NBER WORKING PAPER SERIES

FINANCIAL STRUCTURE, MACROECONOMIC STABILITY AND MONETARY POLICY

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Working Paper 8354
http://www.nber.org/papers/w8354

NATIONAL BUREAU OF ECONOMIC RESEARCH
1050 Massachusetts Avenue
Cambridge, MA 02138
July 2001

This paper was prepared for the XII Symposium of Moneda y Crédito, Madrid, Spain, 30 November and 1 December 2000. We would like to thank our discussants, Rafael Repullo and Ramon Caminal, as well as the conference participants for their comments; and José Vinals for useful discussion. The views expressed herein are those of the authors and not necessarily those of the National Bureau of Economic Research.

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JEL No. E5, G1

ABSTRACT

Over the past twenty years, macroeconomic performance has improved markedly in industrialized and developing countries alike. Both inflation and real growth are more stable now than they were in the 1980s. This stability has been accompanied by dramatic changes in financial structure. We examine the connection between these concurrent events using data from 23 developed and emerging markets countries. There are a number of possible explanations for the widespread improvement in economic outcomes over the past two decades. There is the very real possibility that the world has become a more stable place. Alternatively, monetary policymakers may have become more skillful in carry out their stabilization objectives. That is, the monetary policy of the 1990s may have been more efficient than it was in the 1980s. We provide evidence that policy has in fact improved, suggesting that a rise in the competence of central bankers. But the ability of policymakers to carry out their job depends crucially on their having the tools necessary to reduce inflation and output volatility. The transmission of these interest rate movements to domestic output and prices depends on the structure of the country's banking system and financial markets. We show that a reduction in direct state ownership of banking system assets and the introduction of explicit deposit insurance can help explain the simultaneous improvement in the efficiency of monetary policy and stabilization of the macroeconomy.

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1 Introduction

Over the past twenty years, macroeconomic performance has improved markedly in industrialized and developing countries alike. Both inflation and real growth are more stable now than they were in the 1980s. Looking at a sample of 23 countries we see that during 1990s, in 21 of them inflation variability fell and in 14 of them output volatility was lower than it had been during the previous decade.[1] This stability has been accompanied by dramatic changes in financial structure. Not only have central banks become more independent[2], but the nature of government intervention in banking systems has changed dramatically. The purpose of this paper is to examine the connection between these two concurrent events.

There are a number of possible explanations for the widespread improvement in economic outcomes over the past two decades. There is the very real possibility that the world has become a more stable place. If there are no shocks hitting the economy, it will surely appear stable. Alternatively, monetary policymakers may have become more skillful in carry out their stabilization objectives. That is, the monetary policy of the 1990s may have been more efficient than it was in the 1980s. We provide evidence that policy has in fact improved, suggesting that there has been an improvement in the competence of central bankers.

The ability of policymakers to carry out their job depends crucially on their having the tools necessary to reduce inflation and output volatility. In the majority of the countries in the world, day-to-day monetary policy means controlling short-term interest rates. The transmission of interest rate movements to domestic output and prices depends on the structure of the country's banking system, and financial markets more generally. Policy shifts, as embodied in interest rate changes, are effective only in so far as they influence the level of financing available to firms and individuals wishing to either undertake investment projects or shift consumption intertemporally.

In many countries the banking system is shielded from the impact of monetary policy through barriers created by the government. Specifically, if the government

[1] See Section 2 below for details.

[2] See King (1999).

owns bank assets directly, as it does in much of the world, then the decisions of the managers of the banks may not be as sensitive to normal market forces. Monetary policy that is transmitted to the real economy through its impact on bank lending will be shut down in an country in which banks are owned by the government. If policy is ineffective, the skill of the policymakers is essentially irrelevant. But when governments shed their bank assets, they increase the scope for central banks to stabilize output and inflation. As we show, declines in the level of bank assets owned by the government are related to improvements in both the efficiency of monetary policy and macroeconomic performance.

A second important component of the financial regulatory structure is the nature of the deposit insurance system. The presence or absence of explicit deposit insurance affects both the willingness of bank managers to take risks, and the extent to which firms will be able to access financing directly through equity or bond issuance. We provide evidence elsewhere[3] that the presence of explicit insurance reduces the extent to which firms go directly to capital markets for financing, increasing their dependence on banks. Since an important channel for monetary policy transmission is through bank loans, the more dependent firms are on banks, the more effective is monetary policy. Again, we find that macroeconomic outcomes can be tied to changes in the deposit insurance system.

Overall, our argument proceeds in a series of steps. First, we establish in Section 2 that macroeconomic outcomes have improved. Both output and inflation are more stable in a broad sample of countries around the world. Next, in Section 3 we discuss how it is that banks are crucial for the transmission of monetary policy to the real economy and why it is that both government bank ownership and deposit insurance systems are likely to influence policy's effectiveness. Section 4 provides data on the relationship between the loans extended by banks to the private sector and both the degree of state-bank ownership and whether or not there is explicit deposit insurance. Next we develop a measure of the improvement in monetary policy efficiency. This is the subject of Section 5. As we discuss in some detail, efficient policy results in

[3]See Cecchetti and Krause (2000).

macroeconomic outcomes that are on the inflation-output variability frontier. Policy cannot be efficient if it is ineffective, and so we expect that the ability of policymakers to do their jobs depends on the whether the banking and financial systems are structured so that they can. This brings us to our conclusion in Section 6 where we show that improvements in macroeconomic outcomes can be tied to changes in regulatory structure. Section 7 an overview of the results and a discussion of alternative interpretations.

2 Improved Macroeconomic Outcomes

We study a sample of 23 countries, ranging from large industrial countries to small developing ones.[4] Figure 1 presents a scattered plot of inflation and output variability for 21 of the 23 countries (Israel and Mexico excluded) in the sample, for two periods, 1982 to 1989 and 1990 to 1997. Inflation variability is measured as the squared deviation from 2%, while output variability is the deviation from a log-linear trend. All of our results are robust to measuring inflation variability as deviation from the period average.[5] We have fitted a hyperbolic curve through the points for each sub-period in order to show more clearly how things have changed.

We draw two conclusions from these data. First, there is the fact that the world is a more stable place. The average country has experienced a decline in both inflation and output variability — an unambiguous improvement in macroeconomic performance. Second, the shape of the curves clearly suggest the existence of a trade-off between inflation and output variability. We will not focus on that aspect of the data, but it is clearly evident in the picture.

Figure 2 presents the same information country by country. We see that for 21 of the 23 countries, including all of the members of the EU, inflation variability fell

[4]The list includes Australia, Austria, Belgium, Canada, Chile, Denmark, Finland, France, Germany, Ireland, Israel, Italy, Japan, Korea, Mexico, Netherlands, New Zealand, Portugal, Spain, Switzerland, Sweden, the United Kingdom, and the United States.

[5]For France and Portugal the first subperiod consisted of data from 1983:I-1989:IV, while for Korea and New Zealand we divided the sample into the subperiods 1984:I-1990:IV and 1991:I-1997:IV, as a result of data restrictions.

