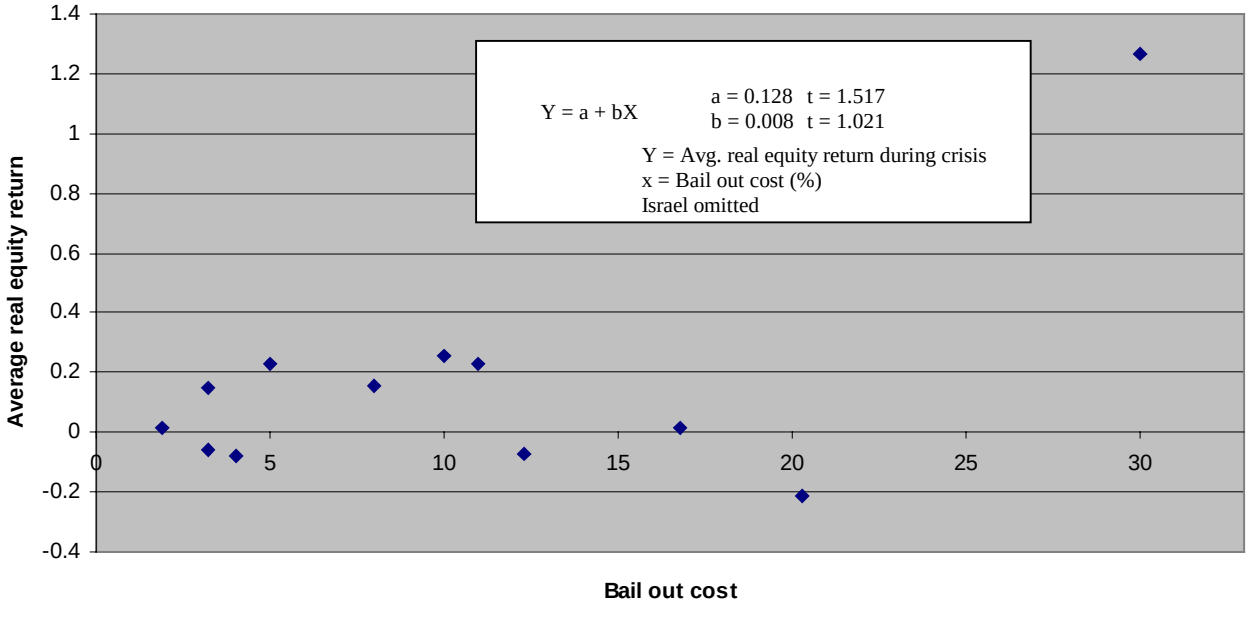


Figure 11: SINGLE CRISIS COUNTRIES

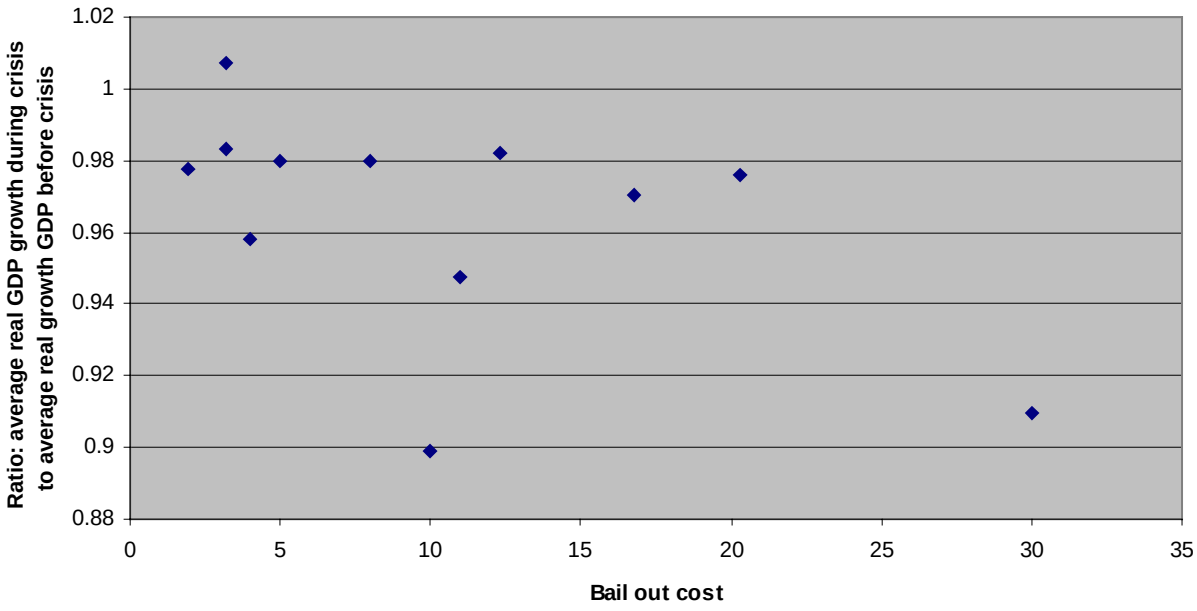


Figure 12: SINGLE CRISIS COUNTRIES

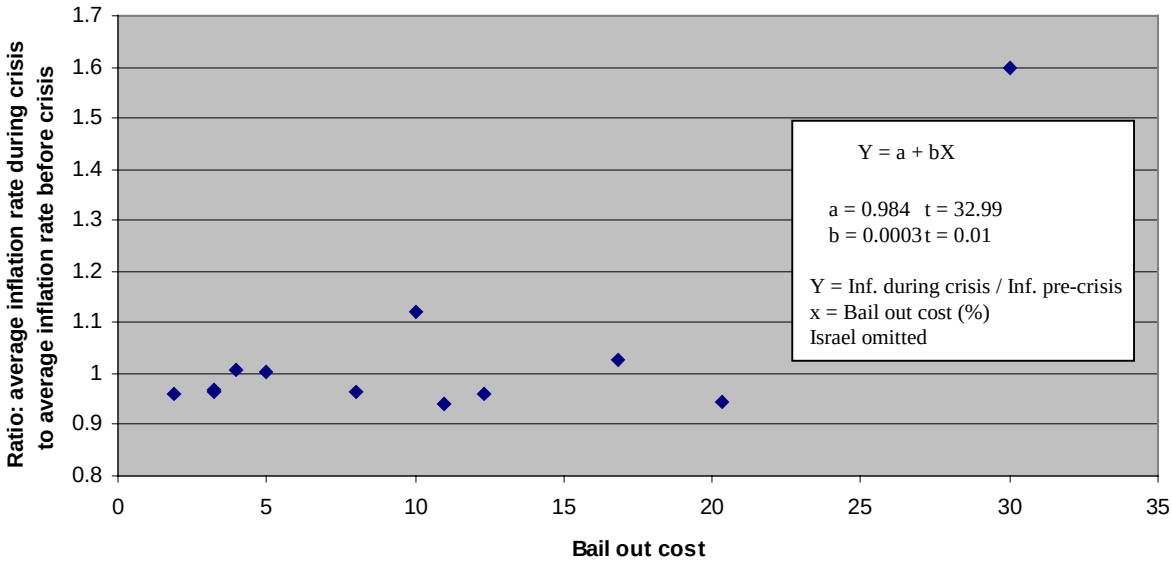


Figure 13: SINGLE CRISIS COUNTRIES

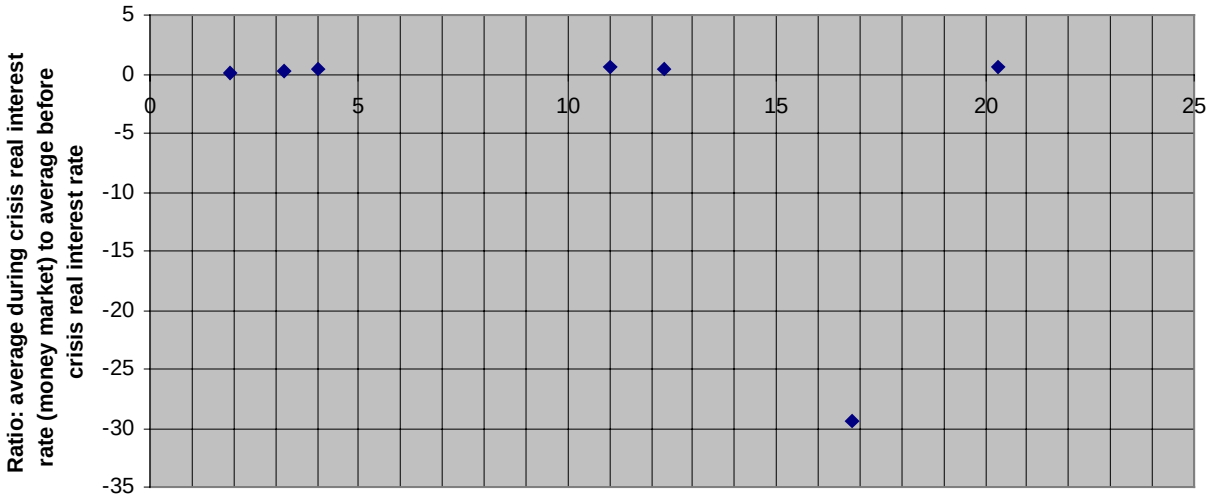
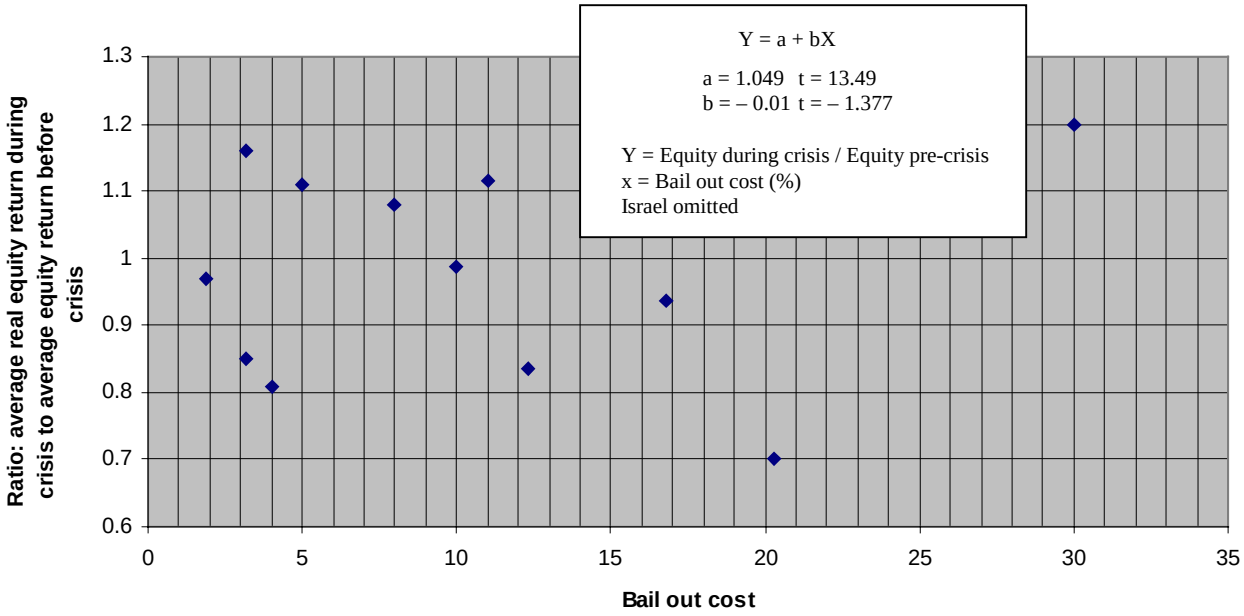


Figure 14: SINGLE CRISIS COUNTRIES



