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**Working Paper**

## Money creation and the demand for money during the Bolivian high inflation of 1982 to 1985

Documento de Trabajo, No. 07/86

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*Suggested Citation:* Morales, Juan Antonio (1986) : Money creation and the demand for money during the Bolivian high inflation of 1982 to 1985, Documento de Trabajo, No. 07/86, Universidad Católica Boliviana, Instituto de Investigaciones Socio-Económicas (IISEC), La Paz

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*Instituto de Investigaciones Socio Económicas*

Documento de Trabajo No. 07/86  
Marzo 1986

**Money Creation and the Demand for Money during  
the Bolivian High Inflation of 1982 to 1985**

*por*  
*Juan Antonio Morales*

# **Money Creation and the Demand for Money during the Bolivian High Inflation of 1982 to 1985<sup>\*</sup>**

by  
Juan Antonio Morales

## **Introduction**

Bolivia's recent economic history has been dominated by the phenomenon of run away inflation and, up to September 1985, the unsuccessful efforts to contain it. The Bolivian monthly inflation rates from the second quarter of 1984 to third quarter of 1985 were the highest in the world in the last thirty five years and comparable only to those suffered in some Central European nations after both world wars. The high rates of growth of prices during this period characterize a clear case of hyperinflation. While the most acute symptoms of monetary disorder presented themselves in the period mentioned, high inflation rates had appeared since March 1982 when the fixed exchange rate regime collapsed.

The Bolivian case constitutes no exception to the rule that high rates in increases in prices are the manifestation of high rates of growth in the money supply. That the Bolivian big inflation had a strong monetary characterization is beyond controversy. But the problem is indeed why the Bolivian policy makers were unable for a relatively long time span to check the increases in the quantity of money.

Several explanations, more or less convergent, for similar cases have been advanced in the literatures.<sup>1</sup> The common element in those theories is that once the economy is thrown on a high inflation path, the process becomes cumulative, with the fiscal deficit being the main source of continuous money creation. But the fiscal deficit becomes in turn endogenous to the inflation rate, making therefore to money supply a process determined by inflation. The clearest case of money creation being determined by the inflation rate is when the government must

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<sup>\*</sup> I am indebted to Jeffrey Sachs and Justo Espejo for helpful discussions.

<sup>1</sup> See for instance Sargent and Wallace (1973), Sargent (1982), Dornbusch (1985), Dornbusch and Fischer (1985), Bruno and

finance a constant real deficit and the public has perfect foresight on inflation (See Sargent and Wallace, 1973).

In this paper I describe the main features of the Bolivian hyperinflation and its prelude. I will not argue about the ultimate causes that ignited inflation. Only as a memorandum item I mention that the high accumulation of public debt in the sentries combined with huge public investment projects that went sour are certainly among the culprits.

The paper emphasizes the estimation of the demand for money, the process of money creation, and the interaction of the latter with the former.

The high rates of growth of prices and of the money stock were concomitant to specific economic policies to which I wish to draw attention. A full treatment of the Bolivian high inflation needs to focus on:

1. The public external debt policies and the derived constraints.
2. The exchange rate policies
3. The wage policies especially in the public sector.
4. The pricing policies of publicly provided goods and services, especially gasoline.
5. The Central Bank credit policies to the private sector and its regulation of the Bolivian private commercial banks.

Throughout the paper there are specific references to policies 1 to 4. Unfortunately, the lack of information prevents the study of the importance of the private banks in the propagation of inflation and of the role played by the highly subsidized loans from the Central Bank to specific groups of private producers.

In Section I, the main events of the high inflation period are given. Significant space is granted in that section to the political context for reasons that will become clear later on. In Section II, estimates of the demand for money are provided as well as the results of causality test on inflation rates and money creation. In Section III, the interaction between money demand and the financing of the fiscal deficit with the inflation tax is examined; the important issue of the stability of the inflation rates is addressed there. The concluding Section brings together the main points of this study.

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Fischer (1985), and Cohen and Sachs (1985).

## **I. Economic and Political Characteristics of the Bolivian Inflation of 1982-1985**

### **a) The main Episodes**

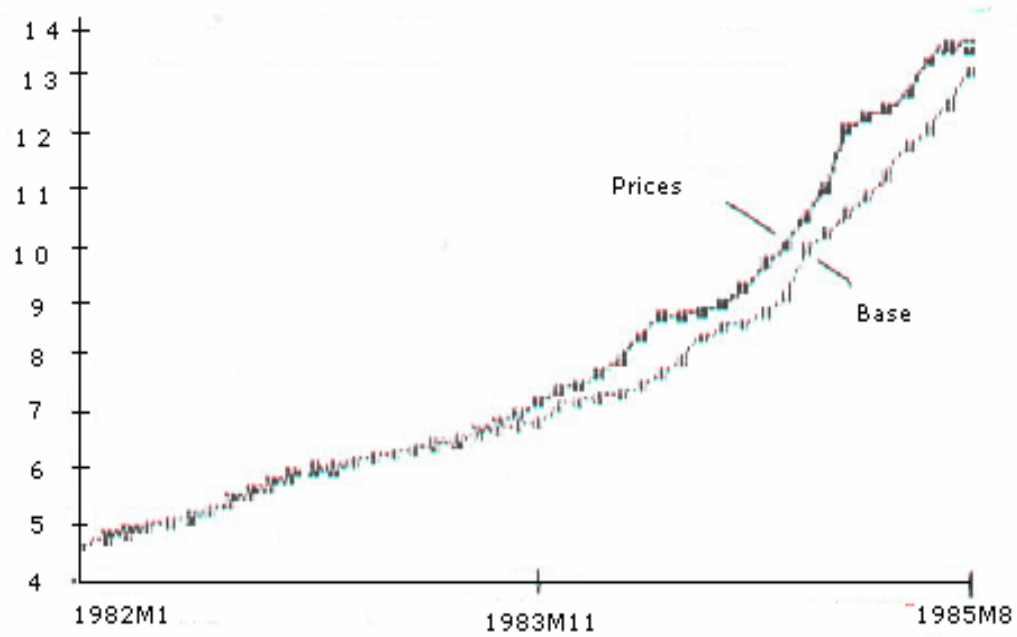
The quantitative characteristics of the high inflation period appear in Table 1. In that Table, prices are measured both by the Consumer Price Index and by quotations of the free market exchange rate. The Table also includes data on the money stock, using three different concepts. The coincidence (and sometimes lack of) in money price movements can be appreciated in Figures 1 and 2. The monetary characteristics of the hyperinflation sub-period are given in Table 2.

Our chronology of inflation starts at the beginning of 1982, with the collapse of the fixed exchange rate regime and its replacement by a dual system with a fixed official exchange rate reserved for imports of wheat and for the servicing of the public external debt, and a free floating rate for all other transactions. Exporters were obliged to surrender to the Central Bank 60 percent of their proceeds at the official exchange rate; the remaining 40 percent could be sold in the free market.