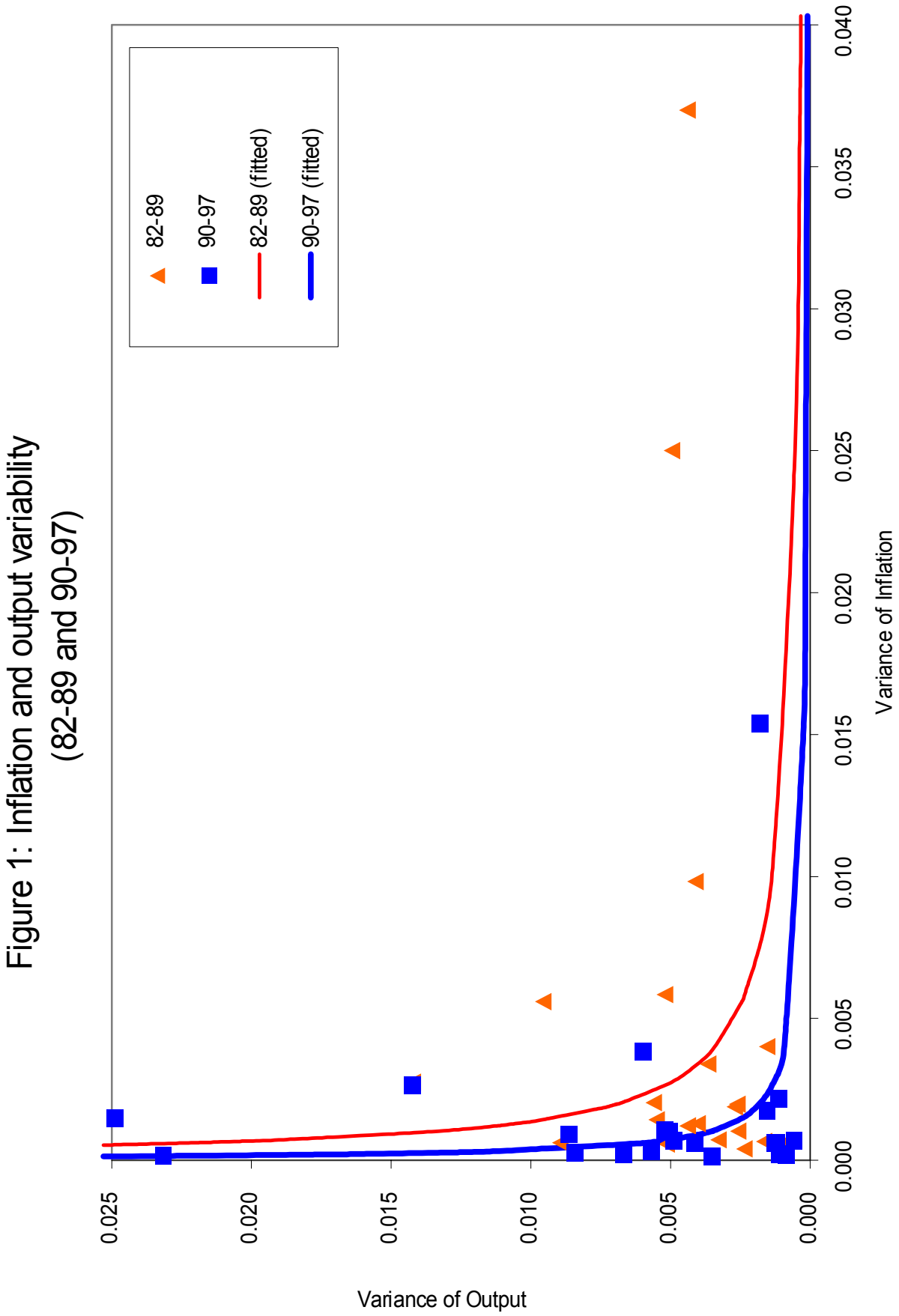
Figure 1: Inflation and output variability
(82-89 and 90-97)
82-89
90-97
82-89 (fitted)
90-97 (fitted)
0.025
0.020
0.015
0.010
0.005
0.000
Variance of Output
0.000
0.005
0.010
0.015
0.020
0.025
0.030
0.035
0.040
Variance of Inflation

between the 1980s and the 1990s. This surely reflects the increasing importance central banks now place on targeting inflation, either explicitly or implicitly.[6] Inflation variability rose in only two countries in the sample, Germany and Korea. Furthermore, output variability rose in 9 countries, 7 of which are in the EU. All of this is consistent with the conclusions in Cecchetti and Ehrmann (1999) that the shift to inflation targeting can move countries along an output-inflation variability frontier.

While we could proceed with the two-dimensional measure of macroeconomic performance, it is useful to combine them together to construct a single measure of increased stability. To do this, we begin by assuming that each country's central banker seeks to minimize the weighted sum of output and inflation variability. This social loss from unstable growth and inflation is given by:

$$\mathcal{L} = \lambda Var(\pi) + (1 - \lambda)Var(y) \tag{1}$$

where π and y are inflation and output, and the weight λ is a measure of the policymaker's inflation variability aversion.[7]

In order to make this summary measure of performance operational, we require a measure of λ. For this, we appeal to the work of Cecchetti, Flores-Lagunes and Krause (2001), who derive the degree of inflation variability aversion in 23 countries from estimates of each country's volatility frontier. Specifically, for each subperiod they estimate the frontier and perform a parallel shift such that the frontier will pass through the data. The estimate of λ follows from the slope of the (shifted) volatility frontier at this point. Unlike the procedure in Cecchetti and Ehrmann (1999), this technique does not assume policymakers are always operating on the inflation-output variability frontier.

Table 1 reports these estimates of the inflation variability aversion coefficients

[6] See Fry, Julius, Mahadeva, Roger, and Sterne (1999) for a discussion of the changes in central bank targeting procedures.

[7] In most circumstances, one assumes that the relative weight on inflation and output variability in the loss is given to the central banker by elected members of the government. In an inflation-targeting framework, the value of λ will be lower, the longer the horizon over which the central bank is instructed to bring inflation back to its target path.