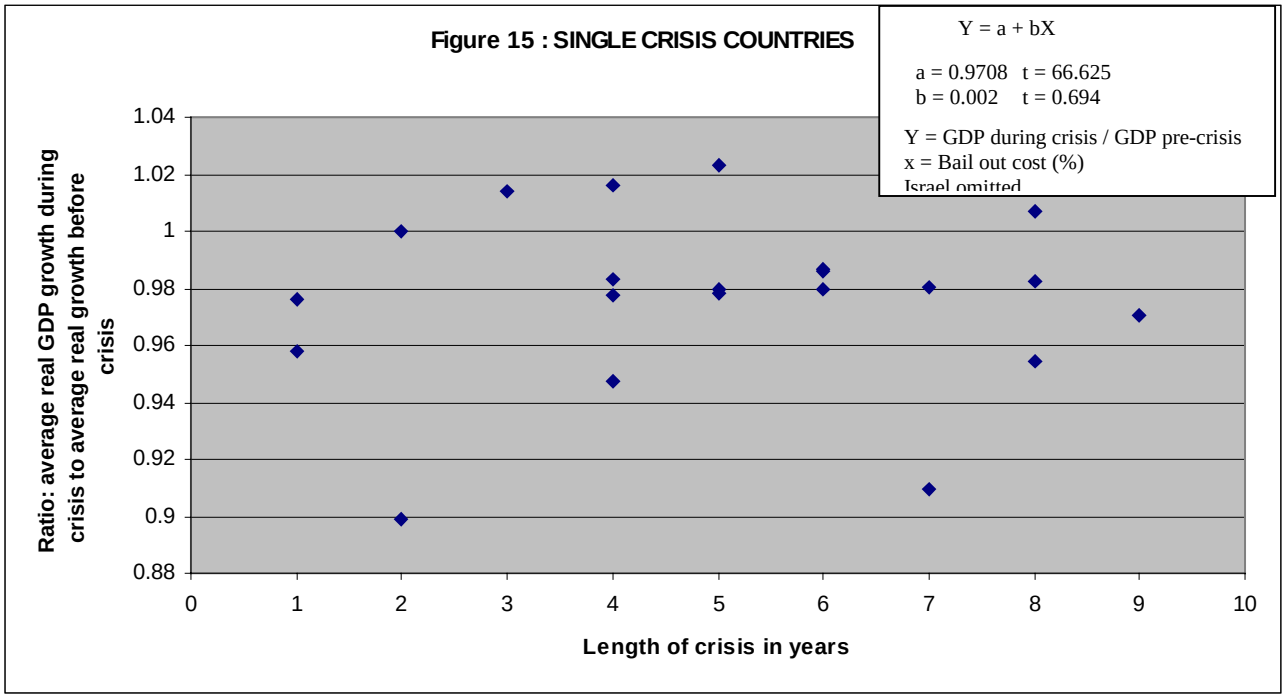


Figure 15 : SINGLE CRISIS COUNTRIES
Y = a + bX
a = 0.9708 t = 66.625
b = 0.002 t = 0.694
Y = GDP during crisis / GDP pre-crisis
x = Bail out cost (%)
Israel omitted
Ratio: average real GDP growth during crisis to average real growth before crisis
1.04
1.02
1
0.98
0.96
0.94
0.92
0.9
0.88
0 1 2 3 4 5 6 7 8 9 10
Length of crisis in years

