

The Success of Currency Reforms to End Great Inflations: An Empirical Analysis of 34 High Inflations

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Abstract: The estimation of an ordered probit model for currency reforms after 30 hyperinflations and four big inflations showed that the introduction of a independent central bank is crucial for the success of a currency reform.

JEL: E31, E58, E65

Key words: Great inflations, currency reforms, central bank independence

November 2006

1. Introduction

To end very high inflations and even hyperinflations in Cagan's definition (1956), that is of inflations rising to rates of 50% per month or more, without causing severe economic disruptions has proved to be a difficult task. The government deficit is huge and increasing and seems to necessitate financing by creating money, government and monetary authorities have lost all credibility. The public try frenetically to get rid of the national money and to substitute it by stable foreign or (formerly) gold or silver money. Thus rates of inflation are surging ahead of the growth of the money supply, the real stock of the national money is far below its normal level and the exchange rate is strongly undervalued. Capital markets have fallen apart and the real economy is in a mess. The social consequences of differently falling real wages in the diverse sectors of the economy and of the elimination of the value of nominal assets are devastating. As a consequence ruling politicians and often even political regimes are discredited, a fact which has led in most cases to a fall of the government or even to the emergence of authoritarian regimes (Paldam 1994).

But in spite of these adverse conditions it has been possible in several cases to reestablish stable national currencies without severe increases of unemployment and with beneficial consequences for the real economy. This has been clearly shown by Sargent (1982) for four central European hyperinflations of the 1920s (compare also Makinen 1984 for the Greek stabilization of 1946, and Bomberger and Makinen 1983 for the Hungarian stabilization 1946). On the other hand, quite a number of reforms ending hyperinflations have been far less successful than the four mentioned by Sargent. This raises the question which institutional reforms are necessary or even sufficient for successful reforms. According to Makinen (1992, see also Cagan 1992, p. 325)

Experience has shown that successfully ending hyperinflations requires a public sector budget balanced by explicit taxes and an end to money finance. It also suggests that to enforce fiscal responsibility, monetary policy has to be constrained by actions such as those creating an independent central bank, restoring external currency convertibility, or submitting domestic policy to foreign supervision. (p. 328)

These are certainly correct observations, but leave open several questions. First, they do not answer the question under which conditions the reform may be politically feasible. Second, it does not address the problem, how the seeming contradiction between the necessity to strongly increase the real stock of the national money, given its very low level, and the control of the money supply can be resolved by the reforms. And finally, it leaves the question open which of the factors

mentioned are necessary and which are only supplementary conditions for the most successful reforms. Subsequently we will try to answer the latter question by a comparative econometric analysis for a sample of all 30 hyperinflations which occurred until now in history and four additional high inflations.

2. Description of 34 High Inflations

A few years ago Bernholz (2003, pp. 166 - 193) tried to answer the questions just asked by a qualitative comparative analysis of all hyperinflations, and by considering four failed additional reforms of high inflations (pp. 189 ff.). He divided the attempted reforms of the 30 hyperinflations (Table 2.1) into three categories depending on the remaining rates of inflation in the year following the reform. The first category of the *most successful reforms* comprised the nine historical cases in which the rate of inflation remained below 25 %. The second category of *less successful reforms* with seven cases referred to remaining rates of inflation between 25 and 99 %. And the last category of *least successful currency reforms* contained fourteen cases in which the rate of inflation remained higher than 99 % or which failed altogether. For the subsequent quantitative analysis we have added four additional cases of attempted currency reforms: The first Greek reform in 1944, the Israeli reform of 1985 and the Argentine (plan Austral) and Brazilian (plan Cruzado) reforms in 1985 and 1986. The Greek reform was the first effort to end the hyperinflation of World War II, and the other three reforms tried to end high inflations below the hyperinflation level in Argentina, Brazil and Israel. Table 2.1 presents the highest monthly inflation rates reached in these 34 historical cases and also the annual rates of inflation remaining in the time following the attempted reforms.