Figure 2: Change in inflation and output variance

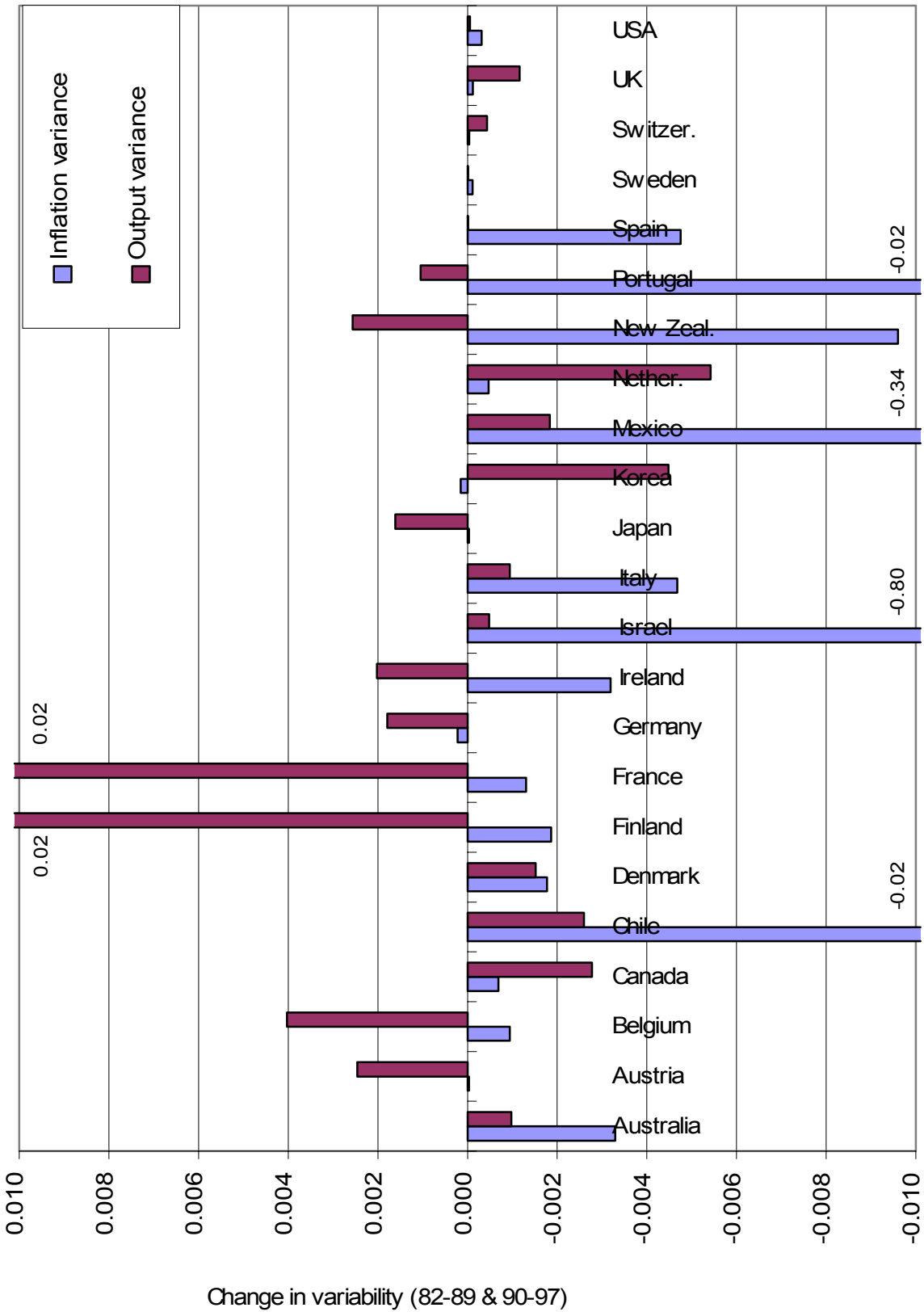

Table 1: Performance Gain

Country	1982:1 to 1989:IV		1990:1 to 1997:IV		Performance Gain
	Aversion to Inflation Variability	Value of the Loss	Aversion to Inflation Variability	Value of the Loss	
Austria	0.999	0.103	0.999	0.100	2.91%
Australia	0.999	0.401	0.869	0.069	82.78%
Belgium	0.994	0.134	0.999	0.029	78.39%
Canada	0.999	0.130	0.999	0.060	53.49%
Chile	0.390	1.741	0.812	1.284	26.30%
Denmark	0.969	0.199	0.971	0.023	88.35%
Finland	0.343	0.357	0.984	0.186	47.93%
France	0.470	0.368	0.981	0.020	94.54%
Germany	0.958	0.048	0.998	0.063	−30.52%
Ireland	0.345	0.357	0.990	0.026	92.80%
Israel	0.227	19.040	0.976	1.186	93.77%
Italy	0.253	0.856	0.880	0.184	78.53%
Japan	0.991	0.075	0.999	0.071	5.89%
Korea	0.994	0.206	0.306	0.145	29.65%
Mexico	0.151	6.229	0.165	0.905	85.48%
Netherlands	0.996	0.066	0.999	0.018	72.49%
New Zealand	0.797	0.866	0.999	0.023	97.31%
Portugal	0.160	0.817	0.951	0.395	51.69%
Spain	0.973	0.582	0.982	0.115	80.17%
Sweden	0.999	0.277	0.998	0.268	3.48%
Switzerland	0.694	0.097	0.931	0.067	31.14%
UK	0.980	0.190	0.999	0.176	7.39%
USA	0.997	0.063	0.999	0.033	48.69%

Value of the loss in each subperiod is the weighted average of inflation and output variability, with weight λ, times 100. Variability is measured as the squared deviation of the change in the log of output from the full-sample trend and the squared deviation of the change in the log of prices from two percent. The performance gain is the percentage change in the loss from the first to the second subperiod. A decline in the loss is improved performance, and is reported as a positive number.

and the value of the loss function (scaled up by a factor of 100) for the 23 countries in our sample. Using this comprehensive measure of performance, only one of the 23 countries -namely Germany- exhibits a decline. This can be explained by the need to adopt policies consistent with the Maastricht treaty's criteria for entry in the monetary union. For 15 countries, performance improved by between 45 and 95 percent. On average, the loss fell from 1.44 to 0.24. Excluding Israel, the improvement was nearly 70%, from 0.64 to 0.19. Furthermore, for Austria, Japan, Sweden and the U.K., performance improves by less than 10%.

What can explain these improvements in performance? In particular, how can we explain the differences across countries? Our main contention is that the cross-country variation is a consequence of changes in financial structure which provided the opportunity for improvements in monetary policy making. To explore this possibility, we now turn to a brief discussion of how it is that monetary policy affects inflation and real economic activity.

3 Financial Structure and the Transmission Mechanism

Central bankers all agree that their actions have affects on both inflation and the real economy. Most researchers accept this, but disagreement over the reasons continue today.[8] While traditional theories focus on the direct impact of interest rates or exchange rates, the more recent *lending view* concentrates on the importance of banks in transmitting monetary impulses to the real economy.

The lending view has two parts, one that focuses on the impact of policy changes on borrower balance sheets and a second that focuses on bank loans. In both, the effectiveness of policy depends on capital market imperfections that make it easier for some firms to obtain financing than others. Information asymmetries and moral

[8] A number of excellent and comprehensive surveys of the theories of the monetary transmission mechanism have appeared in recent years. These include Bernanke (1993), Gertler and Gilchrist (1993), Kashyap and Stein (1994, 1997), Hubbard (1995), and Cecchetti (1995).

hazard problems, together with bankruptcy laws, mean that the state of a firm's balance sheet has implications for its ability to obtain external finance.[9] By reducing expected future sales and by increasing the cost of rolling over a given level of nominal debt, policy-induced increases in interest rates (which are both real and nominal) cause a deterioration in the firm's net worth. Furthermore, there is an asymmetry of information in that borrowers (firms) have better information about the potential profitability of investment projects than creditors (banks). As a result, as the firm's net worth declines, the firm becomes less creditworthy because it has an increased incentive to misrepresent the riskiness of potential projects — an outcome that will lead potential lenders to increase the risk premium they require when making a loan. The asymmetry of information makes internal finance of new investment projects cheaper than external finance.

More important for the transmission mechanism per se is that some firms are dependent on banks for finance, and that monetary policy affects bank loan supply. A reduction in the quantity of reserves forces a reduction in the level of deposits, which must be matched by a fall in loans. Nevertheless, lower levels of bank loans will have an impact on the real economy only insofar as there are firms without an alternative source of investment funds.

Substantial empirical evidence supports the importance of both capital market imperfections and firm dependence on bank financing. Kashyap and Stein (1997) provide a summary of two types of studies. The first type suggests that banks rely to a substantial extent on reservable-deposit financing and that, for this reason, a contraction in reserves will prompt banks to contract their balance sheets, reducing the supply of loans. The second type establishes that there are a significant number of bank-dependent firms that are unable to mitigate the shortfall in bank lending with other sources of finance. Overall, recent research does imply the existence of a lending channel.[10]

[9] As emphasized by Kashyap and Stein (1994), this is true for both financial and nonfinancial firms.

[10] This is not to say that the traditional mechanisms, through interest rates and exchange rates, are not present as well. Unfortunately, it has proved to be very difficult to disentangle the individual

Cecchetti (1999) elaborates further on the importance of firms' dependence of bank loans for the effectiveness of policy changes. He looks at how differences in the size, concentration, and health of the banking systems, across a sample of 16 countries, are likely to affect the impact of monetary policy and concludes that "countries with many small banks, less healthy bank systems, and poorer direct capital access display a greater sensitivity to policy changes than do countries with big healthy banks and deep, well-developed capital markets."[11]

For our purposes here, the important conclusion is that the nature of the transmission mechanism is clearly influenced by the structure of a country's financial system. Furthermore, only in places where the banking system is free to react to market forces will it even be possible for policy to be transmitted through intermediaries. This immediately suggests that the ability of monetary policy to engage in stabilization will depend on the regulatory environment in which the banks function. It is to this issue that we now turn.

4 Regulation and Intermediation

The nature of financial regulation has a profound influence on the intermediation process. The overarching goal of such regulation is to insure the stability of the financial system. In doing so, governmental oversight has an affect both on the structure of the financial system and on the behavior of individual intermediaries.

Many regulations are subtle in both their intent and their effect. Others are not. For example, La Porta, López-de-Silanes, Vishny and Shleifer (1997, 1998) examine how a country's legal system is related to its financial structure. Investors provide capital to firms only if they believe they will get their money back. For equity holders, this means that they must be able to vote out directors and managers who do not pay them. For creditors and holders of bonds, this means that they must have authority to repossess collateral. Furthermore, these nominal legal rights must be accompanied

importance of the various channels of transmission.

[11] Cecchetti (1999), p. 2.

by confidence that the laws will be enforced. In countries where these protections are strong, equity and bond markets are broad and deep and primary capital markets will be important. By contrast, in those places were investor protections are weak, finance will come primarily through the banking system.[12]

The decision by governments to insure banking system liabilities either through direct ownership of banks or through deposit insurance is an pathway for regulation to affect intermediation. Cross-country differences in the extent to which governments guarantee deposits, implicitly or explicitly, have a clear impact on the nature of bank dependence and the extension of credit in an economy.

