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Why Have Some Monetary Reforms Succeeded and Others Not? – An Empirical Assessment

by
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Abstract:

Monetary history is characterised by crisis and reform. The paper is dedicated to an explanation of what makes monetary reforms successful. A cross-sectional econometric analysis is chosen to deal with this problem. It is based on a standard macroeconomic model of commitment and credibility. As the dependent variable, we calculate a post-reform inflation rate. The exogenous variables are the degree of legal commitment and the constraining influence of institutions. The paper allows for the conclusion that monetary commitment, the consideration of institutional constraints and abstinence from the money press are crucial for the success of a monetary reform.

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I.   The Problem

Although the consciousness for monetary stability has grown in the last two decades, many countries still suffer from inflation. The need for monetary stabilisation is still prevalent. Venezuela as well as some Eastern European countries are currently discussing options for new monetary regimes. At the end of the 20th century, one can look back on approximately 70 monetary reforms since World War I. Many were successful, some failed. An eventual failure reduces the credibility of further efforts to stabilise the economy. Thus, to avoid future failures it makes sense to analyse past monetary reforms carefully.

Typically, a monetary reform is necessary after a period of severe inflation, sometimes hyperinflation. In most cases, high inflation is caused by the inability of the government to cover its expenditure without printing money. This causes inflation as well as future inflationary expectations in the public. The announcement of a monetary reform may lead to dynamic inconsistency if the public does not believe in the announcement. Therefore, the success of a monetary reform may depend not only on the choice of the right regime, but also on other factors. The hypothesis developed here is that the institutional setting in the country or its economic order respectively plays a major role. The relationship of monetary commitment and institutions is subject to closer scrutiny.

In the next section, we theoretically explain the incentives of a monetary policymaker to inflate after a monetary reform. These considerations form the basis for an econometric model to estimate the determinants of success and failure of monetary reforms. We introduce the econometric model in section III. In section IV, we present the results of a cross-sectional analysis using a sample of 29 reforms after World War II. The results are discussed in section V. The final section is dedicated to economic policy conclusions.

II.   Theoretical Considerations

The theoretical analysis begins at a point in time of severe inflation. However, we assume that a consensus about the benefits of price level stability and the need of disinflation has been reached within the society.[1] Methodically, we construct an objective function for the policymaker which he seeks to maximise under certain constraints (Barro 1983). These are direct costs of inflation and costs of expected inflation. The constraints are

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[1]   Végh (1995) shows that consensus can be reached more easily after a hyperinflation than after chronic inflation.

politically best considered by the government through committing to a monetary regime. The choice of monetary policy is in fact the choice of a set of rules (Brennan and Buchanan 1981, p. 65). Thus, commitment is made by governments rather than by monetary policymakers such as central bankers.[2] The main goal of commitment is to diminish inflationary expectations. We suppose that the government as well as the public have rational expectations. The public uses all information available in period s (I_s) to form expectations about the rate of inflation in period $s+1$.

We assume that the main reason for high inflation was the government's need for revenues (Bernholz 1995, pp. 263f). Other sources of revenues such as income tax or value added tax proved insufficient to cover the government's expenditure.[3] Therefore, it seemed attractive for the government to increase the money supply. It tried to issue enough money to maximise the amount of seigniorage S.

$$(1) \qquad Z = \delta S - \phi(\pi, \pi^e) \to \max_{\pi}{}^4,$$

where: $\dfrac{d\phi}{d\pi} > 0$ and $\dfrac{d\phi}{d\pi^e} > 0$.

The weight the government places on seigniorage in (1) is denoted by δ with $\delta \geq 0$. We define $\phi = \exp(\pi^2 + k(\pi^e))$ where $k(\pi^e)$ describes the costs of expected inflation. Increasing expected inflation raises the political costs associated with inflationary expectations. The government takes the expected inflation rate as given. The fact that actual inflation enters the cost function in a quadratic form also takes into account the cost of deflation. Thus the objective function becomes:

$$(2) \qquad Z = \delta\pi \exp(-\alpha\pi^e) - \exp(\pi^2 + k(\pi^e)).$$

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[2]   Cukierman (1992, p. 53) also concludes that this is adequate. See also McCallum (1997).

[3]   Another motive of the government can be debt reduction which – on the other hand – can be incorporated into equation 1. Instead of raising revenues to pay off debt, the debt will be reduced via money growth.

[4]   Alternatively, a loss function could be minimised.

Equation (2) can be maximised with respect to π. The first-order condition is given by $\frac{dZ}{d\pi} = \delta \exp(-\alpha\pi^e) - 2\pi \exp(\pi^2 + k(\pi^e)) \overset{!}{=} 0$. Rearranging this condition finally yields:

$$(3) \qquad \delta \frac{M}{P} = 2\pi \exp(\pi^2 + k(\pi^e)).$$

Equation (3) shows that the optimal inflation rate in this setting can only be derived implicitly. It can be rearranged to (4) which can be seen as a basic equation for an econometric analysis:

$$(4) \qquad \ln 2\pi + \pi^2 = \ln \delta + \ln(M/P) - k(\pi^e).$$

The theoretically interesting factor in (4) is $k(\pi)^e$, reflecting the costs of inflationary expectations. These can be increased by a commitment to a monetary regime designed to keep inflation low. In case of reneging, the commitment has to generate high costs for the policymaker to be credible (Barro and Gordon 1983). The costs of commitment can be specified in different ways. In the next section, we distinguish three options.

III. The Econometric Model

a) Specification of costs of commitment

In this subsection, the expression $k(\pi^e)$ is further specified. There are three options to think of. In the first specification the costs of inflationary expectations are set equal to the degree of legal monetary commitment C.

$$(5) \qquad k(\pi^e) = C.$$

The variable C is a composed index, restricted between 0 and 1. It consists of 10 criteria with 12 components which are described in detail in *Table A2* of Appendix 1.[5] It is calculated as the unweighted and weighted average of these criteria. The unweighted index of commitment C_{uw} attributes the same weight to each of the ten criteria. In contrast, the weighted index C_w attributes more weight to the objectives of monetary

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[5]   See also Freytag (2001).

policy, governmental influence, external obligations, convertibility and limitations on lending to the government. Less weight is given to appointment and dismissal procedures, competitive elements, regulatory issues and accountability (*Table A1*). The index of commitment, thus, reflects a monetary regime, such as a central bank system or a currency board. The calculation of the index is comparable to the index of central bank independence as calculated by Cukierman (1992, p. 381). Theoretically, it has a negative impact on inflation. It has to be emphasised that *C* reflects legal commitment. It does not measure the de facto monetary regime.

A legal commitment is ceteris paribus not a sufficient condition for success. There might be constraints which do not allow the commitment to become credible. To give an example: in a country with perfect unionisation and collective bilateral wage negotiations, the government introduces a currency board to reduce the annual inflation rate from 200 per cent close to zero inflation. Now presume the negotiators do not consider the case of zero inflation while bargaining. This will cause unemployment to rise heavily unless the government inflates moderately. It then has the choice to follow a sustainable monetary policy (with rising unemployment) or to give up the currency board (with declining credibility). Taking the labour market regime into account from the beginning, would certainly lead to a different monetary regime through the reform.