Table 1: All Hyperinflations and f Other 20th Century High Inflations

Country	Year(s)	Highest Inflation p. Month	Annual Inflation in Year after Reform	Country	Year(s)	Highest Inflation p. Month	Annual Inflation in Year after Reform
Austria	1921/22	124.27	3.83	Hungary	1923/24	82.18	-6.33
Argentina	1985/86	30.64	50.9	Hungary	1945/46	1.295E+16	40.91
Argentina	1989/90	196.6	84	Israel	1984/85	21.7	21.26
Armenia	1993/94	438.04	177.78	Kazakhstan	1994	57	177.01
Azerbaijan	1991/94	118.09	322.2	Kyrgyzstan	1992	54.17*	383.77
Belarus	1999	'59,5*	161	Moldova	1992	170,98*	83.3
Bolivia	1984/86	120.39	19.4	Nicaragua	1986/89	126.62	3.5
Brazil	1985/86	21.83	72.8	Peru	1989	104.14	73.33
Brazil	1989/90	84.32	84.38	Poland	1921/24	187.54	24.48
Bulgaria	1997	242.7	2.93	"	1989/90	77.33	62.22
China	1947/49	4208.73	11248955	Serbia	1992/94	309000000	100
Congo (Zaire)	1991/93	124.3	598.37	Soviet Union	1922/24	278.72	-0.5
France	1789/96	143.26	235.44	Taiwan	1945/49	398.73	82
Germany	1920/23	29525.71	-1.68	Tajikistan	1995	78.1	234
Georgia	1993/94	196.72	163	Turkmenistan	1993	62.5	179.6
Greece	1942/44	11288	464.93	Ukraine	1991/93	249	376
Greece	1944/46	126.02	1.27	Yugoslavia	1990	58.82	110.15
Notes: * Geometric Average of Quarter. Serbia with Montenegro: New Yugoslav Republic.							
Not in all Cases the Annual Rate of Inflation after Reform Could be Calculated for a Full Year. Moreover, in cases in which the inflation surged further in the second year after the reform efforts, the figure for this year has been taken.							

Bernholz has tried to explain the successes or failures of the reforms to end the inflations in the three categories considered by comparing the differences in the institutional changes contained in them. We follow this approach, but substitute his verbal by a more compelling quantitative analysis. Table 2.2 presents the most important characteristics of the attempted reforms. It is mainly based on the description of the reforms provided by Bernholz (2003, Tables 8.2, 8.4, 8.6 and 8.7). For a detailed discussion the reader is referred to the source. Briefly we consider five qualitative institutional indicators which may be important for the success of a currency reform for theoretical reasons. The first two indicators cover the existence of domestic and foreign credits to replace money financing of the government budget, the third indicator is with respect to the introduction of central bank

independence, the fourth indicator shows the existence of credit limits of the government with the central bank. Finally the credible fixing of the exchange rate is the fifth indicator.

Table 2: Institutional Characteristics of Currency Reforms

Country	Dom. Credit	For. Credit	CB indep	Budg. Fin.rule	Fixed Ex.ra.	Country	Dom. Credit	For. Credit	CB indep.	Budg. Fin.rule	Fixed Ex.ra.
Austria	yes	yes	yes	yes	Yes	Hungary I	yes	yes	yes	yes	yes
Argentina I	no	no	no	no	no	Hungary II	yes	yes	yes	no	no
Argentina II	yes	yes	yes	yes	Yes	Israel	yes	yes	no	no	no
Armenia	yes	yes	yes	no	no	Kazakhstan	no	yes	no	no	no
Azerbaijan	yes	yes	No	no	no	Kyrgyzstan	yes	yes	no	no	no
Belarus	yes	yes	no	no	No	Moldova	yes	yes	no	no	no
Bolivia	no	no	no	no	no	Nicaragua	no	yes	yes	no	yes
Brazil I	yes	no	no	no	no	Peru	yes	no	yes	no	no
Brazil II	yes	yes	no	no	no	Poland I	yes	no	yes	no	no
Bulgaria	yes	yes	yes	yes	yes	Poland II	yes	yes	no	no	no
China	yes	no	no	no	no	Serbia	no	no	no	no	no
Congo (Zaire)	yes	no	no	no	no	Soviet Union	yes	no	yes	no	no
France	yes	no	no	no	no	Taiwan	no	no	no	no	yes
Germany	no	yes	yes	no	yes	Tajikistan	yes	yes	yes	no	no
Georgia	yes	yes	no	no	no	Turkmenistan	yes	yes	no	no	no
Greece I	yes	yes	no	no	no	Ukraine	yes	yes	No	no	no
Greece II	no	yes	yes	no	yes	Yugoslavia	yes	no	no	no	no