The shift in the exchange rate regime represented a major upheaval. It affected inflationary expectations profoundly and caught the government unprepared to cope with the new environment. Between March 1982 and October 1982 prices increased 141 percent, while the free market exchange rate increased 354 percent (See also Table 1).

**Figure 1:**

**Prices and Money. January 1982 - August 1985. Logarithms**



**Figure 2:**

**Monthly Inflation Rates of Growth of the Monetary Base  
January 1982 - August 1985**

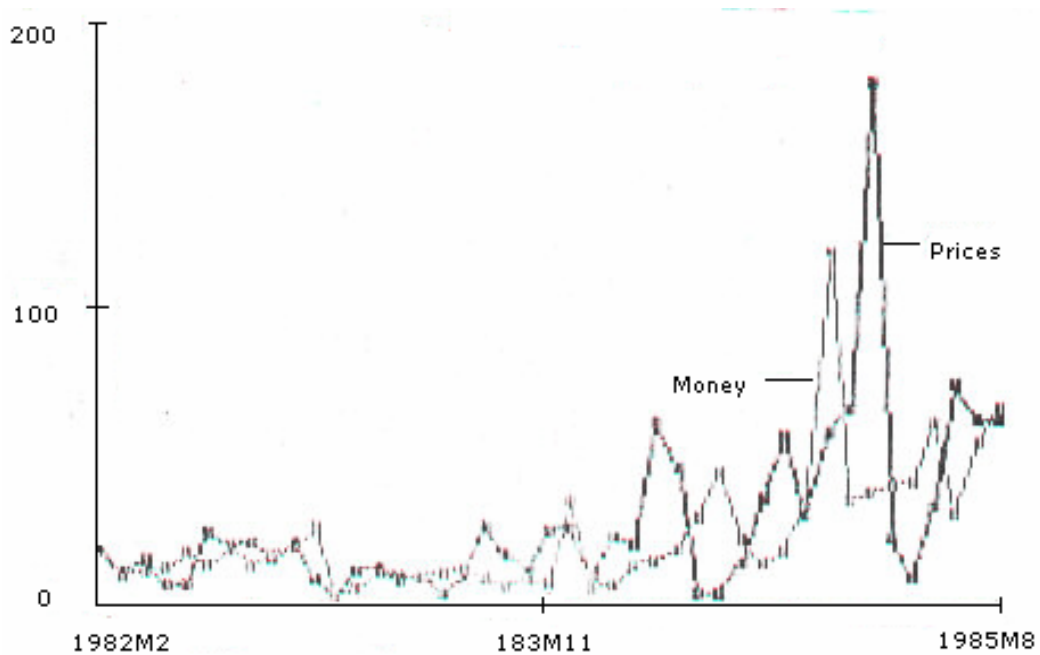


Table 1

## Prices and Money in Bolivia: January 1982 - August 1985

	Consumer Price Index (Base 1966=100)	Free Market Exchange Rate (Pesos per US)	Monetary Base (Million of \$b.)	M1 (Million of \$b.)	M2 (Million of \$b.)
1982 Jan	989.21	42.35	15704.00	16543.30	29383.70
Feb	1148.09	43.92	17718.00	17121.00	32759.70
Mar	1241.70	48.21	19107.00	18838.60	39494.40
Apr	1398.34	79.38	20672.00	19672.20	39638.50
May	1454.52	88.36	22708.00	21578.20	43018.40
Jun	1523.00	103.12	26273.00	25310.70	49333.40
Jul	1851.68	148.76	29208.00	29484.60	59620.40
Aug	2182.81	184.24	33933.00	32739.10	66277.10
Sep	2607.75	256.91	37558.00	37528.40	76356.50
Oct	2989.36	218.00	43371.00	43726.10	83488.10
Nov	3550.10	232.06	51086.00	46324.10	85144.30
Dec	3825.64	283.04	63726.00	56557.60	98536.10
1983 Jan	3848.40	340.80	64723.00	55352.50	102724.00
Feb	4242.96	430.66	67877.00	60477.60	107752.00
Mar	4744.27	475.23	74528.00	66613.70	116883.00
Apr	5141.26	397.25	80274.00	70805.70	123912.00
May	5617.02	365.47	87481.00	75762.20	130334.00
Jun	5796.78	341.90	96748.00	83660.10	144505.00
Jul	6380.29	508.60	107196.00	90631.30	156334.00
Aug	8035.26	718.26	116032.00	93115.00	164695.00
Sep	9353.67	761.14	123021.00	100537.00	178995.00
Oct	10432.80	866.20	133206.00	109480.00	188564.00
Nov	13018.20	1213.16	143378.00	120546.00	200345.00
Dec	16392.40	1243.88	194838.00	175124.00	266077.00
1984 Jan	17959.90	1800.00	205310.00	183649.00	286188.00
Feb	22091.90	2200.00	219137.00	174197.00	290456.00
Mar	26761.90	2543.00	249631.00	237920.00	344546.00
Apr	43614.10	3576.00	288534.00	269699.00	388000.00
May	64121.10	3512.00	344775.00	330044.00	460603.00
Jun	66730.10	3342.00	449392.00	440004.00	623864.00
Jul	70184.40	3570.00	658708.00	598766.00	863752.00
Aug	80709.20	7038.00	811946.00	717751.00	1071070.00
Sep	110836.00	13685.00	934724.00	889206.00	1313570.00
Oct	176371.00	15205.00	1188390.00	1193910.00	1647160.00
Nov	242026.00	18469.00	1491680.00	1495310.00	1984690.00
Dec	373293.00	24515.00	3344660.00	3295520.00	3985740.00
1985 Jan	629972.00	73016.00	4569740.00	4629500.00	5634760.00
Feb	1781380.00	141101.00	6374580.00	6454590.00	7734480.00
Mar	2225670.00	128137.00	9084340.00	9089080.00	10971200.00
Apr	2487920.00	167428.00	13036000.00	12884600.00	16438000.00
May	3375310.00	272375.00	21500300.00	21308800.00	26611800.00
Jun	6023640.00	481756.00	28557800.00	27777500.00	37803800.00
Jul	10017500.00	885476.00	45041700.00	47341300.00	60952300.00
Aug	16675200.00	1182300.00	76502500.00	74306300.00	98700600.00

Source: Bolivia, Banco Central, Boletín Estadístico, (Several Issues from 1982 to 1985)