Consequently, the second specification adds in the institutional setting in a country, consisting of formal and informal as well as politically created (economic order) and spontaneously evolved institutions. It is modelled as a number of institutional factors (*IF$_i$*) also restricted to values between 0 and 1 (Appendix 2).[6] We identify six institutional factors:

- *Political stability* (*PS*) implies that a political system is stable rather than long-term survival of a party in government. It is composed of three elements: unsuccessful irregular executive transfers (coup d'état), successful irregular executive transfers and political reprisals in the year of monetary reform.

- An indicator of *fiscal stability* (*FS*) should meet two conditions. Ideally, it should not be based exclusively on historical performance, and it should also be calculable. The indicator is derived from the fiscal balance (revenues minus expenditure) of the state which is divided by the GDP.

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[6]   There is one exception, namely *OP2* (see Appendix 2).

- *Labour market flexibility* (*LM*) is ideally measured by an index giving evidence of the duration of unemployment and the speed, with which structural change is managed on the labour market. A lack of reliable data forces us to use an alternative, namely the gross shift between sectors in history instead of analysing labour market regimes. We thus look at the actual flexibility of the labour force, which may be affected by several factors, e.g. the labour market regime, but also technological change and the state of development a country is in.

- *Openness* (*OP*) of the country is restricted to trade (exports plus imports).

- *Public attitude to inflation* (*POI*) is comprised of past experience and actual regulations. The former inflation record is especially relevant for a country after a hyperinflation. People are very sensitive as regards stability: since they know the cost of inflation on average they strongly oppose another hyperinflation. Elements forming the measure are past inflationary experience, indexation and price freezes. In transition economies, however, the past inflation experience may be too little to form a collective memory.

- If a fixed exchange rate regime is chosen, it makes sense to also consider *properties of the reserve currency* (*RC*). It should not only be chosen to import stability, but also to protect the reform country from external shocks.

Alternatively to these factors, the index of economic freedom can be applied. The measurement of economic freedom is similar to the other variables. The index of economic freedom is the average of a number of criteria like trade policy regime, tax policy, monetary policy etc. (Gwartney and Lawson 1997 and Gwartney, Lawson and Samida 2000). Naturally, to be useful for the goal of our analysis, the criteria for monetary policy have to be eliminated from both indexes since monetary commitment has already been considered. Moreover, it is necessary to avoid statistical interference.

These institutional factors are explained in detail in Appendix 2. Their theoretical impact on inflation is negative, i.e. the higher political stability, fiscal stability, labour market flexibility, openness and public opposition to inflation are, the lower is the optimal inflation rate for the policymaker. The variable *RC* needs more description: it is high when the choice of the reserve currency is likely to protect the country from exogenous shocks. This is given if a high share of foreign trade is either with the reserve country itself or with other countries having also fixed their exchange rate

towards the reserve country (Freytag 1998). The expected sign is negative, i.e. high protection from external shocks reduces inflation.

(6) $k(\pi^e) = C + IF_1 + \ldots + IF_n$.

The third specification models the relation between commitment and institutions by calculating the costs of commitment as a function of the difference between the degree of commitment and the average of the institutional factors *i*, all restricted to values between 0 and 1. The costs are the higher, the smaller the difference between the level of commitment *C* and the average level of the institutional factors IF_i. In other words: a high degree of commitment is likely to stabilise expectations if it is accompanied by high political stability, fiscal stability etc. It is less likely so if there are huge differences between the degree of legal commitment and the actual institutional setting. The quadratic form implies that big differences will cause high costs and that all summands are positive. As a result, the costs of commitment decrease as compared to its highest possible costs not only if the degree of commitment is too low, but also if it is too high. To take them into account properly, we specify the costs of commitment as follows:

(7) $k(\pi^e) = \dfrac{1}{(C - \dfrac{\sum_{i=1}^{n} IF_i}{n})^2}$.

To sum up: the first specification does not allow for a judgement of how credible commitment is. The second corrects for institutional factors, but the relation between commitment and these factors is not close at all. Theoretically most appealing, in the third case $k(\pi^e)$ is modelled as an ex-ante proxy for credibility. Credibility itself depends on how good the chosen commitment harmonises with the institutional setting in the country. The better the degree of commitment suits the institutional setting, the higher the credibility of the reform and the lower the inflation rate are.

b) Other determinants of the success of monetary reform
    Seigniorage. In the theoretical model, the success of the reform also hinges on the degree to which the government needs seigniorage (δ) and on the demand for money (*M/P*). An actual attitude of the government towards

seigniorage δ, naturally, cannot be observed.[7] Instead, a measure of seigniorage itself has to be applied. There is no clear concept of seigniorage, the difficulty being to link monetary and fiscal aspects. Klein and Neumann (1990) incorporate both aspects and show that the correct magnitude of seigniorage transferred to the government cannot be determined by a simple formula such as the Cagan-type we implicitly used in the theoretical considerations ($S = mL(\pi^e)$) (Gagan 1956). The same holds for the two concepts of seigniorage which are generally used, the so-called opportunity cost concept and the monetary seigniorage concept. Instead, a correct measure of seigniorage has to consider legal, institutional and operational details of money creation (Klein and Neumann 1990). Only then the contribution of seigniorage to the public budget in different countries can be made fully comparable.

The demand for real money is defined as $L(\pi^e) = \exp(-\alpha\pi^e) = M/P$. As we cannot observe $(-\alpha\pi^e)$ we have to operate with M/P. However, both *M* and *P* are already incorporated in other variables. *M* is part of any measure of seigniorage, whereas *P* is a component of the endogenous variable, the inflation rate. Thus, multicollinearity is very likely to occur. Therefore, one remedy is to not include the demand for money. The technique of dropping a variable is one possible answer to this problem, but not the best since information disappears, if the variable's estimators differs from zero (Kennedy 1992, pp. 180-186).

An alternative is to form a principal component, i.e. a composite variable consisting of the two multicollinear variables (ibid.). In a heuristic way, this is done constructing the variable *SEIGN*. It is calculated as the annual increase in base money over the sum of public revenues and the annual increase in base money for the same year (see Appendix 2). Thus, it comprises the information about the demand for money and the dependence on seigniorage. This can be seen when looking at the expected sign of both variables. Both the reliance on seigniorage δ and demand for real money (*M/P*) positively contribute to post-reform inflation (4.11): $\ln 2\pi + \pi^2 = ...\ln\delta + \ln(M/P) + ... = ...\ln\delta + \ln M - \ln P + ...$. The variable *SEIGN* includes both δ and *M* with the theoretically shown direction of causation. We add *lnP* to the left hand side, so that *P* is included in the dependent variable, again having the theoretically expected sign. Next, we approximate *Seigniorage* $\approx \ln M + \ln \delta$ respectively and find that inflation positively depends on *SEIGN*. It is a good approximation and allows to not

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[7]   This holds regardless of whether or not the government has committed to a rule that abolishes direct loans received from the monetary authority.

compose a special variable for the demand for real money. The theoretically expected impact of this variable on the success of the reform is negative, that is the expected influence on inflation is positive.