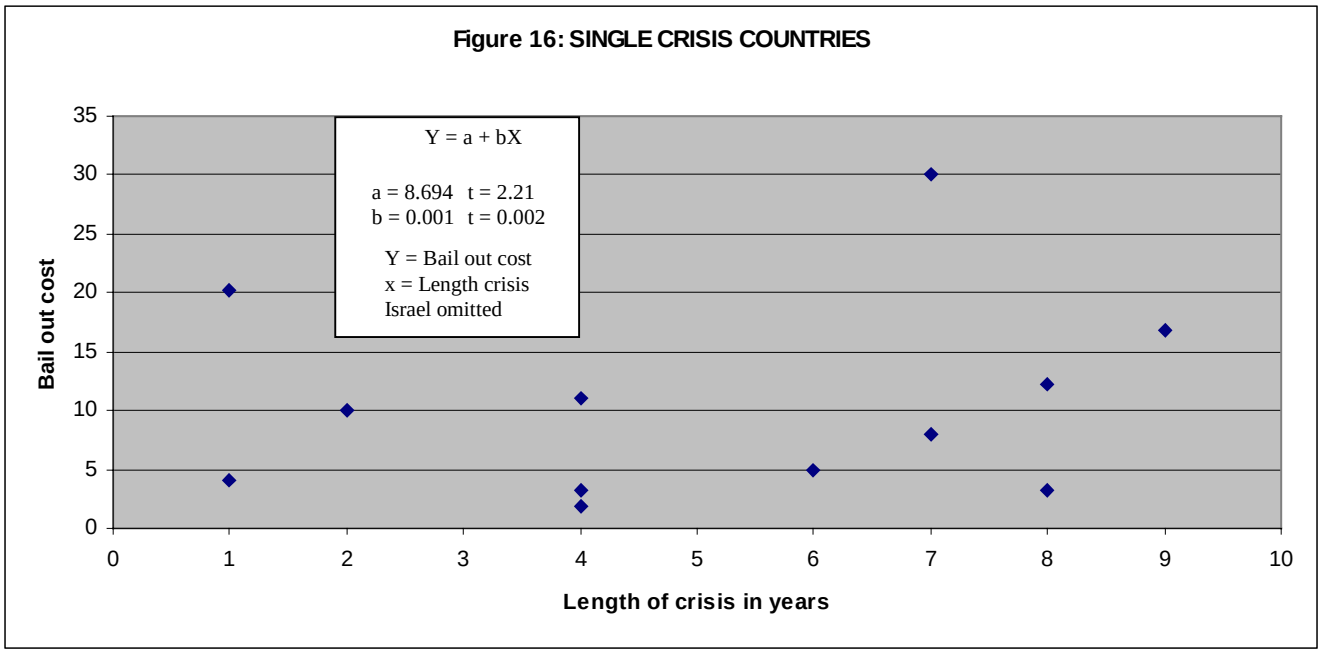


Figure 16: SINGLE CRISIS COUNTRIES
Y = a + bX
a = 8.694 t = 2.21
b = 0.001 t = 0.002
Y = Bail out cost
x = Length crisis
Israel omitted
Bail out cost
35
30
25
20
15
10
5
0
0 1 2 3 4 5 6 7 8 9 10
Length of crisis in years

Figure 17: MULTICRISIS COUNTRIES

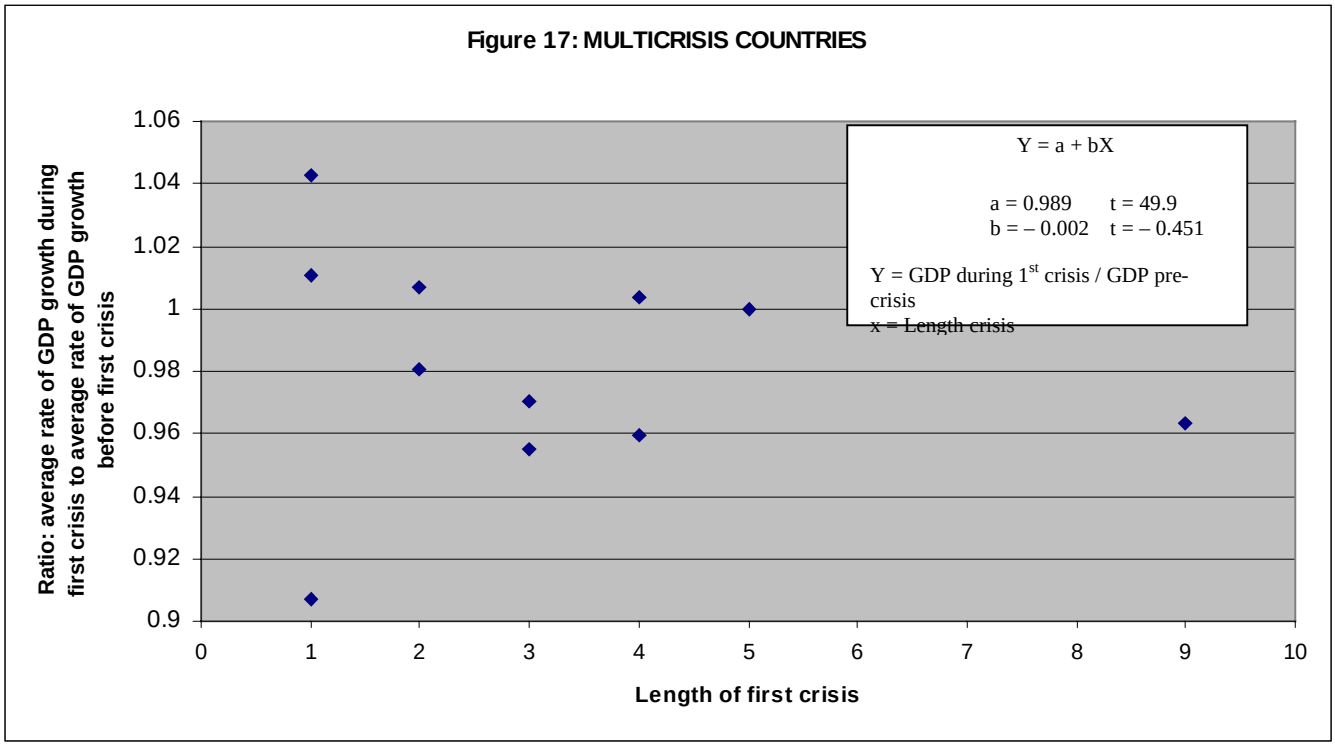
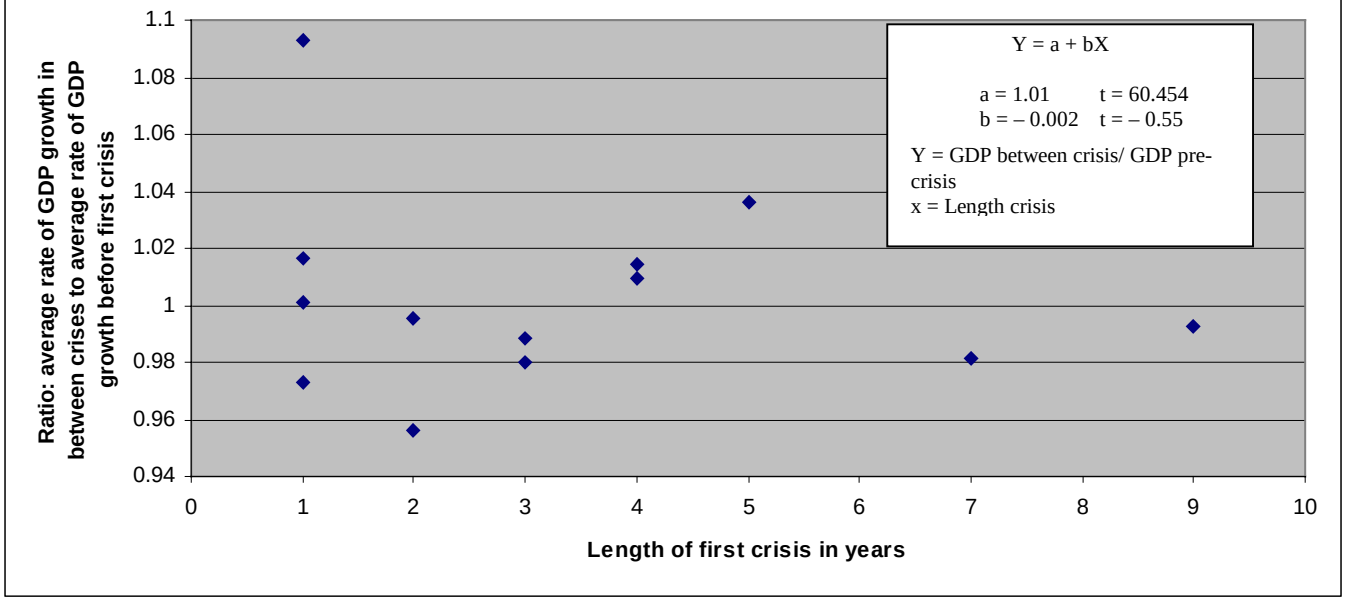