**Table 2**  
**Main Monetary Characteristic of the Bolivian Hyperinflation**

	A	B
1. Approximate beginning month of hyperinflation	April 84	August 85
2. Final month of hyperinflation	August 85	August 85
3. Approximate number of months of hyperinflation	17.00	13.00
4. Ratio of prices of final month to month before hyperinflation	623.10	331.20
5. Ratio of monetary base at end of final month to quantity at first of beginning month	306.50	116.10
6. Ratio of M1 at end of final month to quantity at first of beginning month	312.30	124.10
7. Ratio of M2 at end of final month to quantity at first of beginning month	286.50	114.30
8. Average monthly rate of growth of prices (percentage)	46.01	56.26
9. Average monthly rate of growth of monetary base (percentage)	40.04	44.16
10. Average monthly rate of growth of M1 (percentage)	40.20	44.90
11. Average monthly rate of growth of M2 (percentage)	39.49	43.98
12. Maximum monthly rise in prices (percentage) c)	182.77	197.84
13. Change in monetary base in month of maximum change in prices (percentage)	39.59	36.63
14. Month in which real value of monetary base was at a minimum	Febr. 85	Febr. 85
15. Ratio of minimum real value of monetary base in month before hyperinflation (percentage) - Tage	38.36	24.49

Notes: A) Price index is the consumer price index  
B) Price index is the free market exchange rate  
C) February 85 for the CPI and January 85 for the exchange rate

What factors at the origin of the exchange rate collapse and the coetaneous spurt in inflation? We cannot identify all of them but it is quite sure that the unanticipated increase in the burden of the external debt in early 1982 had a major impact. Foreign exchange reserves were rapidly depleted in part to service the debt and in part because no further long term borrowing was possible in view of the international debt crisis. The public, aware of the precarious reserve



position, aggravated the problem speculation against the peso.

With rising expectations of higher exchange rates, exporters ceased almost completely, by the middle of 1982, to surrender their dollars to the Central Bank in the proportion that they were obliged and concomitantly they stopped their tax payments. To obtain the needed foreign currency to service the debt and for imports of the public enterprises, appeals were made to the Central Bank. This institution, in view of the scarcity of foreign exchange made loans in pesos, that in turn were employed by the beneficiaries to purchase dollars from the public at the free rate. This behavior was indeed highly inflationary and shows, in passing, one of the most direct links between debt, and inflation.

The uncertainty in the foreign exchange market metastasized to the rest of the economy increasing the dollarization of the economy and hence limiting the maneuvering space of the government in regard to economic policy.<sup>2</sup>

Since the dual exchange rate regime had created much animosity in the public and was blamed for the economic troubles, one of the first steps of Siles Zuazo when he started his administration in October 1982, was to return to a unified fixed exchange regime. The new rate was set at slightly below the free market rate (190 pesos per dollar versus 219 pesos in the free market). Along with fixing the exchange rate at an initially realistic level, a set of temporary regulations to control capital movements and the foreign exchange market, and curtail imports of non-essentials was enacted. In the same stabilization package, the prices of publicly provided goods and services were increased quite significantly.

While the de facto devaluation brought about by the new exchange rate regime and the increase in administered prices were standard stabilization instruments, the program contained two controversial measures, namely, a de-jure "dedollarization" and the establishment of wage indexation.

The dedollarization measure converted dollar and dollar-denominated liabilities among residents in peso contracts. The predictable immediate consequence of this policy was an increase in the intensity of capital flight as the government was unable (or even unwilling) to implement the administrative mechanisms to prevent this. Dedollarization greatly increased the

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<sup>2</sup> Dollarization has important negative effects on the design and effectiveness of macroeconomic policies. From a stabilization viewpoint, dollarization reduces the real revenue from money creation as it impinges upon the base of the inflation tax. For a discussion on dollarization and currency substitution see e.g. Ramírez-Rojas (1985). The related issue of the role of indexed

uncertainty surrounding the exchange rate policy.<sup>3</sup>

Wage indexation was installed with a rule that provided for an automatic increase in the minimum wage as soon as the inflation rate hit the threshold of 40 percent after the last adjustment. The increase in the minimum money wage to be of 100 percent; wages above the minimum were indexed in a proportion equal to the reciprocal of the number of times that the former were above the latter. This modality of wage indexation revealed itself to be an extraordinary mechanism of propagation of inflation.

It should be stressed that the compliance with the exchange rate regulations imposed by the Siles Zuazo government was very loose. During the first year, a thriving black market defeated all controls and, from the second year on, it evolved into a parallel "gray" market were tolerated or even legalized. The chastised dual exchange regime made a come back with the gray market.

In the first months of 1983, inflation seemed to be under control; however, pressures were building up, for instance, the exchange rate in the free (and black) market went up significantly precluding high price rises in consumer goods (See again Table 1). The worsening of the situation in the second half of 1983 forced the government to go again through an stabilization package in November with the usual measures: steep devaluation of the peso, price increases in the publicly provided goods and services, and increases in wages in compensation.

This package was unsuccessful and the need to devalue again arose in the first months of 1984. The stabilization measures of April 1984 constituted the most comprehensive (and orthodox) package before the one of August 1985. The peso was steeply devalued with the official exchange rate going from 500 pesos per dollar to 2000 pesos. Administered prices increased between fourfold and fivefold. Major steeps were taken to renegotiate the public and private foreign debts, and wage indexation was changes from the threshold rule to a one of a fixed periodicity of four months applicable 100 percent to all wages. The package included a

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money in hyperinflation is examined in Bomberger and Makinen (1983).

<sup>3</sup> It is quite clear that some degree of forced dedollarization was unavoidable to give some clout to the controls on foreign exchange. Dedollarization was also expected to provide a slow program of debt liquidation both private and public. In particular dollar-denominated reserves of the banking system in the Central Bank were a cause of utmost concern since they had been dilapidated by the previous military government. Private debt liquidation, hopefully obtained at a slow pace, was deemed to be a reactivation measure. In addition, the intellectual authors of the measure through, somewhat naively, that the demand for foreign exchange for domestic transactions would decrease, lessening therefore the pressure in the parallel market. On this see for instance R. Morales (1983).

provision for a small increment in wages.<sup>4</sup> The April 1984 program also included proposals for institutional and tax reforms. The former intended to give more power to the monetary authorities, while the latter aimed at modernizing the tax system.

The stabilization program was predictably received with furor by the labor unions and even the political parties in the government coalition. The government, unable to cope with the social tensions, yielded shortly to the demands to increase money wages to make more palatable the bitter medicine. The failure of the April stabilization program marked the beginning of hyperinflation and pushed to extremes the situation of financial disorder (See Table 2).

In May 1984, the government forced by the Confederation of Bolivian Workers, declared a unilateral moratorium on the payments of her debt to the international banks. This stance aggravated capital flight and put more pressure in the weakened peso.

The final months of 1984 witnessed uncoordinated efforts to stabilize and, paradoxically, unjustifiable increments in money wages that were financed by credits from the Central Bank to the public and the private sector.