By insuring deposits, banks' liability holders are significantly less likely to request the return of callable deposits, reducing the chances of bank runs. But at the same time, deposit insurance subsidizes bank risk-taking activities and allows the payment of lower interest rates to depositors.[13] This channels money through banks, and away from financial markets. Direct state bank ownership has a similar impact.

The perverse effect of state-ownership of banks on the size and development of financial markets has been extensively discussed in the literature. Barth, Caprio and Levine (1999) look, among other aspects, at the relationship between ownership practices and the performance of the financial sector. The evidence presented in their paper points to a detrimental effect of state ownership of banks on financial development and the securities markets. La Porta, López-de-Silanes and Shleifer (2000) also discover an unfavorable effect of government ownership of banks on several financial development variables, consistent with the political view of government ownership of banks leading to a decrease in efficiency.

Consistent with this, in Cecchetti and Krause (2000) we observe that countries with an explicit insurance scheme in place have smaller external capital markets and, possibly, a lower number of publicly traded firms, once differences in production and

[12]Cecchetti (1999) discusses this in the context of the euro area.

[13]See Demirgüç-Kunt and Huizinga (1999) who use a cross-country sample to show that deposit insurance decreases rates of return paid by banks, reduces market discipline faced by banks and their managers, and increases banks' risk taking. Demirgüç-Kunt and Detragiache (1999) extend this analysis, finding that deposit insurance increases the probability of banking crises.

growth are controlled. Our model and empirical findings suggest that an increase in deposit insurance, either implicit or explicit, reduces equity issuance and may reduce the number of firms issuing equity. The reason for this is that increasing depositor's protection makes bank deposits more attractive than the (riskier) equity shares, requiring higher rates for the latter and resulting in a lower issuance of stocks.

The importance of state bank ownership on the size of the private loan market is easy to establish. To do this, using our sample of 23 countries, we look at the relationship between the share of banking system assets owned by the government and the size of bank loans (as a percentage of GDP).[14] Figure 3 presents a scatter diagram of data on these two quantities, for the year 1995, together with a simple regression line.

Consistent with the findings of Barth, Caprio and Levine (1999) and La Porta, López-de-Silanes and Shleifer (2000), we find a negative correlation. That is, countries in with higher government bank ownership have a lower level of overall credit extended to the private sector.

Taking this one step further, we look at the change from 1985 to 1995 in state bank ownership and its relationship with changes in outstanding bank credit. The result in Table 2 is fairly clear. Those countries in which the government has shed direct control of bank assets, and so the banking system has become less centralized, have experienced an increase of bank loans to the private sector.

Clearly, the regulatory system shapes the financial intermediation system in important ways. Given the importance of banks in the monetary transmission process, this leads us to conclude that regulation is important for monetary policy effectiveness. In particular, we expect that in countries where state-owned banks are important monetary policy will be weaker since the size and terms of government-controlled bank loans are commonly not market oriented.

When loans rates are not market determined, monetary policy's impact is clearly blunted. The consequences for private sector activity of a change in the short-term interest rate controlled by the central bank will have a lower impact on the lending of

[14]The appendix contains a full description of all of the data, as well as selected series.

Figure 3: State-Bank Ownership and Credit Market Size (1995)

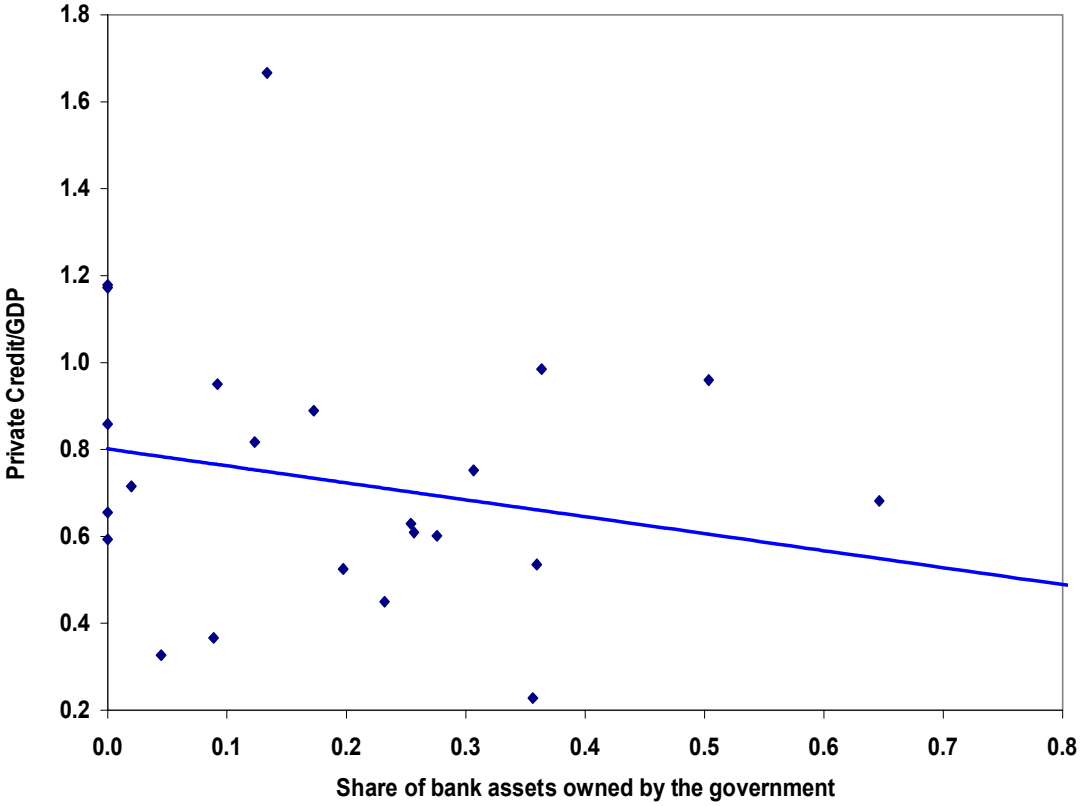

Table 2: Loans, State Bank Ownership and Deposit Insurance

Financial Market Variable	Average for		Change	Correlation of Change with Loans
	1985	1995		
Private Sector Loans/GDP	0.614	0.745	0.131	
State-owned Bank Assets	0.324	0.192	−0.132	−0.25
Explicit Deposit Insurance	0.522	0.783	0.261	−0.01

Values are the averages for 23 countries. For state-owned bank assets, the number are as a percentage of the total in the largest ten banks. For explicit deposit insurance, the reported value is the percentage of countries with an explicit system.

state-owned banks that it would on privately owned banks operating in a competitive environment. If the behavior of banks is unaffected by policy actions, there will be no lending channel to transmit monetary policy to the economy, leaving much less scope for policymakers to achieve their objectives.

Turning to deposit insurance, we expect bank loan financing to be relatively more important than equity financing in the presence of deposit insurance. This implies that countries which have adopted an explicit insurance system should exhibit firms with a higher dependence on bank loans as a means of financing. To study this possibility, using data from Table I of Demirgüç-Kunt and Detragiache (1999) we construct a measure of the evolution of each country's deposit insurance regime from 1985 to 1995. Our data is normalized so that '1' represents instituting an insurance system between 1985 and 1995, '0' represents no change, and '-1' the elimination of the explicit insurance system between 1985 and 1995.

Our expectation is that a shift toward an explicit insurance, for a given level of state bank ownership, will drive firms into the banking system, decreasing equity issuance and increasing bank dependence. The impact on the actual level of credit extended by banks to private firms is ambiguous. The results in Table 2 show that, between 1985 and 1995, the level of state bank ownership declined on average while the proportion of countries with explicit deposit insurance increased. Overall, the amount of private credit extended (relative to GDP) also rose. The results presented in the right-most column of the table suggest that the change in from banks to the private sector is negatively correlated with the change in state-owned bank assets, but is uncorrelated with the change in the deposit insurance system.

As we discuss in our earlier work, Cecchetti and Krause (2000), this does not mean that deposit insurance is irrelevant for financial structure. There we report evidence that the presence of deposit insurance affects the intermediation mechanism primarily through its impact on the size of equity markets. Countries with explicit deposit insurance have a external capital markets to GDP ratio to that is roughly ten percentage points lower than those that do not.[15] If deposit insurance reduces

[15]See Cecchetti and Krause (2000), Table 1.

the reliance of firms on equity financing, dependence on bank loans will rise. This strengthens the lending channel, broadening the effectiveness of monetary policy.