Figure 18: MULTICRISIS COUNTRIES



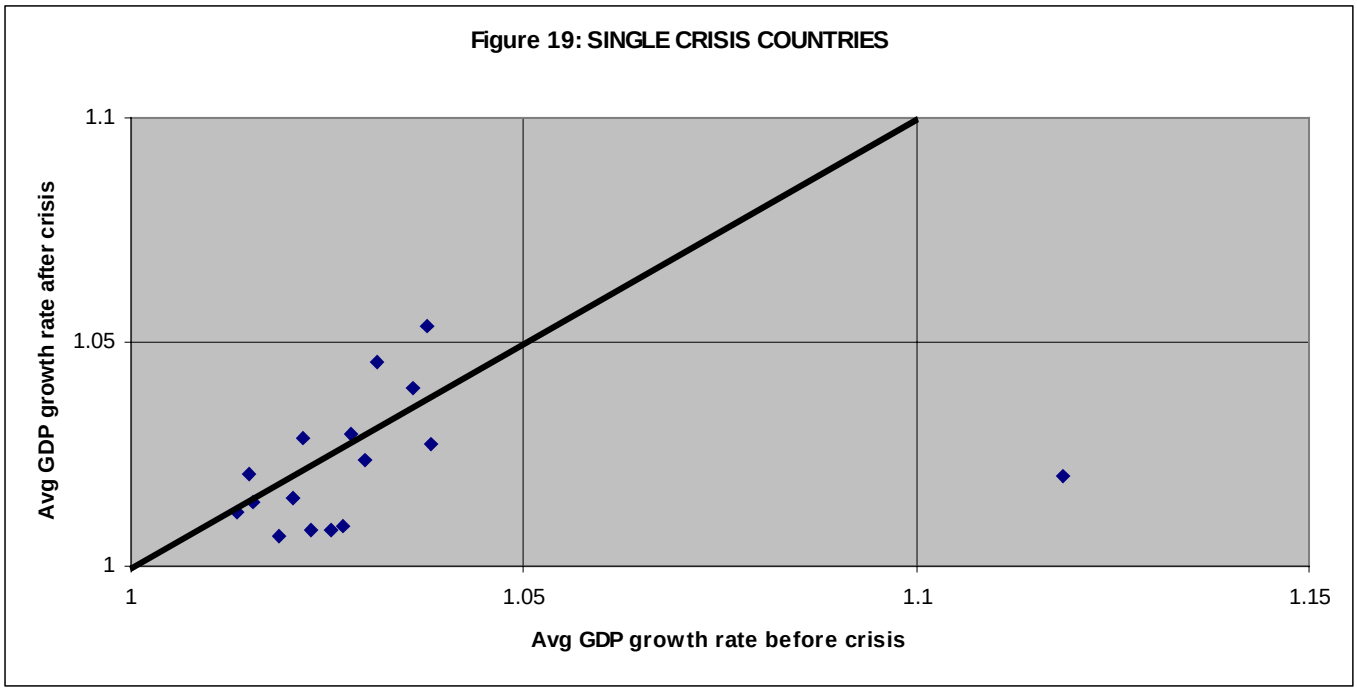


Figure 19: SINGLE CRISIS COUNTRIES
Avg GDP growth rate after crisis
1.1
1.05
1
1
1.05
1.1
1.15
Avg GDP growth rate before crisis

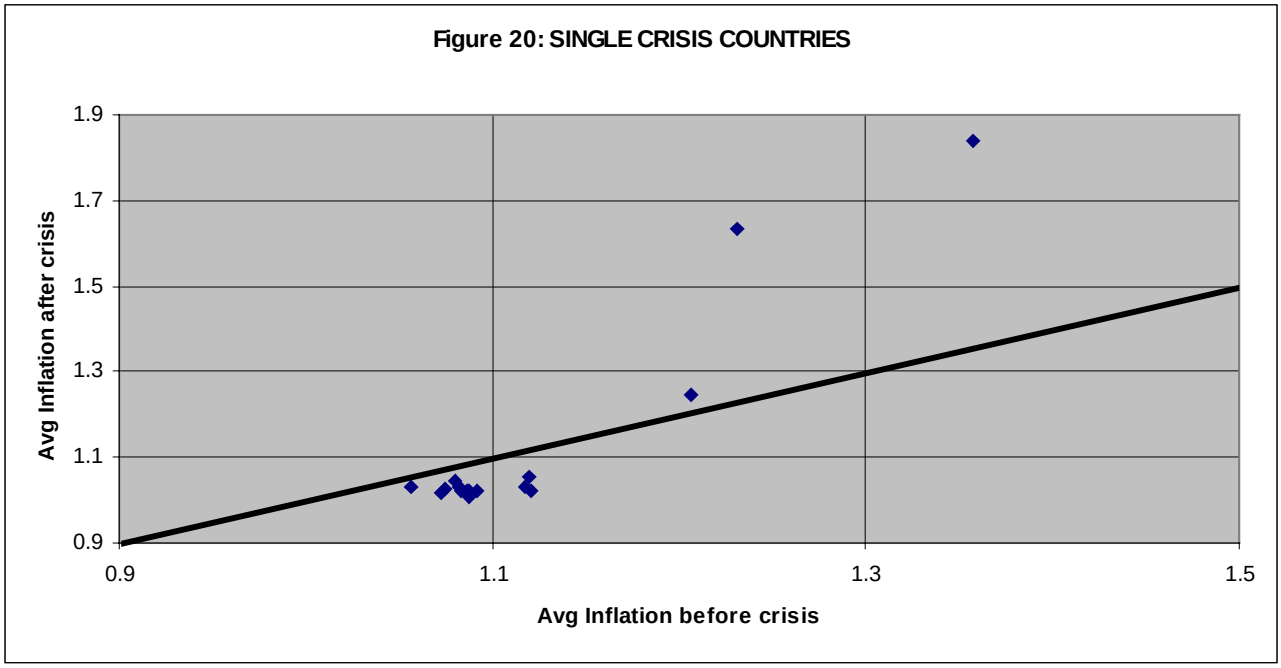


Figure 20: SINGLE CRISIS COUNTRIES
Avg Inflation after crisis
1.9
1.7
1.5
1.3
1.1
0.9
0.9
1.1
1.3
1.5
Avg Inflation before crisis