The Siles Zuazo administration made a last (and futile) attempt at stabilization in February 1985, with a package similar to the one of April 1984, that included additionally, provisions for the indexation of taxes and interest rates. This plan failed again after ten thousand miners marched in the streets of La Paz in protestation.

In November 1984, Siles Zuazo was forced to call to early elections. The took place in July 1985, and the new president Mr. Paz Estenssoro inaugurated his term on August 1985. The new government prepared during the month of August another stabilization plan that came to light the 29th of that month. During the three weeks preceding the enactment of the plan, the economy went through a frenzy of speculation and grant uncertainty, especially in the sensitive parallel foreign exchange.<sup>5</sup>

The August 29, 1985, package finally stopped inflation. An analysis of how this was

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<sup>4</sup> It is worth noting that the labor unions decided to foregone around of wage indexation that was due right before that plan was announced. The labor unions displayed occasionally a cooperative behavior that was not fully appreciated neither by the authorities nor by the press.

<sup>5</sup> It is interesting to note that this speculation against the plan contrasted sharply with what happened in the final months of the European hyperinflations after World War I where expectations of reform altered the behavior of prices and increased the demand for real cash balances. See Cagan (1956) and LaHaye (1985). Ironically the Bolivian adverse speculation helped the stabilization plan since it led to extraordinary increases in some prices that, a few days after the plan came to light, disappeared

obtained is beyond the scope of this paper.

b) The political context

The period of high inflation was marked by political instability, first with the military governments and afterwards with the democratically elected government of Mr. Siles Zuazo. With the support of urban workers and peasants Siles Zuazo had won three consecutive elections and after each one he was denoted victory by military or parliamentary interventions. The last election that he won was in 1980. A military coup d'etat blocked him from taking power. After two years of intervention, the military decided to reconvene the Congress elected in 1980, which in turn ratified Siles Zuazo in the presidency.

The political backing of Siles Zuazo consisted of a loose coalition of three centrist parties -including the Christian Democrats among them- and the Communist Party. In two of the centrist parties there were, however, radical factions that frequently opposed the government policies. As was mentioned above Siles Zuazo initially enjoyed a strong support from the unions and peasant organizations. These groups expected almost immediate gratification from this administration under the form of higher wages that could help them to recoup the heavy losses in real wages and income that they had suffered in the preceding ten years during the, mostly, military governments. Their initial enthusiastic support became however, a bitter opposition marked by the feeling of betrayal once their hopes failed to materialize.

Moreover, the political coalition was ridden with bickering and in-fighting since its inception. In Siles Zuazo own party, some of the rival factions broke away to join opposition in Congress. As his coalition started to fade, Siles Zuazo became more reclusive and tended to rely increasingly on a coterie of close advisors and technocrats. In view of the disintegrating economy, creditors, foreign governments and the international community of experts tried to exert leverage in the administration using the channel of the technocrats. These attempts alienated the administration from the unions and its political supporters.

Abandoned by the unions and parties of the left. Siles Zuazo could not either find support in the center and center-right parties and business organizations. Congress dominated

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granting therefore an almost instant credibility to the anti-inflationary measures of the final days of August 1985.

by the center and center-right parties opposed every measure and initiative coming from the Executive. The powerful Bolivian Confederation of Private Enterprises behaved similarly, probably out of fear of expropriations. The presence of the Communist Party in the coalition, that lasted throughout 1984, was an important ingredient in this attitude. Ironically, important sub-sectors in the private sector benefited greatly from some of the economic policies (and mistakes) of the administration, for instance, from the debt liquidation caused by dedollarization and from the loans granted by Central Bank at very subsidized interest rates.

The political isolation of Mr. Siles Zuazo added strong elements to the reigning uncertainty. In this context, his stabilization policies lost completely the important ingredient of credibility and, if anything, they worsened an already difficult situation.

After Siles Zuazo call to early elections in November 1984, the situation worsened completely. The governing coalition disintegrated away. Some of the remaining factions whitening the government attempted to make political gains in the forthcoming elections lobbying for (and obtaining) wage increases financed entirely by money creation. Siles Zuazo obsession with the preservation of democracy and his desire to avoid by all means anything that may hamper the promised elections made him yield to the unreasonable pressures of several groups. The pressures were translated ultimately in more money creation and more inflation.

Table 3 summarized the discussion above on the main economic and political occurrences in the period between February 1982 and August 1985.

**Table 3****The Bolivian High Inflation of 1982-1985. Chronology of Main Events**

Date	Events
February 1982	The Bolivian peso is devalued 43.2 percent
March 1982	The fixed exchange rate regime collapses and is replaced by a dual regime. Most transactions are undertaken with a floating rate
September 1982	Bolivia ceases payments on her foreign debt to the commercial banks
October 1982	The democratically elected government of Siles Zuazo starts its term following a long string of military regimes
November 1982	Return to the fixed exchange rate regime. The peso is devalued 76.8 percent. Controls of foreign exchange and imports are established. Contracts among residents are dedollarization and wage indexation is announced
March 1983	Bolivia resumes payments to the international commercial banks
October 1983	A new stabilization program is put forth. It includes a devaluation of 62 percent and increases in administered prices
April 1984	The Bolivian government attempts once again at stabilization with an IMF-type plan. The peso is devalued 75 percent and administered prices suffer a big hike. The system of wage indexation is modified and steps are renegotiated the foreign debt. Beginning of hyperinflation
May 1984	Big wage increases are granted by the government to compensate for the loss in real wages brought about by the April plan. Government announces a unilateral moratorium in payments to the foreign banks
August 1984	New attempt at stabilization establishing four different official exchange rates
November 1984	President Siles Zuazo is compelled by the opposition parties, in view of the deterioration of the economy, to call early elections. The government attempts for the fifth time since October 1982 to stabilize. Official exchange rates are unified with an accompanying devaluation of 76.8 percent
December 1984	Imprudent wage increases are granted after heavy pressure from the Confederation of Bolivian Workers
January 1985	The peso depreciates 47 percent in the black market
February 1985	The government attempts for the sixth time to stabilize with a package similar to the one April 1984. Indexation of taxes and interest rates is established
March 1985	Ten thousand miners march in the streets of La Paz in protest for the February package
May 1985	The peso is devalued again in 33.33 percent
July 1985	Right and center-right parties win the presidential and congressional elections. The left suffers a very heavy defeat
August 1985	Paz Estenssoro is elected President by Congress. Announcement of a new stabilization plan being studied provokes a frenzy of speculation. On August 29th, a stabilization plan with a shock treatment is presented. The plan eventually stops inflation

### C. The crisis in the fiscal sector

While fiscal imprudence and strong dependency on foreign debt led the economy to a high inflation path, it is also true that we can count the public finances among the main victims of financial disintegration. Once inflation was ignited, the deficit became endogeneized to the inflation rate, via lags in tax collections, and in the official exchange rate and other administered prices through a rather complex mechanism. This last feature is probably specific to the Bolivian policy-making of that period.