International capital mobility. One factor that may also be important for the policymakers' calculus, is the degree of capital mobility. Capital mobility is determined by the legal (national and international) framework and by technical opportunities. In recent economic history, increasing capital mobility can be observed after the collapse of the Bretton-Woods system. During its existence, capital mobility was rather modest, due to political and technological obstacles.

On the one hand, it seems convincing in theory that higher capital mobility contributes to lower inflation rate since the capital owners can avoid the country with a high inflation rate more easily. If they do so, investments are lower than possible, eventually leading to unemployment. This provides a strong disincentive for governments to increase the money supply above a certain level. Given the relatively low degree of capital mobility, one could argue that the inflationary bias during the existence of the Bretton-Woods system was stronger than afterwards.

On the other hand, the Bretton-Woods system had a disciplining effect on governments. Many countries had fixed their exchange rate towards the US-$. This fixing gave a strong disincentive to raise inflation. But even without being part of the system, governments were always reminded of monetary discipline. Consequently, the average inflation rate during the era of Bretton-Woods was lower than afterwards. Until 1973, average CPI in the world was below 10 per cent. From 1974 until 1995 (with the exception of 1978) it was on the two-digit level. Additionally, the increasing average inflation rate can certainly be traced back to supply shocks, in particular the huge price increase of oil in 1973/4 and 1979/80 respectively (IMF (a), October 1996, pp. 100f). Only recently, average inflation moved beyond 10 per cent again. Thus, without the empirical results it remains an open question in which way capital mobility affects the politically optimal inflation rate. The variable *PostBW* is a dummy and measures the effect of the Bretton-Woods system. Its value equals 1 if the reform was made after 1973 and 0 if it was made until then. The impact on inflation is theoretically ambiguous, as explained above.

c) Inflation as the dependent variable

The rate of inflation after the monetary reform is the endogenous variable in the model. Policymakers announce a monetary policy, subsequently react to certain signals and choose an inflation rate which seems optimal from

their personal perspective. In general, the variables are based on the concept of consumer price inflation (CPI). This is the best approximation given the goal to break inflationary expectations in the public, and it is an internationally comparable indicator. Moreover, the data is available for the whole sample. The theoretical model does not allow to separate the rate of inflation on the left hand side. Instead, the expression $\ln 2\pi + \pi^2$ (equation 9) overemphasises high inflation and huge differences within the sample. This makes the estimation even more difficult. Given the diversity of the sample, it therefore makes sense to eliminate π^2 and to approximate $\ln 2\pi + \pi^2 \approx \ln CPI$.

Disinflation with the help of a new monetary regime is a process which takes its time. It can hardly be expected that the annual inflation rates drops down close to zero within a year or even a shorter period. Inflationary expectations are very resistant especially when the public has experienced a few unsuccessful reforms before. People are accustomed to rising prices. Moreover, many contracts may be indexed so that there is an inflationary pressure. Even if the monetary reform is credible (*C-IF* close to zero), the stabilisation process will be time consuming. Thus, we assume a period of five years as being sufficient for the stabilisation process. It can be expected that a success of the reform will be visible within five years. Of course, disinflation can be achieved earlier with the inflation rate being low afterwards. Moreover, a failure can be identified easily within five years. Even if in the first few months or years after the reform a slight stabilisation is observed, this period is long enough to recognise a failure.

Hence, we use two different specifications of the dependent variable.[8] The first is a weighted average of annual inflation rates during a period of five years after the reform (*WCPI*). The highest weight is given to the final year. The second specification is the average inflation rate during this period (*ACPI*). Both are tested in logarithmic form, reflecting the dynamic character of a disinflation program.

IV. The Results

a) Introduction

In this section, the theory on the success and failure of monetary reforms is tested empirically. The sample consists of 29 monetary reforms after World War II (*Table A 3*). Virtually all were implemented after periods of severe inflation. The majority took place in Latin America. We have tried to

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[8]   Detailed definitions and explanations are given in Appendix 2.

avoid a pre-selection bias through the inclusion of a number of reforms which could be easily identified as purely cosmetic undertakings designed to mislead the public (Mas 1995). In Central and Eastern European transition countries, the original changes in the monetary regime during the transition process have not been included. Subsequent monetary reforms due to failures of these attempts have been considered.

The method applied is cross-sectional OLS, the computation is carried out with EViews 3.1.[9] The OLS estimation can produce 'good' econometric result in a sense that the estimators are unbiased and have minimum variances. Estimators having these properties are called BLUE (best linear unbiased estimators). However, the goodness depends crucially on whether the model is well specified. Problems may occur regarding the econometric model,[10] albeit not all difficulties one might think of, are relevant for this study.

b) Tests necessary due to the diversity of the sample
Before we begin with the econometric assessment, we have to consider the diversity of the sample. It consists of reforms pursued within three continents and over almost 50 years. In addition, average post-reform inflation rate varies between 1 per cent and more than 1,300 per cent. First, heteroscedasticity, i.e. the fact that the variances of the residuals are not uniform, cannot be ruled out. If the absolute magnitude of the residuals varies with the magnitude of the variables, both dependent and independent, heteroscedasticity is highly probable. It leads to still unbiased but inefficient estimators. Their variances are bigger than without heteroscedasticity. The sample of 29 monetary reforms is very heterogeneous as regards the

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[9]   Instead of this specification, one can think of applying a completely different approach, namely a binary choice model. The outcome of the reform process is not defined in terms of inflation but as a success (value 0) or a failure (value 1) of the monetary reform. Different to the OLS regression applied here (see blow), a logit or probit estimation would have to be applied in such a case. However, this approach has methodical shortcomings: for one, the outcome is not directly observable. Whether the reform is a success or not has to be decided by the researcher on the base of the observed inflation rates. One way to overcome this problem is to use an index function (Greene 1997, pp. 880f.). One has to choose a rate of inflation CPI* which distinguishes success from failure: y=1 if CPI>CPI*, and y=0 if CPI≤CPI*. Furthermore, the binary choice approach is based on the assumption that the outcome of y (0 or 1) is due to the choices of the acting individual. Since we can take it for granted that the monetary policymaker would in any event choose success (value 0), we do not use this technique. In addition, the number of observations is too small to generate meaningful results of a logit or a probit estimation.

[10]   For a general overview, see Kennedy (1992, in particular the synopsis on p. 45).

magnitude of the variables. In some estimations heteroscedasticity occurred. White's heteroscedasticity test and if necessary White's correction for heteroscedasticity are applied. The interesting feature about White's correction is that even in the presence of heteroscedasticity the OLS method can produce consistent estimators (White 1980). The computational task can be handled more easily than with a GLS estimation (Kennedy 1992, pp. 118f).

Other problems concern the stability and linearity of the parameters. It is assumed that the correlation between explanatory variables and the dependent variable is linear. This needs to be tested. We apply several stability tests to check whether the parameters are robust, e.g. the Ramsey-reset test, the cusum of square-test and recursive residuals. Moreover, subsamples, are estimated separately, e.g. the Latin American countries. We also test whether it is critical to drop countries that do not perfectly correspond with the theory such as Germany 1990 and Hong Kong 1983. In both cases, hyperinflation was not the cause of the reform. As a general result, the parameters have proven robust in these tests. For the choice of the variables, we also calculate the correlation coefficient of the regressors. In general, it is low, the exception being the correlation of all factors with *EF* and *EF2000*. Their correlation with institutional factors and with each other is higher which is in line with theoretical reasoning.