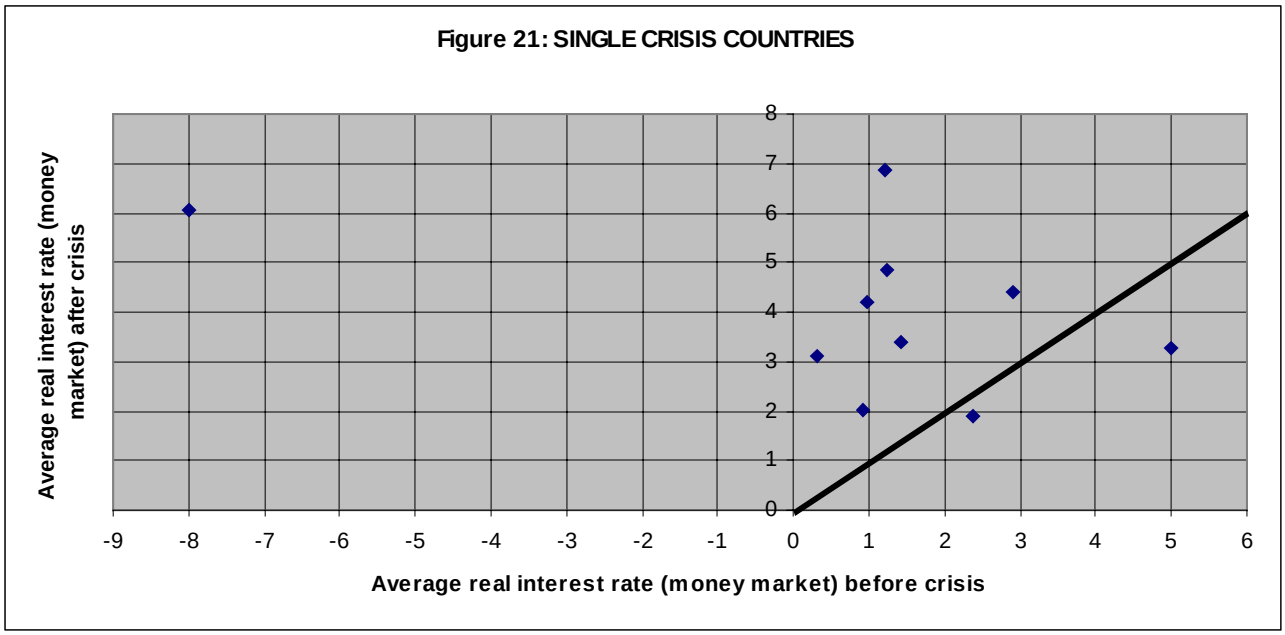


Figure 21: SINGLE CRISIS COUNTRIES
Average real interest rate (money market) after crisis
8
7
6
5
4
3
2
1
0
-9
-8
-7
-6
-5
-4
-3
-2
-1
0
1
2
3
4
5
6
Average real interest rate (money market) before crisis

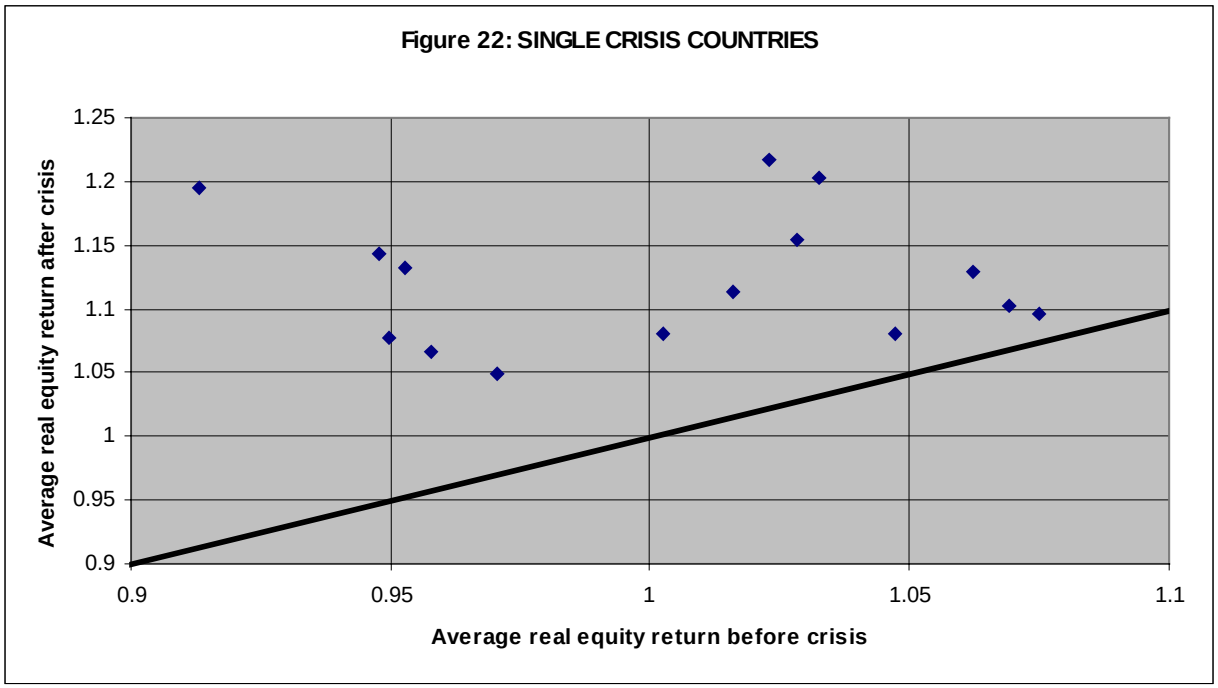


Figure 22: SINGLE CRISIS COUNTRIES
Average real equity return after crisis
1.25
1.2
1.15
1.1
1.05
1
0.95
0.9
0.9
0.95
1
1.05
1.1
Average real equity return before crisis