Overall, it is clear that changes in government involvement in the financial sector have precipitated important changes in the intermediation. The degree to which banking activity is driven by market mechanisms has changed in a number of countries, with potentially important consequences for the monetary transmission mechanism. In particular, we see that in a number of countries the state has shed its banking assets and restructured its deposit insurance system in ways that are likely to make for increased effectiveness of monetary policy. We now proceed to study whether these changes can be tied to both measured improvements in macroeconomic outcomes and changes in the efficiency of monetary policy.

5 Measuring the Efficiency Monetary Policy

In looking at the improvement in macroeconomic outcomes documented in Section 2 we noted several possible explanations. One alternative is that the combined reduction in output and inflation volatility is a consequence of improved monetary policy. That is, central banks may have become more competent and moved their economies closer to the output-inflation variability frontier. To study this possibility, we need to estimate the change in policy efficiency between 1980s and the 1990s.

To construct a simple measure of the change in central bank efficiency, we begin by assuming that central bankers move their interest rate instrument in a manner designed to minimize the simple weighted sum of output and inflation variability that is the loss $\mathcal{L}$ in equation (1). In carrying out their stabilization objective, the policymakers must take account of various types of unexpected events. For convenience, we divide these *shocks* into two groups: (1) those that move output and inflation in the same direction and we label *demand* shocks; and (2) those that move output and inflation in opposite direction and we label *supply* shocks. The policymaker's interest rate instrument is like a demand shock, as it moves output and inflation up and down

together.[16]

The best possible monetary policy will completely neutralize demand shocks, but faces a trade-off when confronted with supply shocks. Since supply shocks move output and inflation in opposite directions, a policymaker must decide whether to stabilize inflation, thereby destabilizing output even further, or the reverse. The decision depends on the tastes as embodied in the weight λ from the objective function.

Returning to the problem, we see that if policy is optimal, then the correlation between inflation and output (measured as deviations from the desired paths) will be minus one. This immediately implies that the product of the variances minus the squared covariance has a lower limit of zero.[17] Writing this as h, we study the properties of:

$$h(i) \equiv \sigma_y^2(i)\sigma_\pi^2(i) - \left(\sigma_{\pi y}(i)\right)^2 \tag{2}$$

where i is the time period over which $h(i)$ is computed. As $h(i)$ falls, monetary policy improves. We go on to examine the change in policy efficiency from the 1980s to the 1990s using:

$$e \equiv \ln\left[\frac{h(1)}{h(2)}\right] \ . \tag{3}$$

When policy efficiency increases, the measure e rises. Furthermore, and as we show in the appendix, this measure is robust to changes in the variance of demand and/or supply shocks that are common to all countries.[18]

Figure 4 presents our estimates for the policy efficiency gain in the 23 countries.[19] Using this measure, the monetary authorities of 19 countries have become more ef-

[16] See Cecchetti (2001) for an extended discussion of monetary policy viewed as a control problem.

[17] This is also true for the case in which the correlation is positive one, but as the derivation in the appendix shows, the measure that we actually use is unambiguous in that it declines only as efficiency improves.

[18] As we discuss in the appendix, the measure e robust to whether or not policy is credible. In fact, an increase in credibility is likely to be measured as an increase in efficiency.

[19] As we discuss in the appendix, can be interpreted in two ways. It is either the improvement in efficiency assuming that the variance of both demand and supply shocks is unchanged between the two subperiods, or it is a measure of the relative change in efficiency assuming that the change in the shock variances are the same across countries. Following the methods used to compute the performance gain in Section 2, we measure the efficiency gain using variance and covariance estimates computed as deviations from inflation of 2% and the full-sample log-trend of output.

Figure 4: Policy Efficiency Gain

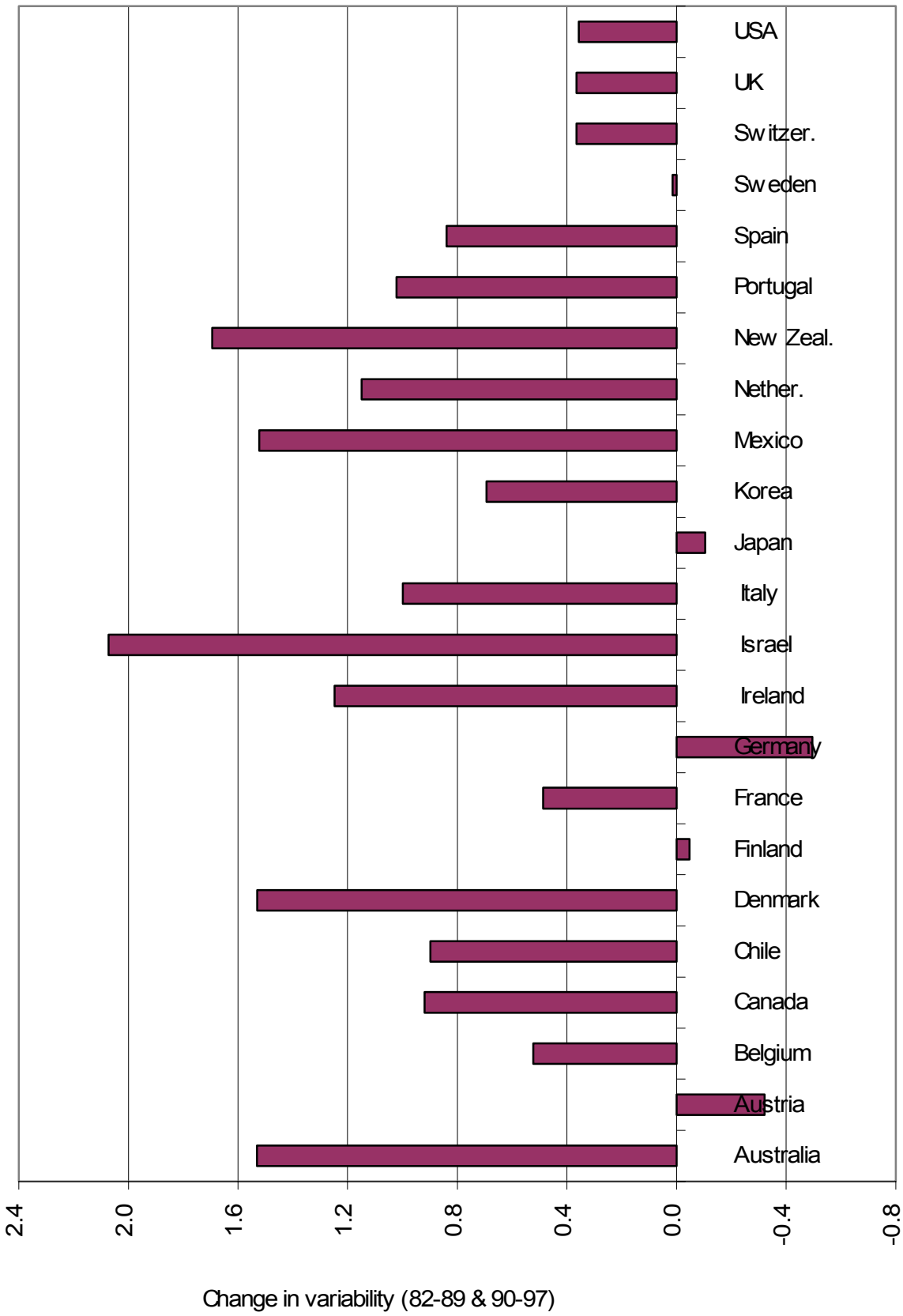

Table 3: Explaining the Gain in Monetary Policy Efficiency

Explanatory Variable	Full Sample (23 Countries)	Excluding Israel (22 Countries)
Intercept	0.571	0.464
(p-value)	(0.00)	(0.00)
Change in State-Owned Bank Assets	−0.263	−0.417
(p-value)	(0.51)	(0.27)
Change in Explicit Deposit Insurance	0.577	0.619
(p-value)	(0.01)	(0.00)
R^2	0.17	0.27

Results are for simple regressions of the gain in monetary policy efficient e plotted in Figure 4 on the change in the percentage of bank assets owned by the state and the change in the deposit insurance system P-values use standard errors robust to heteroskedasticity.

ficient in neutralizing shocks comparing the 1980s to the 1990s. The changes in Australia, Israel and New Zealand can be linked the adoption of explicit inflation targets. Improvements in the non-inflation-targeting European countries are likely linked to the desire to meet the qualification requirements for monetary union, while the decline in performance in Germany is almost surely the consequence of both unification and the necessary adjustment prior to EMU.