As a final assessment whether or not this diversity is problematic, we have made a cluster analysis (with SPSS 10.0), using the Ward method. A cluster analysis is not driven by theory; rather it aims at sorting out regularities and subgroups with similar properties within the sample. The results we obtain support the theoretical considerations and the empirical findings (see below). Regardless of the variables chosen, the clusters identified include either the majority of the worst failures or most of the greatest successes. Appendix 4 shows the results in more detail.

c) Specification 1: showing the importance of commitment

The first equation only considers the degree of commitment. In (8) institutions are neglected. It has the following shape:

$$(8) \qquad \ln ACPI = \beta_0 + \beta_1 C + \beta_2 SEIGN + \beta_3 PostBW + \varepsilon ,$$

where $\varepsilon \sim \text{ND}(0, \sigma_\varepsilon^2)$.

Both *ACPI* (estimations 1 and 2) and *WCPI* (estimations 3 and 4) are tested. The results of different estimations are reported in *Table 1*. As for

the goodness of fit, estimations 1 and 2 yield better results than estimations 3 and 4. The average inflation rate is explained better by the model than a weighted average of inflation rates. Weighting always bears the danger of arbitrariness. Hence, in the specifications 2 and 3, we mainly use *ACPI*.

Table 1: Estimators (Specification 1)

Estimation		**1**	**2**	**3**	**4**
Dependent		*lnACPI*	*lnACPI*	*lnWCPI*	*lnWCPI*
Intercept		3.953***	2.911***	4.063***	2.859***
Commitment	C_{uw}	-5.944***		-6.653***	
Commitment	C_w		-4.702***		-5.186***
Seigniorage	*SEIGN*	6.229***	6.377***	8.654***	8.851***
Dummy	*PostBW*	2.353***	2.677***	2.807***	3.164***
R²		0.758	0.763	0.694	0.693
R²adj		0.729	0.735	0.653	0.656
F-Stat.		26.12	26.87	18.88	18.8
N		29	29	29	29

*, **,***: significant at 10 per cent level, 5 per cent level, 1 per cent level respectively; For an explanation of the variables see Appendices 1 and 2.
Source: See Appendix 5.

The first hypothesis of this paper about the determinants of the average inflation after monetary reforms cannot be rejected through estimations 1 through 4. The index of commitment regardless of the chosen weighting (uw or w) and seigniorage show the expected sign and are significant on the 1 per cent level. The higher the degree of commitment, the lower the average inflation. The politically optimal inflation is positively dependent on monetary seigniorage. Both independent variables have a great impact with that of *SEIGN* being higher.

The sign of β_3, the coefficient for *PostBW* is positive. This evidence can be interpreted as follows: the Bretton-Woods system with its fixed exchange rate exerted a disciplinary pressure on governments, in particular in those countries with a fixed dollar exchange rate. Higher inflation than in the US regularly forced these countries to devalue their currency towards the US-$. This certainly had disciplinary effects. After 1973, the exchange rates became flexible. It also became easier to produce high inflation rates without the external anchor. The increasing capital mobility related to the post Bretton-Woods era has not become a similarly disciplining institution. Furthermore, the reform countries were subject to supply shocks after 1973. *PostBW* does not separate between these two effects. This dummy has a lower coefficient than commitment and seigniorage.

d) Specification 2: institutions matter

So far, we can conclude that commitment matters for the success of monetary reforms. The second hypothesis tests whether institutions also are relevant. Equation (9) adds institutional factors to the specifications independent variables. Alternatively, we substitute *EF* or *EF2000* for the institutional factors. The estimation results of various forms of (14) are reported in *Table 2*.

(9)
$$\ln ACPI = \beta_0 + \beta_1 C + \beta_2 SEIGN + \beta_3 PostBW + \\ [\beta_4 \beta_5 \beta_6 \beta_7 \beta_8 \beta_9][PS2\ FS\ LM73\ OP2\ POI\ RC]^T + \varepsilon.$$

Table 2: Estimators (Specification 2)

Estimation	5	6	7	8	9	10
Dependent	*lnACPI*	*lnACPI*	*lnACPI*	*lnACPI*	*lnACPI*	*lnACPI*
Intercept	6.012***	6.335***	6.428***	6.79***	7.616***	7.183***
C_{uw}	-4.189***	-4.525***		-4.019**	-3.088*	
C_w			-3.607***			-2.394*
Institutions:						
PS2	-0.992	-1.218*	-0.985			
FS	-3.516**	-4.273***	-3.595***			
OP2	-5,91E-05					
POI	-0.69					
RC			-2.384**			
EF				-3.242**		
EF2000					-4.476***	-4.43***
SEIGN	5.576***	6.016***	5.635***	6.374***	4.43***	4.567***
PostBW	2.343***	2.314***	1.785***			
R²	0.837	0.827	0.851	0.783	0.799	0.794
R²adj	0.783	0.789	0.795	0.745	0.77	0.765
F-Stat.	15.42	21.92	15.19	20.473	27.84	27.04
N	29	29	23	21	25	25

*, **,***: significant at 10 per cent level, 5 per cent level, 1 per cent level respectively; For an explanation of the variables see Appendices 1 and 2.
Source:: See Appendix 5.

To incorporate all six institutional factors, does not make much sense. The degree of freedom would be too low. In addition, *LM* and *LM73* are insignificant and do not have the predicted sign. In estimation 5, four institutional factors are regressed on inflation and have the predicted sign. Although only *FS* is individually significant, the institutional setting as a whole also is significant. This is the result of the Wald-Test. The null-hypothesis of this test is that the factors *PS2*, *FS*, *OP2* and *POI* have no

joint influence on the dependent variable. This hypothesis can be rejected at the 1 per cent level of significance. Estimations 6 and 7 show that political stability, fiscal stability and properties of the reserve currency have the predicted sign. *RC* is also significant. The index of commitment, *SEIGN* and *PostBW* loose weight if institutional factors including *EF* and *EF2000* are added. As they are the most comprehensive proxies for institutions, the latter have the expected negative sign and are significant (estimations 8 through 10). Following these estimations, economic freedom increases the political costs of inflation even more than a high degree of commitment.

The tests of specification 2 are not likely to reject the hypothesis that institutions matter. Both the institutional factors and the degree of economic freedom exert a negative influence on the post-reform inflation. The results of estimations 6 and 7 are superior to those of estimations 8 through 10 since the significance of commitment as well as the coefficient of determination R²adj are higher.

e) Specification 3: ex-ante measure for credibility also relevant

Still, (9) does not give evidence of the ex-ante credibility of monetary reforms. The impact of credibility is estimated in equation (10) and reported in *Table 3*.

(10) $\qquad \ln ACPI = \beta_0 + \beta_1 (1/(C - IF)^2) + \beta_2 SEIGN + \beta_3 PostBW + \varepsilon$,

where: $\qquad IF = \dfrac{\sum\limits_{i=1}^{n} IF_n}{n}$.