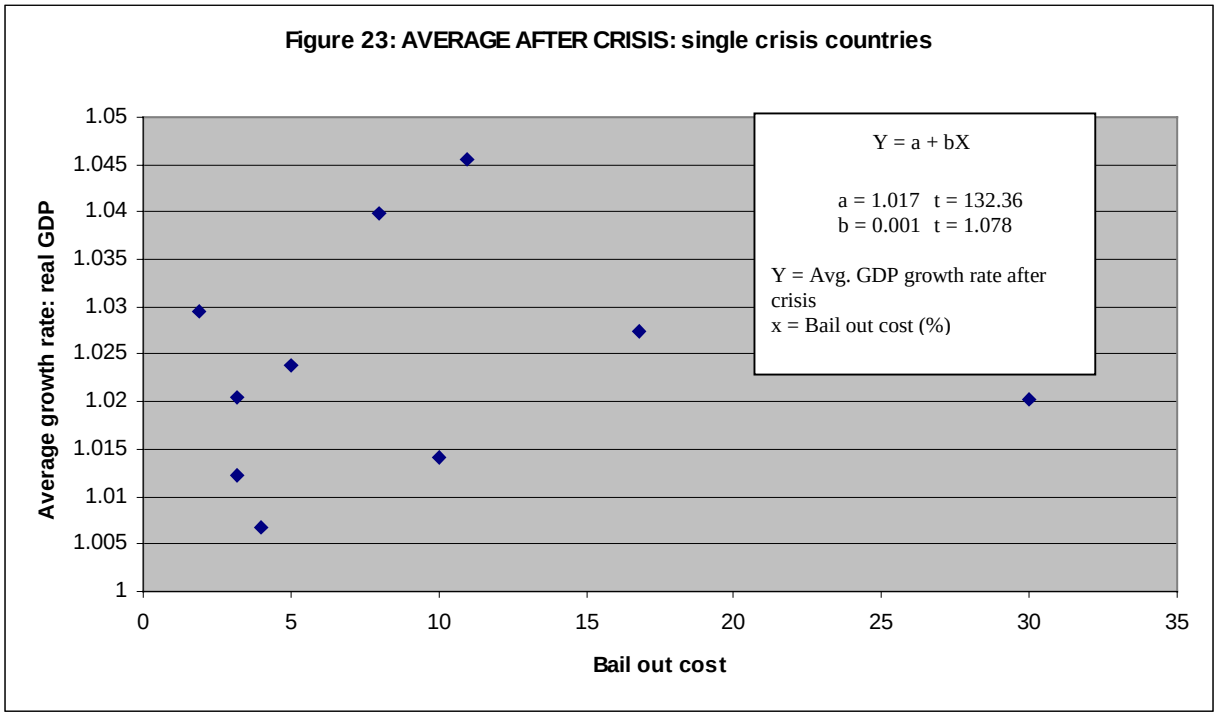


Figure 23: AVERAGE AFTER CRISIS: single crisis countries
Average growth rate: real GDP
1.05
1.045
1.04
1.035
1.03
1.025
1.02
1.015
1.01
1.005
1
0
5
10
15
20
25
30
35
Bail out cost
Y = a + bX
a = 1.017 t = 132.36
b = 0.001 t = 1.078
Y = Avg. GDP growth rate after crisis
x = Bail out cost (%)

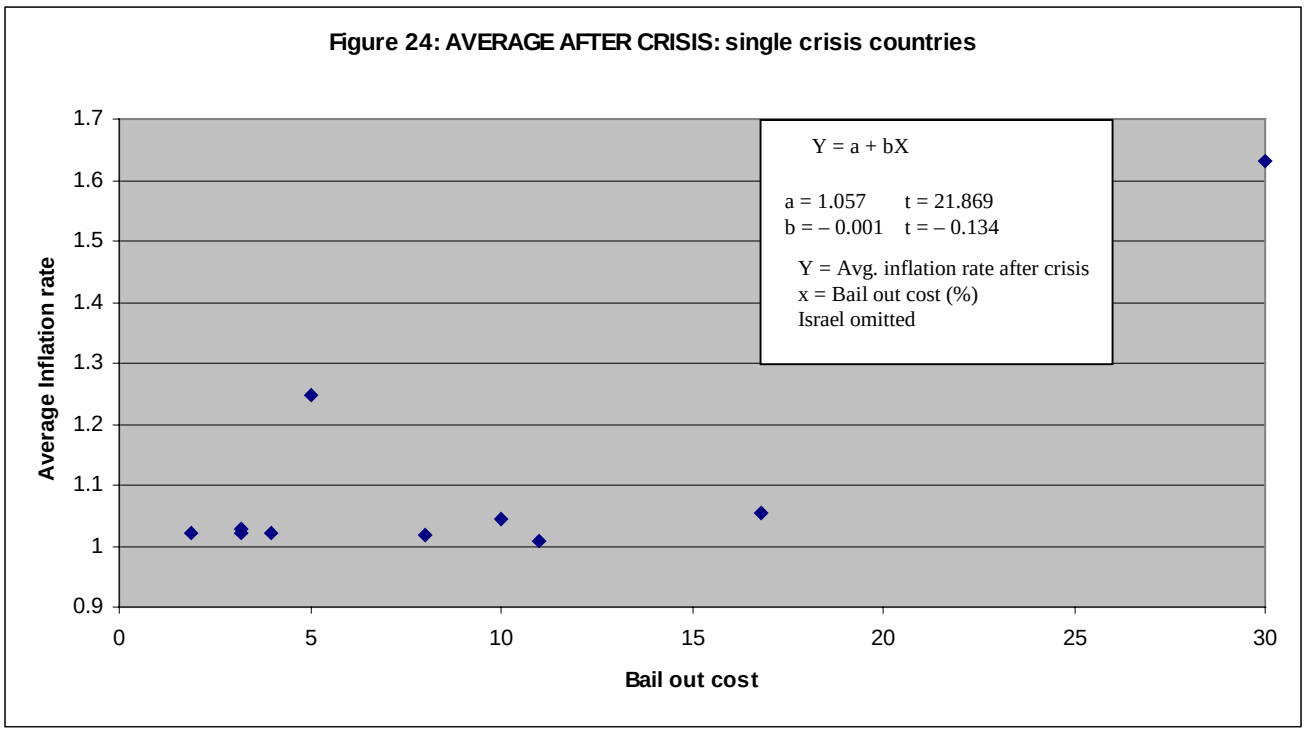


Figure 24: AVERAGE AFTER CRISIS: single crisis countries
Average Inflation rate
1.7
1.6
1.5
1.4
1.3
1.2
1.1
1
0.9
0
5
10
15
20
25
30
Bail out cost
Y = a + bX
a = 1.057 t = 21.869
b = – 0.001 t = – 0.134
Y = Avg. inflation rate after crisis
x = Bail out cost (%)
Israel omitted