3. Econometric Results from an Ordered Probit Model

This section presents the results of an application of an ordered probit model to the data set described in section 2. This model is used instead of a standard regression model as the target variable of the reform (the inflation rate in the post reform period) is very high for sum unsuccessful reforms. These outlying observation would probably have a strong influence on the regression estimates. The ordinal variable to be explained is the variable y taking the value 2 for a fully successful reform, 1 for a less successful reform and 0 for a completely **least successful** reform, respectively. Five dummy explanatory variables are considered: $x1$ (domestic reform credit 1, otherwise 0), $x2$ (foreign reform credit 1, otherwise 0), $x3$

(independence of central bank 1, otherwise 0), x_4 (no government finance by money creation 1, otherwise 0) and, x_5 (credibly fixed exchange rate 1, otherwise 0), respectively.

The ordered probit model is based on a regression model for one underlying non-observable variable y^* with a normally identically and independently distributed error term. If the observable ordinal variable y takes the value s this indicates that the latent y^* lies between two unknown bounds which have to be estimated jointly with the regression coefficients:

$$y_i^* = \sum_{j=1}^k \beta_j x_{ji} + \varepsilon_i$$

$$y_i = s, \text{ if } \gamma_{s-1} < y_i^* \leq \gamma_s, \quad s = 0, 1, \dots, M-1$$

$$\gamma_{-1} = -\infty, \gamma_M = \infty$$

Of course an increase in one of the regressors increases the probability of observing a higher value of y (i.e. more success of the reform) if the corresponding regression coefficient is larger than zero. The estimation results obtained with our data set are reported in Table 1.

Table 3: Estimates of a ordered probit model for 34 hyperinflations, standard errors (Huber/White QML)

	Coefficient	Std. Error	z-Statistic
β_1	-0.596863	0.718525	-0.830679
β_2	-0.759939	0.452530	-1.679313
β_3	1.223581	0.517119	2.366150
β_4	0.408492	1.084764	0.376572
β_5	1.378448	0.948902	1.452676
Limit Points			
γ_0	-0.427969	0.669307	-0.639421
γ_1	0.933315	0.721450	1.293666
Pseudo R-squared	0.3064		

Table 3 indicates that only one indicator is statistically significant at the five percent level for the degree of success of a currency reform, namely central bank independence (β_3). For the domestic and foreign credit indicator the influence on the success of a currency reform is even negative and significant at the 10 percent level for foreign credits. The effect of budget financing rules is weak and statistically insignificant. The coefficient for the fixed exchange rate has the right sign and is rather large, but not statistically significant at conventional levels. However the magnitude of the coefficient indicates that the adoption of a credible fixed exchange rate could be economically highly significant. The magnitude of the estimates indicates that the adoption of central bank independence clearly pushes the latent variable over the second limit point in the region with full success.

4. Conclusion

The estimation of an ordered probit model for currency reforms of 30 hyperinflations and four big inflations of the 20th century showed that the introduction of an independent central bank is statistically and economically highly significant the success of a currency reform. The coefficient for the adoption of a fixed exchange rate is positive and rather large, but not significant at the 5 percent level. The provision of domestic and foreign credits for government budgeted finance even has a negative effect on the success of a currency reform which is statistically significant at the ten percent level for foreign credits. This indicates that the provision of credits to the government may raise doubts about its intention to solve its budget problem in a sustainable manner. Most interestingly legal restrictions on budget financing do not seem to be relevant when the legal status of the central bank is controlled for. Thus central bank independence seems to be of paramount importance as legal safeguard to budget financing are presumably less likely to be binding if the central bank remains under the direct control of the government.

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