The impact of lags in tax collections has been amply documented on the literature on inflations.<sup>6</sup> We need only to add that the inflationary environment and the increasing powerlessness of the government led to more-than-normal tax evasion.

Table 4 summarizes the main features of the public finances during the inflationary period. It is worth noticing that tax revenues for the government fell to a low 3 percent of GDP during the last two years. As a memorandum item, in the seventies revenues were of the order of 12 percent. Table 5 gives the sources of expansion of the monetary base. Given the high subsidy involved in the loans of the Central Bank of the public (banking and non-banking) credit to banks and a significant portion of "other" should be considered as quasi-fiscal deficits. This procedure may be however debatable.

The fiscal impact of the official exchange rate in Bolivia has to be underscored. Bolivia possesses a very important sector of public enterprises, the main ones being exporters. It is quite clear that in this context the level of the exchange rate is crucial for their financial health. A similar comment may be made in regard to the revenues for the government since taxes on the foreign sector constituted traditionally a significant percentage.

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<sup>6</sup> Classic references on this point are Olivera (1967) and Tanzi (1977).

**Table 4**  
**Summary of Public Sector. Operations 1982 - 1985**

	1 9 8 2			1 9 8 3			1 9 8 4			1 9 8 5		
	Public Enterpr	General Govern.	Consoli dated	Public Enterpr	General Govern.	Consoli dated	Public Enterpr	General Govern.	Consoli dated	Public Enterpr	General Govern.	Consoli dated
Current Revenue	27.05	4.62	31.66	20.34	2.94	23.17	9.00	3.00	22.00	n.d.	9.08	n.d.
Current Expenditure	23.83	8.87	32.69	18.91	8.97	27.88	8.61	14.53	33.14	n.d.	16.84	n.d.
Current Account Surplus or Deficit (-)	3.22	-4.25	-1.03	1.32	-6.03	-4.71	0.39	-11.53	-11.14	-0.09	-7.76	-7.85
Capital Revenue	0.06	0.00	0.06	0.17	0.00	0.17	0.17	0.00	0.17	0.06	0.20	0.26
Capital Expenditure	4.50	0.38	4.89	2.98	0.41	3.39	2.31	0.54	2.85	1.37	1.94	3.31
Capital Account Surplus or Deficit (-)	-4.44	-0.38	-4.83	-2.81	-0.41	-3.22	-2.14	-0.54	-2.68	-1.31	-1.74	-3.05
Overall Surplus or Deficit (-)	-1.22	-4.63	-5.86	-1.49	-6.44	-7.93	-1.75	-12.07	-13.83	-1.40	-9.50	-10.90
Financing	1.22	4.63	5.86	1.49	6.44	7.93	1.75	12.07	13.82	1.40	9.50	10.90
- Internal Financing	0.01	4.63	4.64	2.62	7.76	10.37	4.02	12.59	16.61	1.31	9.21	10.52
- External Financing	0.01	-0.27	-0.27	-1.36	-1.16	-2.52	-0.23	-0.70	-0.93	0.09	0.29	0.38
Other	1.20	0.27	1.49	0.23	-0.16	0.08	-2.04	0.18	-1.86	0.00	0.00	0.00

Source: Author's elaboration with data provided by the Ministry of Planning-UDAPE. La Paz. Our estimates differ very considerably from other sources, and particularly from the IMF ones.  
Public Enterprises are non-financial public enterprises



**Table 5**

**Sources of Expansion of the Money Base  
January 1982 - August 1985 (As Percent of GDP)**

	<b>Net Foreign Exchange Reserves</b>	<b>Net Credit to Public Sector</b>	<b>Credit to Banks</b>	<b>Other</b>	<b>Money Base</b>
1982	-8.94	11.43	2.57	4.70	9.76
1983	8.18	8.91	1.64	-10.79	7.94
1984	3.33	3.25	3.39	0.47	10.44
1985 <sup>b</sup>	1.41	-1.08	2.64	6.51	9.44

Source: Author's estimates based on Central Bank of Bolivia data

Notes: <sup>a</sup> Average of quarterly changes in Monetary Aggregates divided by corresponding quarterly GDP

<sup>b</sup> From January 1985 to August 1985

The fixing of a good exchange rate for the public enterprises from the stand-point of government revenues was not however cost less. High exchange rates may have meant a heavier burden of the government of the foreign external debt than otherwise. The redistributive consequences of high official rates for the foreign exchange had also to be taken in consideration since they were the most important instruments of subsidization of certain consumptions. The several attempts to close gap between the official exchange rate and the black market rate ended in failure. The objective of real devaluation was very elusive and each devaluation was followed, after a few weeks of grace, by a new round of inflation was unable to obtain the income distribution changes necessary to obtain a realistic exchange rate. More generally, one of the main problems during the high inflation period was the obtain of a set of relative prices beneficial to the public sector.

Figures 3 and 4 show the difficulties to close the gap between the free market exchange rate and the official one, and in the maintenance of appropriate real exchange rates.

Figure 3

Official and Free Market Exchange Rates  
January 1982 - August 1985 (Logarithms)