Figure 25: AVERAGE AFTER CRISIS: single crisis

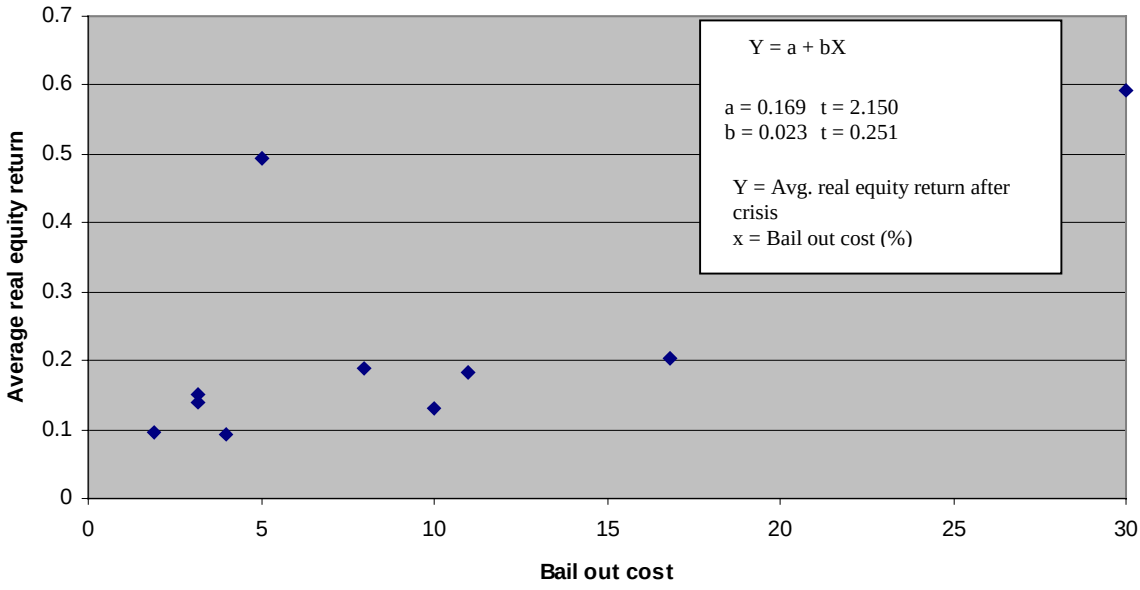


Figure 26: SINGLE CRISIS COUNTRIES

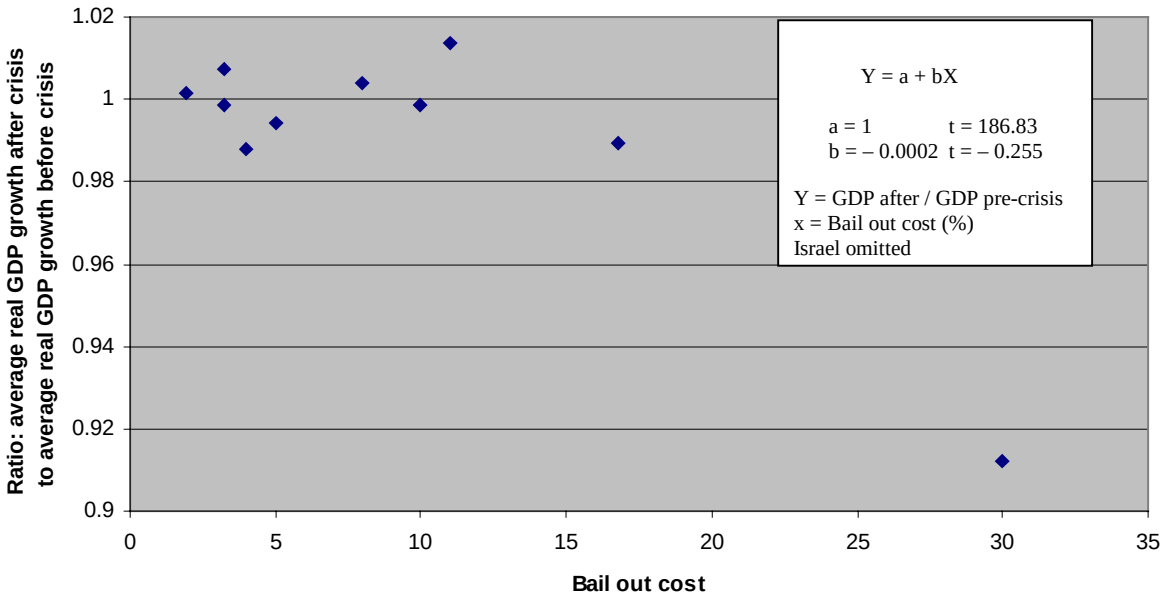


Figure 27: SINGLE CRISIS COUNTRIES

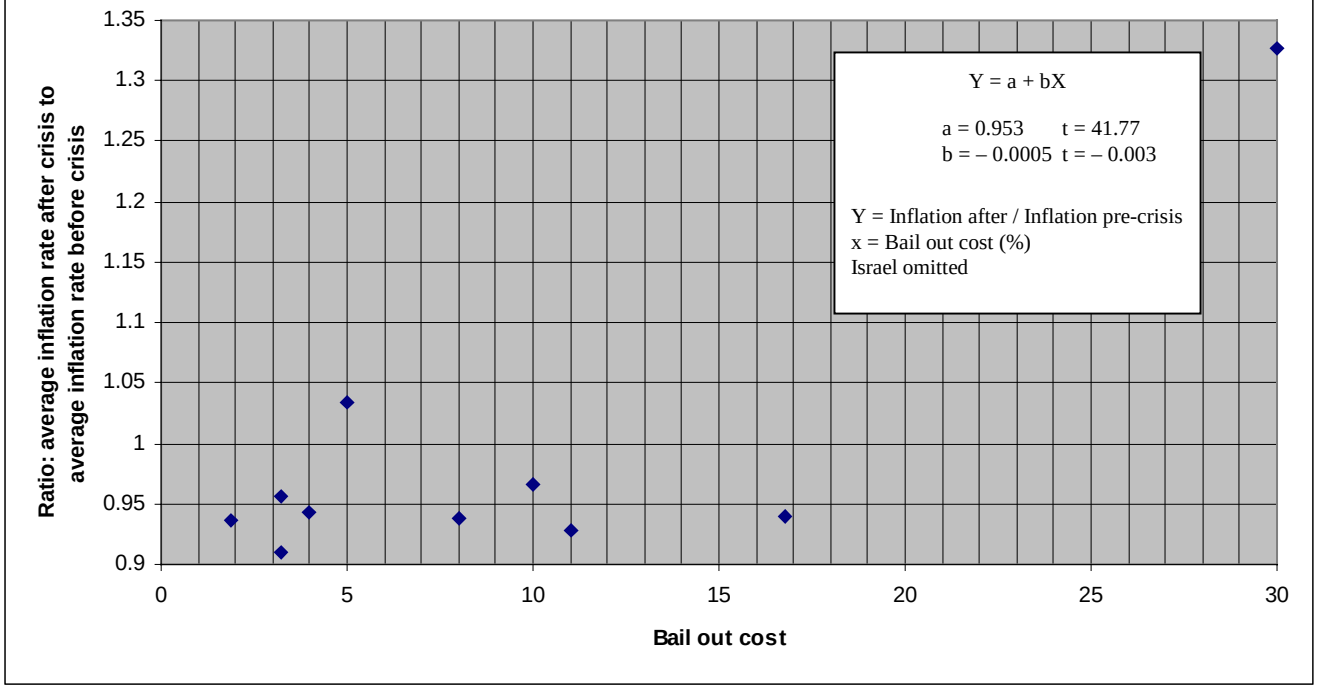
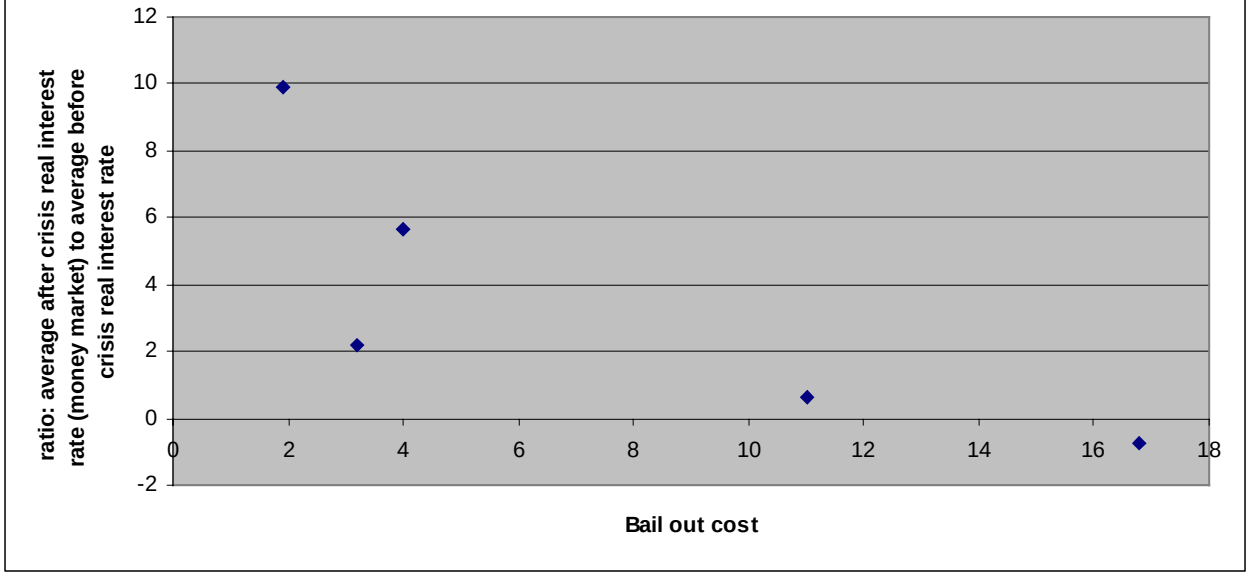