The squared difference between commitment and the average outcome of the institutional factors emphasises great differences and diminishes small differences. Unless marked otherwise, the institutional factors are used in the following specifications: *PS1*, *FS*, *LM73*, *OP1*, *POI*. The estimation results are reported in *Table 3*. It turns out that the proxy for credibility based on the weighted index of commitment (estimations 13 and 14) has a more significant impact on inflation than the one based on the unweighted index (estimations 11 and 12). The significance level and the coefficient of determination are higher in the latter case. The higher the ex-ante credibility of a monetary reform, the lower the politically optimal inflation rate. However, the coefficient of credibility adds little to R²adj. Notwithstanding this result, we conclude that the theoretical considerations cannot be rejected on the grounds of these estimations.

Table 3: Estimators (Variant 3)

Estimation		11[1]	12[2]	13	14
Dependent		*lnACPI*	*lnWCPI*	*lnACPI*	*lnWCPI*
Intercept		0.05	0.472	0.543	0.239
Credibility	$1/(C_{uw}\text{-}IF)^2$	-6.69E-05	-2.98E-06		
Credibility	$1/(C_w\text{-}IF)^2$			-7.34E-06***	9.63E-06***
SEIGN		13.207***	10.893***	8.655***	11.439**
PostBW		2.901***	2.577***	2.43***	2.921***
R²		0.569	0.537	0.605	0.594
R²adj		0.528	0.482	0.557	0.545
F-Stat.		11.02	9.777	12.74	12.185
N		29	29	29	29

[1]: *LM* instead of *LM73* used in $1/(C_{uw}\text{-}IF)^2$; [2]: no use of *LM* or *LM73* in $1/(C_{uw}\text{-}IF)^2$.
*, **,***: significant at 10 per cent level, 5 per cent level, 1 per cent level respectively; For an explanation of the variables see Appendix 1 and 2.
Source: See Appendix 5.

The significance of the proxy of credibility is very sensitive with respect to the specification of a) the degree of commitment and of b) the institutional setting, *IF*. In all estimations, R²adj is smaller than in both specification 1 and 2. The magnitude of the influence of credibility on inflation is small as compared to the influence of commitment alone.

V.   Discussion of the Results

The econometric analysis confirms the theoretical considerations about the determinants of the post-reform inflation rates. The most important independent variable is monetary commitment (*C*). It has a great impact on the post reform inflation rate: its ß-value indicates that an increase in commitment leads to relatively decreasing inflation. Hence, the design of the monetary regime surely matters for the success of the reform.

A very relevant explanatory variable is *SEIGN*. This variable has proven significant regardless of the specification. This upshot is not new, rather, it can be regarded as being another confirmation of the generally accepted insight that solving fiscal problems via money growth causes inflation. The strict separation of fiscal and monetary policy is certainly one important prerequisite for the success of a monetary reform. In many (successful) instances of the sample, the outcome of the variable changes considerably after the monetary reform. For instance, Argentina reduced its reliance on money growth from a value of *SEIGN* of 0.5 prior to 1991 to a value of 0.01 a few years later.

Another regressor of crucial importance is *PostBW*. The probability of a monetary reform to fail rises dramatically in the aftermath of supply shocks and without the disciplining structure of the Bretton-Woods system. The international attitude towards inflation influences the policymakers' decision to create stability. This does not necessarily mean that freedom of capital transactions which started after the end of Bretton-Woods does not discipline governments as well. However, since the sample contains countries with very bad monetary performance, the highly significant positive correlation makes sense economically. This is also very interesting from the policymaker's point of view. For international monetary discipline or international agreement can increase the probability of a success of reforms. Monetary reformers can for instance make use of the scapegoat function of international organisations (Vaubel 1986).

With the exception of the proxy for labour market flexibility, the institutional factors contribute to the explanation of the politically optimal inflation. However, the strength and significance of their contribution are remarkably lower than those of commitment, seigniorage and international discipline. Nevertheless, openness of the country, political stability, public opposition to inflation and a properly chosen reserve currency can contribute to a low post-reform inflation rate. Fiscal stability is a significant determinant of low post-reform inflation. The other exception is *EF*, the index of economic freedom. It has a strong and significant negative impact on the politically optimal inflation.

The ambiguous performance of institutional factors can have two explanations. The first explanation is that the institutional setting may not seem important economically: if this is true, the organisation of the monetary regime itself (*C*) is much more relevant for the success of the reform although institutions are restrictions for the monetary policy. Moreover, one basic restriction is covered by *SEIGN*. This would mean that fiscal stability as defined in Appendix 2 is not relevant. However, *SEIGN* is not correlated with the institutional factors, in particular with fiscal stability.[11] Thus, we regard this explanation as being misleading.

The second and more plausible explanation for the rather low significance is that the composition of the variables for institutional factors (except for the index of economic freedom) suffers from the data shortcomings and the diversity of the sample. The cluster analysis strengthens this argument. Especially labour market flexibility is a case in point. It has been turned out to be impossible to compose a proper indicator.

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[11]   The correlation between *SEIGN* and *FS1* is 0.1556.

The finally chosen gross shift in per cent of the work force is calculated for the same period for all reform countries and does not take into consideration the individual point in time of each monetary reform.

Finally, the proxy for credibility can add to the explanation of post-reform inflation. Nevertheless, it is a very sensitive variable; changing the weights in *C* can even lead to a changing sign of the parameter.[12] Therefore, to be definitely seen as a reliable ex-ante measure of credibility, it has to be based on better data. Nevertheless, the result shows how credibility can be applied as a ex-ante concept in a post-reform model.

VI. Policy Conclusions

This paper has shown the causes of success and failure of monetary reforms in a positive analysis. The main objective of such an analysis is to generate potentially successful reform options for a country suffering from severe inflation. Needless to say that for a precise and credible reform recommendation, it is necessary to also consider detailed institutional circumstances of the country which cannot be adequately covered by the institutional factors defined in this study, even if superior data was available. The situation in reality is considerably more complex than suggested by any model. Notwithstanding, the econometric analysis clearly marks the central requirements of monetary reforms. Therefore, the econometric model presented here can be supportive for deeper analysis of the economic situation in a potential reform country.

As regards policy conclusions, three elements are crucial for a monetary reform to be successful: first, a strong commitment to stability in the legal monetary regime established by the government can prevent the monetary policymaker from inflating. Second, institutional factors certainly restrict the government's choice of an appropriate monetary regime. Monetary policy is only one part of the economic order. The interdependence of its elements has to be considered. Third, a monetary reform undoubtedly fails if the government is unable to generate revenues from other sources than the money press. To answer the question raised in the paper's title, first and foremost these three factors distinguish successes from failures.

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[12]   This is the result of alternative estimations with other weights in *C*.

Appendix 1: The Index of Commitment

To measure the degree of commitment, an index of commitment has been constructed along the lines of an index of central bank independence (Cukierman 1992). It is the (unweighted and weighted, *Table A1*) average of 10 criteria which characterise the monetary regime. *Table A2* shows the codings in detail.