Our primary interest is in whether the distribution of changes in policy efficiency across countries can be explained by differences in the evolution of financial regulatory structures. To examine this, we simply regress the measure of improved monetary policy, e, on the change in the extent of state bank ownership and the change in explicit deposit insurance. Because it is such an outlier, we examine the case both with and without Israel. The results, reported in Table 3 show that point estimates are as we expect. That is, a decline in state bank ownership and switch to explicit deposit insurance are both associated with improvements in monetary policy.

We have now established the main links in our argument. The regulatory structure, especially direct state ownership of banking system assets and the character of

the deposit insurance system, affect the structure of finance. The lower the level of direct governmental ownership of banks, the more loans are extended to the private sector. Second, we have established that changes in financial structure have an impact on the scope of monetary policy to stabilize the economy. In this section we showed how improved efficiency of monetary policy, as measured by the extent to which policy neutralizes demand shocks, is linked to the certain key changes in the regulatory structure. We are now ready to return to the primary question raised earlier: Can changes in financial regulation, by allowing for more efficient central bank policy, explain the improved overall economic performance we have witnessed over the past two decades in a large major of countries? This is the subject of the next section.

6 Explaining the Performance Improvements

Do changes in the financial regulatory environment provide a partial explanation for the measured improvement in macroeconomic outcomes? We address this question in two different ways. First, we show that improved policy efficiency has led to stability. And second, we examine the relationship between the performance gain and the our measures of financial structure. Our expectation is that a reduction in direct governmental ownership of banks and introduction of explicit deposit insurance should enhance the stability of both inflation and output.

Figure 5 plots the performance gain (from Table 2) against the change in monetary policy effectiveness (from Figure 4). All observations yield values which are located within a range of [-0.50,1.69] for policy effectiveness and [-0.01,5.32] for improvement in macroeconomic performance, except for Israel, which is a clear outlier.[20] As has been the case all along, this suggests that Israel is sufficiently different from the other 22 countries in our sample that we should exclude it.

[20]The performance gain for Israel is 17.85 when the monetary authority's goal is to minimize the weighted sum industrial production variance around its average and inflation variance around a 2% target, while the measure of efficiency improvement yields a value of 2.07.

Figure 5: Macroeconomic Performance Gain and Change in Policy Efficiency

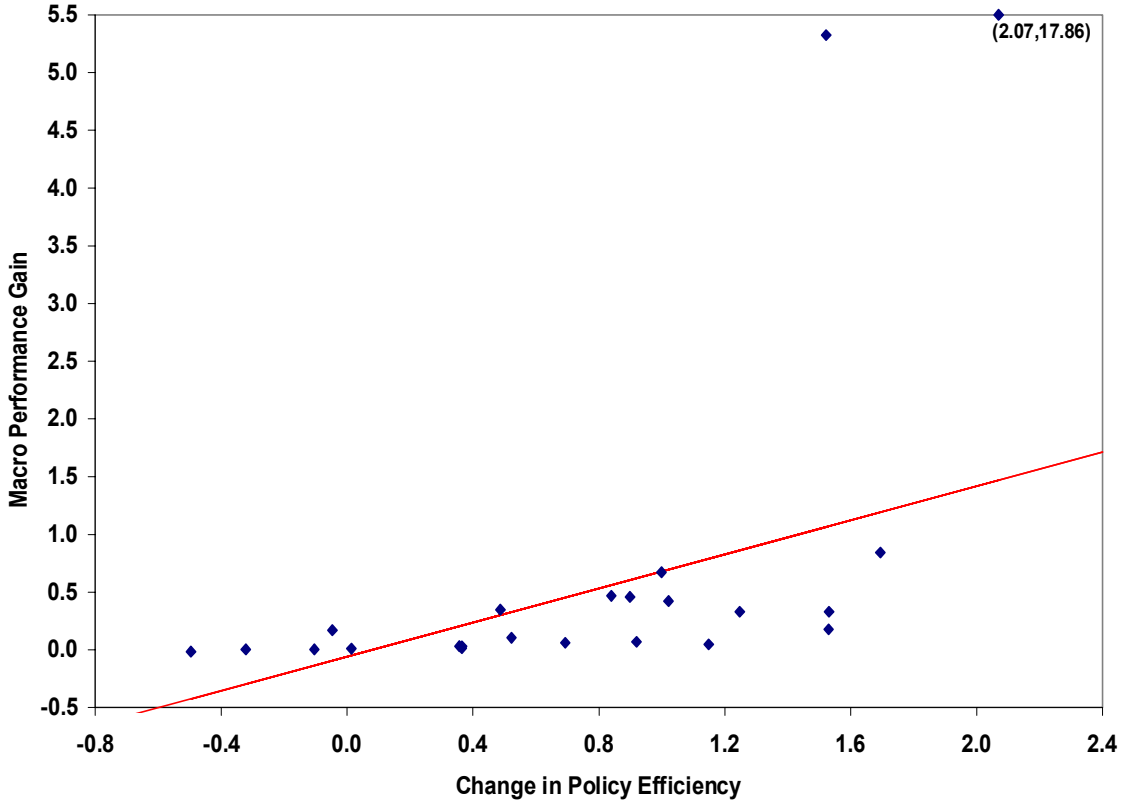

Table 4: Explaining the Performance Gain

Explanatory Variable	Full Sample (23 Countries)	Excluding Israel (22 Countries)
Intercept	1.13	-0.05
(p-value)	(0.32)	(0.71)
Change in State-Owned Bank Assets	−0.90	−2.61
(p-value)	(0.73)	(0.02)
Change in Explicit Deposit Insurance	−0.16	0.53
(p-value)	(0.85)	(0.16)
R^2	0.00	0.40

Results are for simple regressions of the performance gain from Table 1 on the change in the percentage of bank assets owned by the state and the change in the deposit insurance system. P-values use standard errors robust to heteroskedasticity.

The solid line plotted in Figure 5 is the bivariate regression line, excluding Israel. There is a clear positive slope, implying that countries with improvements in policy efficiency also experienced macroeconomic performance gains.

Turning to the direct relationship of changes in financial structure on changes in performance, we take the measures of performance gain reported in Table 1 and regress them on the changes in state-owned bank assets and deposit insurance system. Focusing on the second column, the results excluding Israel, we obtain the results we had hoped for. Countries that either reduced the level of direct state-bank ownership or instituted explicit deposit insurance experienced more profound macroeconomic improvements. That is, the coefficient estimates are of the expected sign and the reduced level of state-bank ownership is statistically significantly different from zero at the 5% level of better. Furthermore, these two variables are able to explain 40% of the variation in the performance data for this sample of 22 countries.

We note that these results are robust to a number of changes in the exact methods used to compute them. As we mentioned above, computing inflation variability as deviations from the mean of the two subsamples, rather than as deviations from 2%,

has virtually no impact on the results. We also examined the ability of alternative measures of the financial regulatory environment to explain the changes in performance. But, with the exception of the deposit insurance and state-bank ownership variables that we include, we were unable to discern any material changes that could have generated the results.[21]

How important are these effects? How can be gauge the importance of state-bank ownership and deposit insurance for stability? To do this we take the examples of Mexico and Chile, both of which instituted deposit insurance and reduced the percentage of bank owned assets between 1985 and 1995. Taking Mexico first, we see from Table 1 that macroeconomic performance improved by 85%, with the loss measure $\mathcal{L}$ falling from 6.23 to 0.90. Our estimates suggest that the implementation of deposit insurance accounts for 0.53, or 10% of the improvements, while the decline in government ownership of bank assets (from 100% in 1985 to 36% in 1995) for 1.68, or slightly over 30% of the decline.

For Chile, the impact of regulatory changes is equally dramatic. While the level of state bank ownership changed only modestly, from 26% to 20% of assets, Chile shifted to an explicit deposit insurance system. This easily accounts for the improvement in performance, from a loss of 1.74 to one of 1.28.