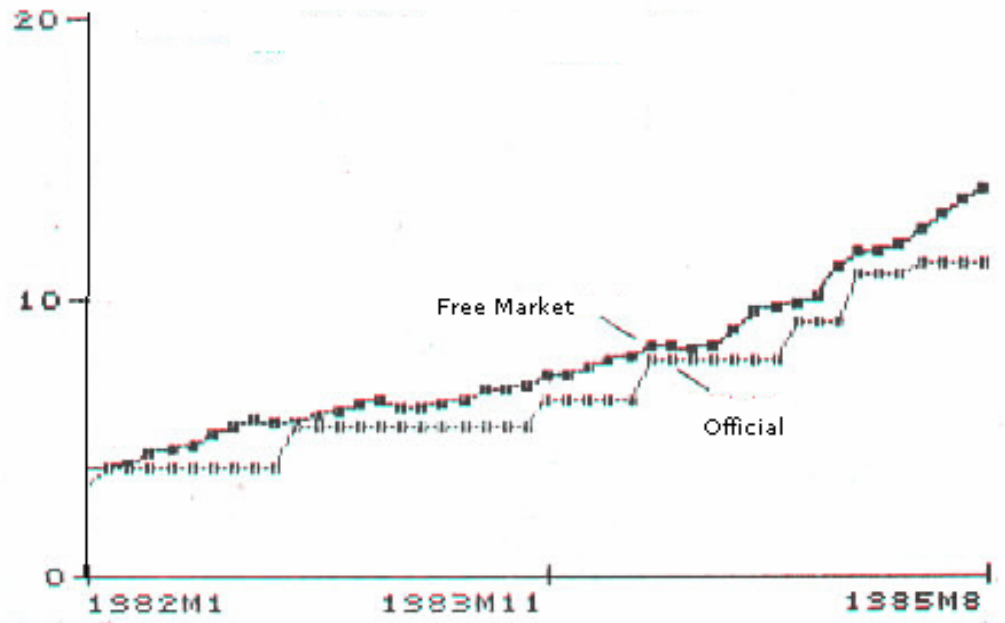
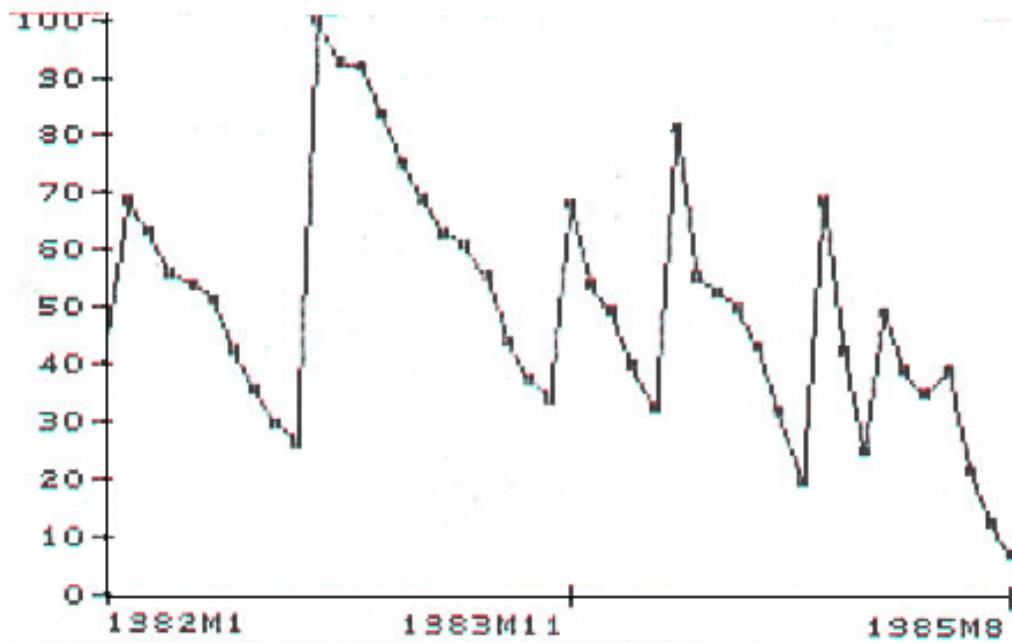


Figure 4

Real Exchange Rates. January 1982 - August 1985



## II. The Demand for Money

### a) Estimates of the demand for money

The demand for money during the period March 1982 - August 1985 has been estimated using a Cagan type of equation. The demand for real cash balances is posited as a function of expected inflation, the other usual arguments in money demand equations are ignored since they are dwarfed by the presence of high rates of inflation.

I assume in this paper that expectations are formed by a adaptive.

Expectations scheme. I shall come back later to discuss the implications of this assumption. The demand for money equation and the expectations mechanism are given by:

$$h_t = \alpha_0 + \alpha_1 \pi_t + \varepsilon_t \quad \alpha_1 < 1 \quad (1)$$

$$\pi_t = \pi_{t-1} + \mu (\dot{p} - \pi_{t-1}) \quad 0 < \mu < 1 \quad (2)$$

where:

$$h_t = \log (M_t/P_t)$$

$M_t$  = End-of-month monetary base

$P_t$  = Consumer price index

$\pi_t$  = Expected rate of inflation

$\dot{p}$  = Actual rate of inflation. This variable will be measured by  $\log (P_t/P_{t-1})$

$\varepsilon_t$  = Random disturbance. The  $\varepsilon_t$ 's are independent, normally distributed with mean zero and common variance

The data are given by monthly observations from March 1982 to August 1985. Seasonal adjustments of the data on money prices included in Table 1 have been performed using a ratio-to-moving average method with geometric weights, before any transformation.

Two comments are in order before proceeding to present the estimations.

First, the choice of the consumer price index (CPI) as the price variable is not without objection.<sup>7</sup> There are important issues concerning the quality of the Bolivian CPI. The most important problem is that during the period of our study many consumer prices were subject to

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<sup>7</sup> Alternatively, wholesale prices and GNP deflators could have been used but they were not available on a monthly basis.

controls directly, or indirectly through the official exchange rate. It must be stated however that the effectiveness of the controls diminished with the acceleration of inflation. A further problem is that the Bolivian CPI has fixed weights with base 1966 that are probably little representative of the consumer's basket in the last years. In addition, price data for the calculation of the CPI are collected only in La Paz. A contender for the CPI was an index of the exchange rate in the free (and during a sub-period black market). Results using this index do not differ markedly from the ones with the CPI but are more difficult to interpret.

Second, the selection of the money stock variable presented also problems. The monetary base was chosen in order to highlight later the role of seignorage in financing the government deficits. Alternatively, M1 could be chosen; M2 is in all likelihood unsuitable since during a part of the period of study, deposits in dollar-denominated accounts constituted a significant percent of it. Bolivian monetary authorities tend to focus exclusively on the emission of notes but this is clearly a very narrow concept. The data on the monetary base are subject to criticism and are less reliable than the ones the emission of notes. A full discussion concerning the data deficiencies, however warranted, is beyond the scope of this paper.

Equation (1) with expectations given in (2) was estimated in two different ways. First, equation (2) was expressed in terms of the corresponding transfer function and then inserted in equation (1). This yielded the non-linear equation:

$$h_t = a_0 + a_1 (1 - \lambda) \sum_{i=0}^{\infty} \lambda^i \dot{p}_{t-i} + \varepsilon_t \quad (1')$$

where:

$\lambda (1-\mu)$ . A maximum likelihood method was used to find the estimates of  $\lambda$ ,  $\alpha_0$ , and  $\alpha_1$ . Since autocorrelation was detected in the  $\varepsilon_t$ 's equation (1') was quasi-differenced and the autocorrelation coefficient  $\rho$  was estimated using the same search procedure as the one employed for  $\lambda$ .

Second, inserting equation (2) directly in equation (1) and after some manipulations the following dynamic equation was found:

$$h_t = (1-\lambda)\alpha_0 + \lambda h_{t-1} + (1-\lambda)\alpha_1 \dot{p}_t + \varepsilon_t - \lambda\varepsilon_{t-1} \quad (1'')$$

Equation (1'') was estimated using an instrumental variable approach using as instruments  $h_{t-1} \dot{p}_t$  and  $\dot{p}_{t-1}$ . The method yields consistent estimators but they are not, in general, asymptotically efficient. As can be seen in Table 6, the two methods yield results that are surprisingly similar.