- Various *objectives* of monetary policy can be thought of, e.g. price stability, employment, external equilibrium etc.
- The higher the *constitutional level* where the monetary regime is laid down, the higher the commitment.
- The lower the *discretionary power* left to the government, the higher the degree of commitment.
- *External obligations*, like an external anchor or contingent help by the IMF or other IOs, also raise commitment.
- The *appointment and dismissal procedures* of monetary policymakers have influence on the degree of commitment.
- Limitations on *lending* to the government are important for the degree of commitment. If lending is allowed, commitment is low.
- *Convertibility* restrictions also diminish the degree of commitment.
- *Competitive elements* in the monetary regime indicate a high degree of commitment.
- *Regulatory issues* exert ambiguous influence of the degree of commitment.
- The same holds for the *accountability* of the monetary authorities.

Table A1: Weights given to the components

Criterion	Component	unweigthed (C_{uw})		weighted (C_w)	
1. Objectives	*Obj*	0.10		0.15	
2. Constitutional level	*Const*	0.10		0.05	
3. Discretionary power	*Gov*	0.10		0.15	
4. External obligations	*Extern*	0.10		0.15	
5. Appointment/dismissal	*Ceo*		0.05		0.025
procedures	*Diss*		0.05		0.025
6. Limitations on lending	*Lim*	0.10		0.20	
7. Convertibility restrictions	*Conv*		0.05		0.10
	Mult		0.05		0.05
8. Competitive elements	*Comp*	0.10		0.05	
9. Regulatory issues	*Reg*	0.10		0.025	
10. Accountability	*Acc*	0.10		0.025	
Sum		1.00		1.00	

Table A2: Codings of the Index of commitment

Criterion	Component	Explanation	Numerical codings
Objectives of monetary policy	*obj*	1. Price stability only goal 2. Other objectives mentioned 3. No goals for monetary policy	1.00 0.50 0.00
Level where monetary regime is established	*const*	1. Constitution 2. Central bank law 3. Decree 4. Not fixed at all	1.00 0.66 0.33 0.00
Discretionary power left to the government	*gov*	1. No power left to the government 2. Exchange rate consulted between government and monetary authority 3. Exchange rate regime completely left to government 4. Government may override monetary authority as regards monetary policy	1.00 0.66 0.33 0.00
External pledge of the government	*extern*	1. Exchange rate fixed to a hard currency and money base fully backed with foreign reserves 2. Exchange rate fixed 3. Crawling peg 4. Conditional help accepted 5. No external pledge	1.00 0.75 0.50 0.25 0.00
Conditions of appointment and dismissal of monetary CEO	*ceo*	1. CEO must be a reputed expert 2. No expertise demanded	1.00 0.00
	diss	1. Appointment with fixed term and dismissal only after bad performance 2. No rules for dismissal 3. Dismissal unconditioned or linked to resignation of governments and single politicians	1.00 0.50 0.00

Criterion	Component	Explanation	Numerical codings
Limitations on lending to the Government	*lim*	1. Monetary authority is prohibited to give credit to the public	1.00
		2. Monetary authority is allowed to purchase public bonds in hard currency on the secondary market	0.66
		3. Monetary authority is allowed to purchase public bonds in any currency on the secondary market and to give limited credit to the government	0.33
		4. No limitations on lending to the government	0.00
Convertibility restrictions	*conv*	1. Full convertibility	1.00
		2. Partial convertibility	0.75
		3. Convertibility for current account transactions only	0.50
		4. Convertibility for capital account transactions only	0.25
		5. No convertibility	0.00
	mult	1. One exchange rate	1.00
		2. Multiple exchange rate	0.00
Competitive elements in the monetary regime	*comp*	1. A hard currency can be used for all transactions	1.00
		2. A hard currency can be used for some transactions, others excluded	0.66
		3. A hard currency may be held	0.33
		4. No holdings or transactions in hard currencies allowed	0.00
Financial market regulation	*reg*	1. Financial market regulation is assigned to a separated bureau	1.00
		2. Financial market regulation is assigned to monetary authority	0.50
		3. No financial market regulation	0.00
Accountability of the monetary authority	*acc*	1. Obligation to inform the public on a regular basis	1.00
		2. Obligation to inform the parliament in public hearings	0.66
		3 Obligation to inform the government without publicity	0.33
		4. No accountability	0.00

Appendix 2: Other Variables

Institutional Factors

Political stability (*PS*) in this context means a political system is stable rather than long-term survival of a government. The variables *PS1* and *PS2* are composed of three elements: unsuccessful irregular executive transfers (coup d'état, *UIET*), successful irregular executive transfers (*SEIT*) and political reprisals in the year of monetary reform (*REPRIS*). The latter is a dummy, its outcome being 0 or 1, depending on whether or not political reprisal exists. *UIET* and *SEIT* are the numbers of coups in the 25 years before the monetary reform. The time span of 25 years has been chosen as this can be more or less be defined as being one generation and is therefore memorable for the public. For both indicators holds: $0 \le PS1, PS2 \le 1$.

$$PS1 = 0{,}5(1 - 0{,}4UIET - 0{,}6SIET)^2 + 0{,}5REPRIS .$$

$$PS2 = 0{,}5(1 - 0{,}4UIET - 0{,}6SIET) + 0{,}5REPRIS .$$

An indicator of fiscal stability (*FS*) should meet two conditions. Ideally, it should not be based exclusively on historical performance, and it should also be possible to calculate it at the moment of the monetary reform. We choose a mix of past and future data; *s* stands for time and *t* denotes the year of the reform. The indicator is derived from the fiscal balance (*FB* = revenues minus expenditure) of the state which is divided by the GDP:

$$FS = \frac{1/8 \sum_{s=t-2}^{t+5} FB_s / GDP_s + 1}{2} , \text{ where } s \text{ denotes time.}$$

Labour market flexibility (*LM*) depends on many factors, the most important being the regulation of the market. The regulation in the countries in the sample is very patchy. To compare the *labour market regime* over both such a time horizon as well as so many countries in our sample is complicated. Thus, instead of analysing labour market regimes, we look at the actual flexibility of the labour force which may be affected by several factors, among others the labour market regime, but also technological change and the state of development a country is in. Our indicator of labour market flexibility, therefore, is rather simple. It is the gross shift in per cent of the work force among the three sectors Agriculture, Industry and Services between 1950 and 1977 which is divided by 66 (the maximum gross shift in 121 countries, Taylor and Jodice 1983a, pp. 257-259). *LM* is restricted between 0 and 1.

$$LM = GrossShifts/66$$

One property of *LM* is that its outcome for advanced countries is lower than for less developed countries. Industrialised countries had already experienced a great deal of structural change from agriculture to industry and to services in 1977 when the time span covered by *LM* ends. Structural change proceeded more rapidly in developed countries than in developing countries until the 1960s. Thereafter it slows down. We have chosen the year 1973 as a benchmark year. A way to improve the empirical content of *LM* is to adjust it to this difference in structural change. *LM73* is defined as follows:

$$LM73 = GrossShifts/66 * \frac{GDP \; per \; Capita_{1973}}{GDP \; per \; Capita \; US_{1973}}$$

We restrict the indicator for openness, *OP*, to trade (*EX+IM*). We define a country with 2,000 US-\$ trade per capita per year as completely open and again set every value above 1 equal to 1.

$$OP1 = 1/3 \frac{\sum\limits_{s=t-2}^{t}(EX+IM)_s \, per \, Capita}{2,000}$$

with $\qquad OP1 = 1$ if $1/3 \dfrac{\sum\limits_{s=t-2}^{t}(EX+IM)_s \, per \, Capita}{2,000} > 1$.