Overall, we conclude that these effects are large. In the case of Mexico, for example, decline in the loss that is related to two changes in the environment is roughly equivalent to a decline in the standard deviation of inflation from 62.7% in the 1980s to 24.3% in the 1990s (both assuming that the inflation objective is two percent). That is, we can trace the change in banking-system ownership and the institution of deposit insurance to a more than fifty percent reduction in inflation volatility.

7 Conclusions

Over the past twenty years, macroeconomic performance has improved worldwide. At the same time, financial systems have evolved. In particular, government

[21] See Table 12 of Barth, Caprio and Levine (1999).

intervention has changed. Looking across a sample of 23 developed and emerging markets countries we study the link between changes in governmental involvement in the financial system and more stable economic outcomes. Our findings suggest that reductions inflation and output volatility can be linked to a combination of reduced state ownership of commercial bank assets and the introduction of explicit deposit insurance.

We postulate that changes in financial regulation influence volatility through their impact on ability of central banks to use their policy tools. When the banking system is largely controlled by the government, there is little scope for monetary policy to stabilize activity. As the banks become privately owned, their lending practices respond to market incentives and monetary policy becomes more effective. When banks are private, central bank interest rate changes have the ability to affect the level of private lending. Only then, can policy makers do their job. Using a new measure of monetary policy efficiency, we are able to establish this relationship in the data.

There are surely many alternative interpretations that could be given to the collection of facts we have assembled here. For example, it could be that there is some fundamental driving force that is reduced state ownership of commercial bank assets, introduction of explicit deposit insurance, improved monetary policy efficiency and macroeconomic stability all at the same time. A candidate would be the presence of financial crises arising from generally poor fiscal and regulatory policies prior during the 1980s. These crises could have led to all of these changes simultaneously.

It is difficult to rule out the possibility that some combination of local and global phenomena caused the regulatory and policy changes as well as reduced volatility. If this were so, our interpretation would be incorrect. We do believe, however, that our results are suggestive that the measure improvements in monetary policy efficiency are a result of changes in financial structure, and that it is these that produced the more stable output and inflation share world-wide.

Appendix I: Measuring Policy Efficiency

In this appendix we derive the measure for policy effectiveness $h(i)$ in equation (2), as well as the change in policy effectiveness e in equation (3). To do this, we consider the policymaking as an optimal control problem in which central bankers set their interest rate instrument in order to minimize the loss given by equation (1), subject to the constraints that are imposed by the structure of the economy.

To begin, we assume that policymakers minimize the loss function

$$\mathcal{L} = E[\lambda(\pi_t - \pi^*)^2 + (1-\lambda)(y_t - y^*)^2] \ , \tag{1}$$

where E denotes the mathematical expectation, π is inflation, y is the (log) of aggregate output, π^* and y^* are the desired levels of inflation and output, and λ is the relative weight given to squared deviations of output and inflation from their desired levels.[22]

Minimization of this loss requires knowledge of the determinates of deviations of output and inflation from their desired levels. We assume that two random shocks push y and π away from y^* and π^*. The first shock — the aggregate demand shock (d) — moves output and inflation in the same direction; the second shock — the aggregate supply shock (s) — moves output and inflation in opposite directions. Policy is only capable of moving output and inflation in the same direction, and so is analogous to an aggregate demand shock.

A simple textbook aggregate demand and aggregate supply is sufficient for the task at hand.[23] The aggregate demand curve is the negative relationship between $(\pi - \pi^*)$ and $(y - y^*)$ that is shifted by the demand shock (d) and interest rate policy changes (r):

$$\pi - \pi^* = -\omega(y - y^*) - \delta(r - d) \ . \tag{2}$$

[22] An alternative specification of the loss function would include interest rate variability as a policy concern. This would imply that interest rate volatility should have fallen in countries with improved performance. However, this is not the case in the data.

[23] Romer (2000) provides a very description of how to derive this simple model.

where ω is the slope coefficient.

Analogously, aggregate supply is the positive relationship between inflation deviations and output deviations that is shifted by the supply shock (s). We can write this as

$$\pi - \pi^* = -\frac{1}{\gamma}(y - y^*) - \beta s \ . \tag{3}$$

Normalizing δ and β to be specific functions of γ and ω, we can write the reduced form of the system (2) and (3) as

$$y - y^* = -\gamma(r - d) + s, \tag{4}$$

$$\pi - \pi^* = -(r - d) - \omega s \ , \tag{5}$$

where δ and β have been chosen to yield this simple form.

The quadratic objective and linear economic structure means that the optimal policy response to demand and supply shocks is a simple linear rule. That is, the instrument response is of the form

$$r = ad + bs, \tag{6}$$

where a and b are the degree to which policy reacts to the two shocks. Minimizing the loss, subject to the constraint imposed by the structure of economy, yields optimal values for the reaction parameters a and b, which we label $a*$ and b^*. These are simply

$$a^* = 1 \tag{7}$$

$$b^* = \frac{-\lambda\omega + (1 - \lambda)\gamma}{\lambda + (1 - \alpha)\gamma^2} \ . \tag{8}$$

An optimal policy has two parts, first the authorities completely neutralize all demand shocks, and second they accommodate supply shock depending on structural parameters (ω, γ) and their preferences (λ).

We measure efficiency by estimating how close outcomes are to those that would

be implied by this optimal policy. To derive a measure, first note that for any policy the variances of output and inflation, as well as their covariance are given by

$$\begin{aligned}
\sigma_y^2 &= E(y-y^*)^2 = (1-\gamma b)^2\sigma_s^2 + \gamma^2(a-1)^2\sigma_d^2 && (9)\\
\sigma_\pi^2 &= E(\pi-\pi^*)^2 = (\omega+b)^2\sigma_s^2 + (a-1)^2\sigma_d^2 && (10)\\
\sigma_{y\pi} &= E(y-y^*)(\pi-\pi^*) = -(1-\gamma b)(\omega+b)\sigma_s^2 + \gamma(a-1)^2\sigma_d^2 \ , && (11)
\end{aligned}$$

where σ_s^2 and σ_d^2 are the variances of aggregate supply and aggregate demand shocks respectively.

Our measure of efficiency is based on the quantity

$$h = \sigma_y^2\sigma_\pi^2 - [\sigma_{y\pi}]^2 \ . \tag{12}$$

If policymakers adopt the optimal policy, this is zero. That is $h^* = 0$, as policymakers will eliminate all aggregate demand shocks, leaving only aggregate supply shocks which generate a correlation of minus one between output and inflation. The measure h is based on the coefficient of variation of inflation and output, and will be zero when they are perfectly correlated.

In general,

$$h = \gamma^2(a-1)^2[(1-\gamma b)^2 + (\omega+b)^2)]\sigma_s^2\sigma_d^2 \ . \tag{13}$$

Looking at (13) we see that closer a is to $a^* = 1$, the closer h is to zero. It is also true that h declines with both σ_s^2 and σ_d^2. As the world becomes calmer overall this measure of the level of efficiency appears to decline. We discuss how we handle this issue below.

We study the change in h by taking the log of the ratio of its level in the first period to that in the second. That is, we look at

$$\begin{aligned}
e \equiv \ln\left[\frac{h(1)}{h(2)}\right] &= \ln\{\gamma(1)^2(a(1)-1)^2[(1+\gamma(1)b(1))^2 + (\omega(1)+b(1))^2]\} \quad (14)\\
&\quad - \ln\{\gamma(2)^2(a(2)-1)^2[(1+\gamma(2)b(2))^2 + (\omega(2)+b(2))^2]\}\\
&\quad + \ln\{\sigma_s^2(1)\sigma_d^2(1)\} - \ln\{\sigma_s^2(2)\sigma_d^2(2)\}
\end{aligned}$$

where $h(i)$ is the value of h is period i. As is clear from (14), e can change for several reasons. First, rises as a moves closer to a^*. This is the effect that we wish to isolate. Unfortunately, a change in the variance of demand and supply shocks, in particular a decline in $\sigma_s^2\sigma_d^2$, will also cause e to increase. But if we assume that the change in $\sigma_s^2\sigma_d^2$ is common to all of the countries in our sample, then the cross-country variation in e gives us a measure of the relative improvement in policy efficiency allowing us to focus on the cross-sectional determinates of e.