**Table 6**  
**Demand for Money Regressions**  
**(March 1982 - August 1985, Monthly Data)**

Equation	Method of Estimation	$\lambda$	$\alpha_0$	$\alpha_1$	SEE	Adjusted $R^2$	D.W.	$\rho$	Durbin-H
(1')	Maximum							0.75	
	Likelihood <sup>a</sup>	0.81	3.05175 (0.09104)	-3.82686 (0.32683)	0.09264	0.9619	1.6168		
(1'')	Instrumental	0.61116	3.13339	-3.76388	0.01605	0.8868			0.22016
	Variables <sup>b</sup>	(0.11337)	(0.90044)	(1.02952)					

Notes: Standard errors in parenthesis

<sup>a</sup> The values of  $\lambda$  were estimates using the search procedure of Hildreth-Lu (1960). The search over  $\lambda$  was carried down to intervals of 0.01 over the interval (0.99). The search over  $\rho$  was carried down to intervals of 0.05 over the interval (-0.95, 1.00)

<sup>b</sup> The instruments used in the estimation are the dependent variable lagged one period and period an the independent variable current and lagged one period. The estimates of  $\lambda$ ,  $\alpha_0$ ,  $\alpha_1$  are consistent but not asymptotically efficient

The estimates of the crucial reaction coefficient  $-\mu\alpha_1$  are 0.7271 (standard deviation = 0.0621) in the Maximum Likelihood method, and 1.4635 (standard deviation = 0.4003) in the instrumental variables approach. In this second case, the point estimate of the reaction coefficient is above unity; however we cannot reject the null hypothesis  $-\mu\alpha_1 \leq 1$  at the 5 percent significance level.

#### b) Money and prices: Causality tests

The issue of how money is generated is important, both from a theoretical viewpoint as well as for the statistical validity of the methods used in the estimation of the system of equations given by equations (1) and (2). In fact, the process of money creation together with the money demand equation is at the heart of the problem of hyperinflation.

Sargent and Wallace (1973) examined this issue proposing Granger-causality test on the rates and inflation and money creation.

With a procedure similar to the one employed by Sargent and Wallace (1973) we propose the two following equations:

$$\dot{p}_t = \gamma + \sum_{i=-4}^5 \beta_{-i} \dot{m}_{t-1} + u_t \quad (3)$$

$$\dot{m}_t = \delta + \sum_{i=-4}^5 \gamma_{-i} \dot{p}_{t-1} + u'_t \quad (4)$$

where:

$$\dot{m}_t = \log(M_t / M_{t-1})$$

Inflation causes money creation in the Granger sense if the data lead to reject the null hypothesis  $H_0: \beta_4 = \beta_3 = \beta_2 = \beta_1 = 0$  in equation (3). Conversely money creation causes inflation in the Granger sense in the null hypothesis  $H_0: \gamma_4 = \gamma_3 = \gamma_2 = \gamma_1 = 0$  is rejected. Remark that the  $\beta$ 's ( $i=1,4$ ) are the coefficients on future values of  $m$ , while the  $\gamma$ 's ( $i=1,4$ ) are the coefficients on future values of  $p$ .

Quasi-differenced versions of (3) and (4) were estimated with monthly data for the period August 1982 March 1985. Results of the estimation appear in Table 7 and Table 8. The results of Table 7 are not completely conclusive. First, the Durbin-Watson is relatively low and falls in a region of indeterminacy. If, in fact, there is no correlation in the disturbances the F-value obtained to test null hypothesis will make it reject it at the 5 percent significance level. The critical value  $F^*(4,21)$  is 2.84. In addition, if we observe the relative magnitudes of the coefficients (in absolute values) we notice that except for the one on the first forward lag, the coefficients on the future rates of money creation are somewhat larger than the corresponding coefficients on the lagged rates. The t-values, not reported in the table, are also larger in absolute terms. The results in Table 8 are more nintid. With an F-value of 1.4942 the null hypothesis cannot be rejected. The coefficients on future rates of money creation are also smaller (in absolute values) than the coefficients on lagged rates.

Table 7

**Inflation Regressed on Money Creation**  
(August 1982 - March 1985)

**Dependent Variable:  $\log(P(T)/P(T-1))$**   
**Independent Variables: Forward and Backward Lags of  $\log(M(T)/M(T-1))$**

ABS (I)	Coefficients on Future Rates of Money Creation	Coefficients on Lagged Rates of Money Creation
0	-0.073965 (0.251229)	0.633998 (0.255272)
1	0.614996 (0.230233)	0.364185 (0.252281)
2	0.420606 (0.231890)	0.463391 (0.273524)
3	-0.470079 (0.244275)	-0.531387 (0.275847)
4		-0.205236 (0.292131)
5		-0.732071 (0.390311)

Notes: Constant = 0.0785557 (0.060704)  
 RHO = 0.24056  
 D.W. = 1.6857  
 R<sup>2</sup> = 0.7333  
 F(4/21) = 3.4253  
 Estimated standard errors in parenthesis

Table 8

**Money Creation Regressed on Inflation**  
(August 1982 - March 1985)

**Dependent Variable:  $\log(P(T)/P(T-1))$**   
**Independent Variables: Forward and Backward Lags of  $\log(M(T)/M(T-1))$**

ABS (I)	Coefficients on Future Rates of Money Creation	Coefficients on Lagged Rates of Money Creation
0		0.3221960 (0.125039)
1	0.0409525 (0.114041)	0.0412463 (0.131260)
2	0.2280121 (0.108600)	0.2781970 (0.153145)
3	-0.1096670 (0.114223)	0.1459090 (0.192498)
4	0.0042988 (0.101836)	-0.1387600 (0.190366)
5		-0.0048129 (0.181910)

Notes: Constant = 0.0063117 (0.038138)  
 RHO = 0.20289  
 D.W. = 1.9242  
 R<sup>2</sup> = 0.7883  
 F(4/21) = 1.4942  
 Estimated standard errors in parenthesis

We may conclude tentatively, in view of the results of Tables 7 and 8, that inflation "causes" money in the Granger sense.

A more thorough description of the process governing money creation would incorporate the political economy features of Section I above. Indeed, our study suggests that, at least in the Bolivian case, monetary emission responded to a rather complex set of factors and not only to the need to finance a constant real deficit or even a growing one. Organized labor that resisted wage cuts and tried to maintain real disposable income constant, political instability, and shocks in the parallel foreign exchange market have to be taken into account. Many of those factors created surprises to the fiscal budget and non programmed money expansion.