The remaining indicator is not restricted between 0 and 1.

$$OP2 = 1/3 \sum\limits_{s=t-2}^{t}(EX+IM)_s \, per \, Capita \, .$$

Public opposition to inflation (*POI*) is made up of past experience and actual regulations. The former inflation record is especially relevant for a country after a hyperinflation. People are very sensitive as regards stability: since they know the cost of inflation on average they are strongly opposing another hyperinflation. Again, the time horizon is 25 years before the reforms, roughly a generation. One part of the indicator is the number of years with an inflation rate of at least 100 per cent p.a. (*H*), divided by 25.The other elements are dummies for the absence of repressed inflation

(*REPIN*), that is prices are at least partly fixed[13], and indexation of wages, taxes, government bonds etc. (*INDEX*):

$$POI = (\frac{H}{25} + REPIN + (1 - INDEX))/3.$$

To measure how appropriate the reserve currency is, we calculate the institutional factor *properties of reserve currency* (*RC*). It is composed of two elements: first, the number of foreign countries fixing the exchange rate towards the same reserve currency, is calculated by taking those five countries apart from the reserve country with which trade is most intense: if all five are pegged to the reserve currency, RC_{er} is one, with four currencies being pegged, RC_{er} is 0.8 and so on. The measure of the trade share RC_t is simply defined by the quotient of bilateral trade between the reform country and the reserve country and the reform country's total international trade.

$$RC = (RC_{er} + RC_t)/2.$$

As an alternative to the application of a combination of five institutional factors, in what follows we introduce a comprehensive index, the index of economic freedom by Gwartney and Lawson (1997, p.4). Their index consists of 17 components, separated into four groups. These groups are:

1. Money and inflation, 4 components, weight: 15.7 per cent (omitted).
2. Government operations and regulations, 6 components, 34.6 per cent.
3. Takings and discriminatory taxation, 3 components, 27.2 per cent.
4. Restraints on International Exchange, 4 components, 22.5 per cent.

Since the first group (money and inflation) is the subject of our analysis, we eliminate it from the index, but use the results that Gwartney and Lawson reached in their study. In case there is no result for the year of the reform, we take the next one available after the reform result. The reason for this is the assumption that the change in the overall economic system coincides with the monetary reform.

$$EF = \frac{(G2*0.346 + G3*0.272 + G4*0.225)_{GL}}{0.843*10}.$$

Similarly, *EF2000* is calculated as the weighted average of five groups (except for monetary policy and alternative currencies) of the 2000 index of

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[13] This definition explicitly includes the fixing of prices of food, utilities etc. for an urban population which is usual in many Latin American countries.

economic freedom by Gwartney, Lawson and Samida (2000, p. 7) which is composed of 23 components in seven groups:

1. Size of government, 2 components, 11 per cent.
2. Structure of the economy and the use of markets, 4 components, 14.2 per cent.
3. Monetary policy and price stability, 3 components, 9.2 per cent (omitted).
4. Freedom to use alternative currencies, 2 components, 14.6 per cent (omitted).
5. Legal structure and property rights, 3 components, 16.6 per cent
6. International exchange: trade, 5 components, 17.1 per cent
7. Freedom to exchange in capital and financial markets, 4 components, 17.2 per cent.

$$EF2000 = \frac{(G1*0.11 + G2*0.142 + G5*0.166 + G6*0.171 + G7*0.172)_{GLS}}{0.762*10}$$

Other Exogenous Variables

The other exogenous variables are explained in section III. *SEIGN* is the average of seigniorage in five years after the reform, *M* denotes the money base, *R* stands for revenues.

$$SEIGN = 1/5 * \sum_{s=t+1}^{t+5} \frac{M_s - M_{s-1}}{R_s + M_s - M_{s-1}} .$$

$PostBW = 0$, if $t \leq 1973$, and $PostBW = 1$, if $t > 1973$.

The Dependent Variable

Inflation is calculated in two ways. First, the annual rates of consumer price inflations are differently weighted (*WCPI*). An average inflation considering the disinflation process is calculated. Later periods are given higher weights. Second, we calculate an average inflation rate of the five years after the reform.

$$WCPI = \frac{\pi_t + 2*\pi_{t+1} + 3*\pi_{t+2} + 4*\pi_{t+3} + 5*\pi_{t+4} + 10*\pi_{t+5}}{25} .$$

$$ACPI = ((P_{t+5}/P_t)^{0.2} - 1)*100$$

Appendix 3: The Sample of 29 Monetary Reforms

Table A3: Pre-Reform Inflation, Monetary Regimes and the Degree of Commitment in the Sample

Countries	Year	CPI in t-1	Monetary Regime	C_{uw}	C_w	Pi in t o t+5
1) **Argentina**	1991	2,313.7	Currency Board	0.798	0.873	8.3*
2) **Argentina**	1985	549.4	CB[1], fixed ER	0.462	0.462	577.6
3) **Bolivia**	1987	277.0	CB, fixed ER	0.540	0.466	16.3*
4) **Bolivia**	1963	5.9	CB, fixed ER	0.540	0.466	7.3*
5) **Brazil**	1994	1,000.0	CB, fixed ER	0.495	0.482	113.8
6) **Brazil**	1989	1,431.7	CB, flexible ER	0.238	0.188	736.9
7) **Brazil**	1986	226.1	CB, fixed ER	0.346	0.317	1,310.7
8) **Chile**	1975	511.1².	CB, fixed ER	0.474	0.350	78.6
9) **Estonia**	1992	1,069.0²	Currency Board	0.787	0.837	37.6*
10) **Germany**	1990	n.a.	CB, flexible ER	0.665	0.649	3.5*
11) **Germany**	1948	25.4	CB, fixed ER	0.707	0.712	1.0*
12) **Greece**	1954	9.1	CB, flexible ER	0.424	0.312	3.1*
13) **Hong Kong**	1983	10.1²	Currency Board	0.674	0.804	5.8*
14) **Israel**	1985	374.9	CB, fixed ER	0.503	0.478	23.8*
15) **Israel**	1980	75.0	CB, flexible ER	0.495	0.411	196.5
16) **Korea**	1962	12.1	CB, fixed ER	0.441	0.308	18.9*
17) **Latvia**	1992	243.6²	CB, flexible ER	0.632	0.628	35.2*
18) **Lithuania**	1994	409.7²	Currency Board	0.715	0.829	27.9*
19) **Mexico**	1993	15.5	CB, fixed ER	0.628	0.641	22.1*
20) **Mexico**	1987	87.3	CB, fixed ER	0.378	0.291	35.8
21) **Nicaragua**	1990/91	7,475,8	CB, fixed ER	0.662	0.649	14.5*
22) **Nicaragua**	1988	911,5	CB, fixed ER	0.441	0.358	1,009.2
23) **Peru**	1991	7,592.3	CB, flexible ER	0.578	0.624	31.7*
24) **Peru**	1985	110,5	CB, fixed ER	0.445	0.383	823.3
25) **Russia**	1994	874.6	CB, fixed ER	0.611	0.632	59.2
26) **Slovenia**	1991	n.a.	CB, flexible ER	0.511	0.507	18.2*
27) **Ukraine**	1992	n.a.	CB, fixed ER	0.187	0.266	215.2
28) **Uruguay**	1993	68.4	CB, fixed ER	0.457	0.425	28.5*
29) **Uruguay**	1975	77.3	CB, fixed ER	0.440	0.391	56.5

[1]: CB = central bank, ER = exchange rate; ²: CPI in t.; * if av. CPI < 50 per cent, the reform is assessed as being a success for the cluster analysis (see also footnote 9 and Appendix 4).
Source: See Appendix 5.