It is worth making two observations about our measure e. First, if either shocks are not perfectly observable or if policy can only react with a lag, then it will be impossible to completely neutralize demand shocks. In this more realistic case, it will be impossible for policy makers to adjust their instrument to insure that $(\pi - \pi^*)$ and $(y - y^*)$ are perfectly negatively correlated, and so h^* will deviate from zero. Fortunately, this does not affect our measure of the *change* in policy efficiency.

Finally, we note that our measure of efficiency is will be related to changes in the credibility of policymakers but not its level. If a policymakers becomes more credible, then this will reduce the inflation bias and generate a movement toward the efficiency frontier. Lack of credibility itself, however, should not have an impact on the ability of a skillful central banker to neutralize demand shocks.

Appendix II: Data

1. Inflation and Output data for Austria, Belgium, Denmark, Finland, France, Germany, Ireland, Italy, Netherlands, Portugal, Spain, Sweden and the United Kingdom are from Datastream; those for Australia, Canada, Japan, Mexico, New Zealand, Switzerland and the United States are taken from the OECD Main Economic Indicators. Data for Chile are from the Central Bank of Chile's WWW-homepage (inflation), and from DRI (industrial production); Israeli data are taken from DRI (industrial production, and inflation). Korea's data are taken from IFS (industrial production) and DRI (inflation). For France and Portugal the first subperiod consisted of data from 1983:I-1989:IV, while for Korea and New Zealand we divided the sample into the subperiods 1984:I-1990:IV and 1991:I-1997:IV, as a result of data restrictions.

2. Loans/GDP data was obtained from the International Financial Statistics Yearbook, edited by the IMF, by dividing the sum of entries 32d-g by entry 99b.

3. Data on Bank Assets Owned by the State are from Table 2 of La Porta, López-de-Silanes and Shleifer (2000), which measures the percentage share of the assets of the top 10 banks in a given country owned by the government of that country.

4. Data on Deposit Insurance Index are from Table I of Demirgüç-Kunt and Detragiache (1999).

Table A1: Selected Data

	Bank Loans/GDP		Percentage of Bank Assets Owned by the State		Explicit Deposit Insurance	
Country	1985	1995	1985	1995	1985	1995
Australia	0.432	0.817	0.230	0.123	0	0
Austria	0.732	0.959	0.637	0.504	1	1
Belgium	0.291	0.601	0.276	0.276	1	1
Canada	0.458	0.593	0.000	0.000	1	1
Chile	0.593	0.525	0.255	0.197	0	1
Denmark	0.491	0.366	0.174	0.089	0	1
Finland	0.688	0.752	0.307	0.307	1	1
France	0.822	0.889	0.751	0.173	1	1
Germany	0.860	0.985	0.364	0.364	1	1
Ireland	0.267	0.326	0.045	0.045	0	1
Israel	0.576	0.681	0.646	0.646	0	0
Italy	0.511	0.535	0.654	0.360	0	1
Japan	1.047	1.179	0.000	0.000	1	1
Korea	0.514	0.629	0.447	0.254	0	0
Mexico	0.107	0.228	1.000	0.356	0	1
Netherlands	0.708	0.950	0.092	0.092	1	1
New Zealand	0.363	0.859	0.235	0.000	0	0
Portugal	0.647	0.609	0.904	0.257	0	1
Spain	0.673	0.715	0.020	0.020	1	1
Sweden	0.460	0.449	0.279	0.232	0	0
Switzerland	1.464	1.666	0.134	0.134	1	1
UK	0.708	1.172	0.000	0.000	1	1
USA	0.704	0.655	0.000	0.000	1	1
Averages						
All Countries	0.614	0.745	0.324	0.192	0.522	0.783
Excluding Israel	0.616	0.748	0.309	0.171	0.545	0.819

References

Barth, James R., Gerald Caprio Jr. and Ross Levine (1999), "Banking Systems Around the Globe: Do Regulation and Ownership Affect Performance and Stability?", World Bank, unpublished manuscript.

Bernanke, Ben S. and Alan S. Blinder (1988). "Credit, Money and Aggregate Demand", *American Economic Review,* **78(2)**, pp. 435-439.

Bernanke, Ben S. and Alan S. Blinder (1992). "The Federal Funds Rate and the Channels of Monetary Transmission", *American Economic Review,* **82(4)**, pp. 901-921.

Bernanke, Ben S. and Mark Gertler (1989). "Agency Cost, Net Worth and Business Fluctuations", *American Economic Review,* **79(1)** , pp. 14-31.

Bernanke, Ben S. and Mark Gertler (1995). "Inside the Black Box: The Credit Channel of Monetary Policy Transmission", *Journal of Economic Perspectives,* **9(4)**, pp. 27-48.

Cecchetti, Stephen G. (1995). "Distinguishing Theories of the Monetary Transmission Mechanism", *Federal Reserve Bank of St. Louis Economic Review,* pp. 83-100.

Cecchetti, Stephen G. (1999). "Legal Structure, Financial Structure, and the Monetary Transmission Mechanism", NBER Working Paper 7151.

Cecchetti, Stephen G. (2001). "Making Monetary Policy: Objectives and Rules," *Oxford Review of Economic Policy* Vol. 16 No. 4, Winter, forthcoming.

Cecchetti, Stephen G. and Michael Ehrmann (1999). "Does Inflation Targeting Increase Output Volatility? An International Comparison of Policymakers' Preferences and Outcomes", NBER Working Paper 7426.

Cecchetti, Stephen G., Alfonso Flores-Lagunes and Stefan Krause (2000). "Has Monetary Policy Become More Efficient In Mexico?", Banco de Mexico, Research Document 2000-09.

Cecchetti, Stephen G., Alfonso Flores-Lagunes and Stefan Krause (2001). "Has Monetary Policy Become More Efficient: A Cross-Country Analysis", Unpublished paper.

Cecchetti, Stephen G. and Stefan Krause (2000). "Deposit Insurance and External Finance", Unpublished paper.

Demirgüç-Kunt, Asli and E. Detragiache (1999), "Does Deposit Insurance Increase Banking System Stability? An Empirical Investigation", Unpublished paper.

Demirgüç-Kunt, Asli and Harry Huizinga (1999), "Market Discipline and Financial Safety Net Design." Unpublished paper.

Fry, Maxwell, DeAnne Julius, Lavan Mahadeva, Sandra Rogers, and Gabriel Sterne, "Monetary Policy Framework in a Global Context," Bank of England, Centre for Central Banking Studies, unpublished manuscript, June 1999.

Gertler, Mark, and Simon Gilchrist. "The Role of Credit Market Imperfections in the Monetary Transmission Mechanism: Arguments and Evidence." *Scandinavian Journal of Economics* 95 (1993): 43–64.

Kashyap, Anil K and Jeremy C. Stein (1994). "Monetary Policy and Bank Lending", in *Monetary Policy*, N. G. Mankiw, Ed., Chicago, Ill.: University of Chicago Press for NBER.

Kashyap, Anil K and Jeremy C. Stein (1997). "The Role of Banks in Monetary Policy: A Survey with Implications for the European Monetary Union",*Federal Reserve Bank of Chicago Economic Perspectives,* pp. 2-18.

King, Mervyn 'Challenges for Monetary Policy: New and Old", in *New Challenges for Monetary Policy*, Proceedings of the symposium sponsored by the Federal Reserve Bank of Kansas City, August 1999, 11-57.

La Porta, Rafael, Florencio López-de-Silanes, Andrei Shleifer, and Robert W. Vishny. "Legal Determinants of External Finance", *Journal of Finance* 52 (July 1997): 1131-50.

La Porta, Rafael, Florencio López-de-Silanes, Andrei Shleifer and Robert W. Vishny (1998), "Law and Finance", Journal of Political Economy, 106, 1113-1155.

La Porta, Rafael, Florencio López-de-Silanes and Andrei Shleifer (2000),"Government Ownership of Banks", NBER Working Paper No. 7620.

Romer, David, "Keynesian Macroeconomics without the LM Curve", *Journal of Economics Perspectives* 14 (Spring 2000) 149-169.