Figure 28: SINGLE CRISIS COUNTRIES



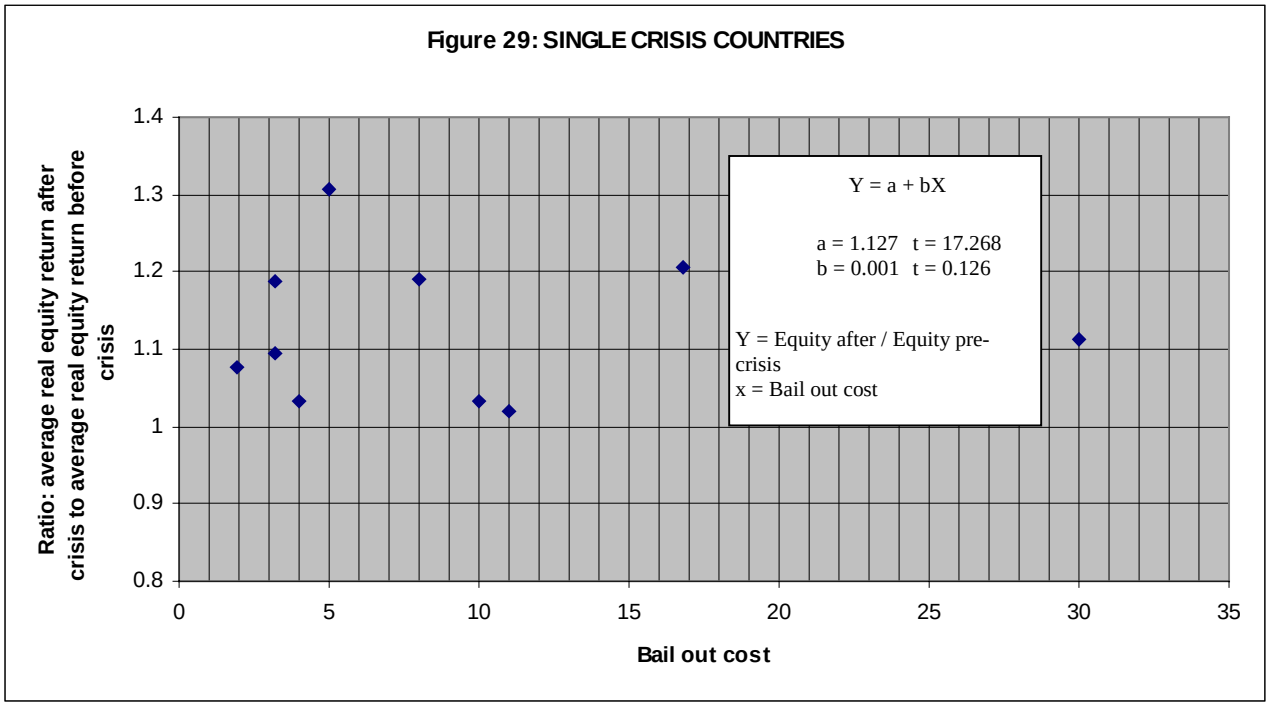


Figure 29: SINGLE CRISIS COUNTRIES
Ratio: average real equity return after crisis to average real equity return before crisis
1.4
1.3
1.2
1.1
1
0.9
0.8
0
5
10
15
20
25
30
35
Bail out cost
Y = a + bX
a = 1.127 t = 17.268
b = 0.001 t = 0.126
Y = Equity after / Equity pre-crisis
x = Bail out cost

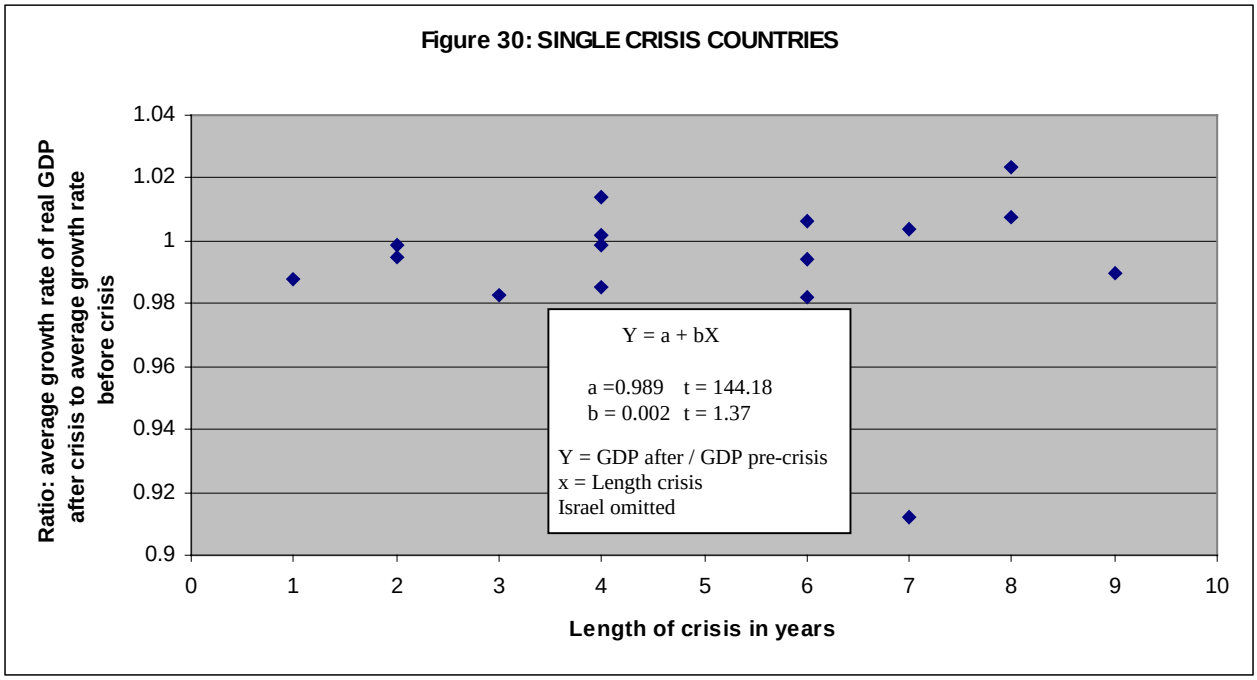


Figure 30: SINGLE CRISIS COUNTRIES
Ratio: average growth rate of real GDP after crisis to average growth rate before crisis
1.04
1.02
1
0.98
0.96
0.94
0.92
0.9
0
1
2
3
4
5
6
7
8
9
10
Length of crisis in years
Y = a + bX
a =0.989 t = 144.18
b = 0.002 t = 1.37
Y = GDP after / GDP pre-crisis
x = Length crisis
Israel omitted

Figure 31: SINGLE CRISIS COUNTRIES