The sample does not contain former socialist countries introducing a new monetary regime during the transformation process. After a failure of the new regime in Estonia, Lithuania, Latvia, Slovenia, Russia and the Ukraine, a monetary reform as defined here become necessary in these countries. Those reforms are considered in the sample.

Appendix 4: Some Features of the Cluster Analysis

The following *Table A4* shows the most relevant and interesting clusters depending on the variables chosen for the cluster analysis. The numbers in the groups refer to cases introduced in *Table A3*, first column. We have used the Ward method since it assigns the cases more precisely to the 'correct' groups than other methods (Backhaus et al. 1994). One condition for the goodness of the analysis is that the variables are not highly correlated. Therefore, the clusters based on *EF* or *EF2000* (highly correlated with the institutional factors) are less easily distinguished.

Table A4: Results of the Cluster Analysis

Variables	Group 1	Group 2	Group 3	Group 4
SEIGN, *ACPI*	1, 8, 3, 23, 12, 18, 14, 26, 28, 10, 11, 20, 5, 21, 17, 15, 27 (mainly successes, 14 out of 17)	7, 29, 9, 19, 4, 16, 6, 25, 13 (mixed evidence)	2, 24, 22 (only failures)	no
SEIGN, *ACPI*, C_{uw}, $(C\text{-}IF)^2$	all other cases	2, 22, 24 (only failures)		no
C_{uw}, $(C\text{-}IF)^2$	all other cases	10, 29 (mixed evidence)	22, 24, 2 (only failures)	no
SEIGN, *ACPI*, C_w	10, 21, 17, 20, 11, 23, 14, 26, 5, 28, 15, 3, 4, 25, 1, 9, 18, 13 (mainly successes, 15 out of 18)	7, 29, 16, 19, 12, 6, 27, 8 (mixed evidence)	2, 24, 22 (only failures)	no
SEIGN, *ACPI*, C_w, *PS1*, *OP2*, *LM73*, *FS*, *POI*	11, 17, 9, 12, 15, 14, 13, 19, 20, 18, (mainly successes, 9 out of 10)	10, 26, 3, 16, 7, 1, 25, 27 (mixed evidence)	2, 24, 22 (only failures)	28, 29, 6, 8, 4, 21, 23, 5 (mixed evidence)
ACPI, C_{uw}, $(C\text{-}IF)^2$, *PS2*, *FS*, *POI*, *OP1*, *LM73*	9, 18, 11, 14, 27, 17, 25, 12, 13, 15 (mainly successes, 7 out of 10)	1, 26, 3, 16, 7, 28, 29, 10 (mixed evidence)	22, 24, 8, 21, 4, 23, 5, 6, 19, 20, 2 (mainly failures, 6 out of 11)	no
PS2, *FS*, *POI*, *OP1*, *LM73*	10, 26, 9, 16, 4, 12, 17, 25, 11, 15 (only 1 from Latin America)	2, 19, 1, 21, 24, 3, 7, 29, 8, 23 (all from Latin America)	18, 28, 20 (mixed evidence)	5, 6, 22, 27, 14 (mixed evidence)[1]

[1]: Hong Kong forms a fifth group.
Source: See Appendix 5

Appendix 5: Data Sources

To begin with, the index of commitment *C* consists of ten components. An important source for these components is the central bank law of the respective country, particularly for details about internal relations between central bank and government. Many central bank laws today are available on the internet. A collection of central bank homepages is given by Mark Bernkopf (http://.adams.patriot.net/~bernkopf/banks-nf.html). A list of central bank laws and directives can also be found at the New York University (www.law.nyu.edu/centralbankscenter/texts/order.html). Both homepages are very useful. To complete the list, we draw upon the library of the Deutsche Bundesbank in Frankfurt/Main. Central bank laws are also reprinted in Aufricht (1962). Some central bank laws and further information (Israel, Slovenia, Hong Kong, Ukraine) have been sent to the author upon request. A valuable source, especially for external monetary relations of countries as well as for monetary history, is Picks Currency Yearbook and its successor, the World Currency Yearbook, edited by Philip Cowitt. They were published between 1955 and 1989. External features can also been found in IMF (d). Beside this collection, many papers and books are valuable. Among them, we particularly make use of Bähr (1994), Bennett (1993 and 1994), Buch (1993), Cukierman (1992, pp. 371-411), (Fischer 1986), Fischer, Hiemenz and Trapp (1985), Greenwood (1983), Mastroberardino (1994, pp. 161-171 and 187-197), and Schuler (1996).

For the computation of institutional factors, a number of sources are used. Before we describe the sources by variables, one remark about the German monetary reform in 1948, the eldest reform in the sample, is due. For some of the independent variables, different issues of Statistisches Bundesamt (a) and SVR (1966) are consulted. In general, the following sources are used.

The indicators of political stability *PS1* and *PS2* are based on the following sources. Indicators of coup d'etats (*SEIT* and *UIET)* are taken from Taylor and Jodice (1983b, pp. 89-94). They report irregular transfers until 1977. For the period from 1978 through 1994 The Economist was consulted to collect information about coup d`etats. The same holds for the component *REPRIS*: on the basis of reading old issues, we decided whether to assign a 1 or a 0. The variable for fiscal stability (*FS*) is mainly based on IMF (a), IMF (b) and IMF (c). Only the data for Hong Kong and Korea are based upon national statistics which have been sent to the author. Labour market flexibility is calculated following Taylor and Jodice (1983a, pp. 257-259). For the calculation of *LM73* we a use IMF data in addition. The indicators of openness (*OP1* and *OP2*) are based upon the United Nations Yearbook of International Trade Statistics. Additionally, IMF (a), IMF (b) and (c) are used. For the calculation of the indicator of Public opposition to inflation *POI* we employ IMF (c) data for the component *H*. *REPIN* is based on back

issues of The Economist, and for *INDEX* we refer to Fischer (1983) as well as Bruno and Piterman (1990) and Corbo and Solimano (1991). <u>Properties of reserve currencies *RC*</u> are computed with the help of data data from the United Nations Yearbook of International Trade Statistics and Statistisches Bundesamt (1994a and 1994b). Finally, the index of <u>economic freedom *EF* and *EF2000*</u> are modified versions of the index composed by Gwartney and Lawson (1997) and by Gwartney, Lawson and Samida (2000) respectively. The calculation of the other independent variables, in particular the influence of <u>seigniorage *SEIGN*</u> is purely based on IMF (a through c) data. The same holds for the dependent variable <u>consumer price inflation (*WCPI, ACPI*)</u>.

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