### III. Money Creation and the Fiscal Deficit

The interplay between the demand of money and the fiscal deficit is examined below, in a first approximation, using a closed-economy model along the lines proposed by Bruno and Fischer (1985) (See also Cohen and Sachs (1985)).

Let the demand for money be expressed as in equation (1), with adaptive expectations following (2). Let the financing of the fiscal deficit be given by:

$$M_t - M_{t-1} = P_t D \quad (5)$$

where D is a given real deficit

In the steady state  $\dot{p} = \dot{m} = \pi_t = \pi_{t-1}$ . For  $\pi_t = \pi_{t-1}$ , let us define the "seignorage" function S as:

$$S(\dot{p}) = (\exp(\dot{p}) - 1) (\exp(\alpha_0 + \alpha_1 \dot{p})) / \exp \dot{p} \quad (6)$$

$S(\dot{p})$  is a continuous concave function of  $\dot{p}$ , if  $\dot{p} \geq 0$ , that attains a maximum at  $\dot{p}^* = \log(1 - (1/\alpha_1))$ .  $S_{\max}$  will denote the value of S at  $\dot{p}^*$ .

If D is positive and  $D \leq S_{\max}$ , there are two non-negative steady state rates of inflation, say  $\dot{p}_1$  and  $\dot{p}_2$ , that are solutions to the equation

$$S(\dot{p}) = D \quad (7)$$

Moreover, it is easy to see, given the shape of S, that  $\dot{p}^*$  is an interior point in the open interval  $\dot{p}_1$  and  $\dot{p}_2$ .

Under our hypothesis of adaptive expectations, it can be shown that the low steady state rate of inflation is stable. Indeed, taking first differences in equation (1), we obtain:

$$\dot{m}_t - \dot{p}_t = \alpha_1 (\pi_t^* - \pi_{t-1}^*) \quad (8)$$

Inserting (8) in (2) we obtain:

$$\pi_t - \pi_{t-1} = \mu(\dot{m}_t - \pi_{t-1}) / (1 + \alpha_1 \mu) \quad (9)$$

We shall assume -  $\alpha_1 \mu_1$  (1, for if  $0 < \mu \alpha_1$ ) prices are always unstable given money growth, as a well known. Notice that our empirical results on the reaction coefficient stated above do not contradict this assumption.

Now, from a slight generalization of equation (5) we have:

$$(M_t - M_{t-1}) / M_{t-1} = P_t / M_{t-1} S \quad (10)$$

or equivalently:

$$M_t / M_{t-1} = \{1 - (P_t / M_t) S\}^{-1} \quad (11)$$

Therefore:

$$\pi_t - \pi_{t-1} = (\mu / (1 + \mu \alpha_1)) \{-\log((1 - P_t S / M_t) - \pi_{t-1})\}$$

or

$$\pi + (\mu / (1 + \mu \alpha_1)) \log(1 - P_t S / M_t) = (1 - \mu (1 + \mu \alpha_1)) \quad (12)$$

Linearizing (11) around any steady solution  $(\dot{p}, D)$ , and assuming without any loss of generality that  $\alpha_0 = 0$ , the following expression is obtain:

$$\pi_t = \sigma \pi_{t-1} \quad (13)$$

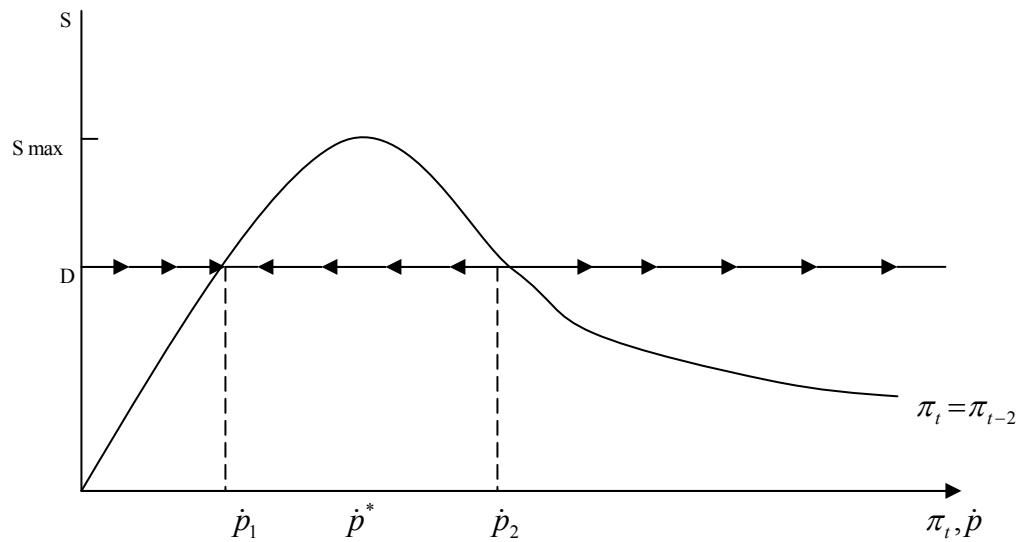
where:

$$\sigma = (1 + \mu \alpha_1) + \mu / (1 + \mu \alpha_1) + \mu \alpha_2 (\exp \dot{p} - 1)$$

If  $\dot{p} = \dot{p}_1$ , the low inflation steady state, then  $0 < \sigma < 1$  and  $\pi_t$  converges in non-oscillatory

discrete jumps to  $\dot{p}_1$ . Thus  $\dot{p}_1$  is a (locally) stable steady state while  $\dot{p}_2$  is unstable since  $\sigma > 1$  if  $\dot{p} = \dot{p}_2$ . This can be seen as follows. The value of  $\sigma$  depends upon the term  $-\alpha_1 (\exp \dot{p} - 1)$  being smaller, equal or greater than one. Since  $\dot{p} = \dot{p}_1$  lies to the left of  $\dot{p} = \log(1 - 1/\alpha_1)$ , and remembering that  $\alpha_1 < 0$ , then  $-\alpha_1 (\exp \dot{p} - 1) < 1$ . A symmetric argument applies to the case  $\dot{p} = \dot{p}_2$ .

The situation is depicted in Figure 1. Notice the convergence to the low inflation rate from any initial point below  $p$ , a given  $D$  ( $S_{\max}$ ).



If instead of adaptive expectations, rational expectations assumed, the stable steady is the high one as is shown, for instance, in Cohen and Sachs (1985) in a slightly different context.

Combining the results of Table 4 and Table 6, different pairs of stationary rates were obtained: they appear in Table 9. In order to make comparisons, the optional inflation taxes and the actual inflation rates are also included.

If we look to what happened in 1982 and 1983 we notice that the actual inflation rates were well below the optional inflation tax, but they were above the low steady inflation rate. Had the deficit stayed on those levels, if our model is valid, inflation would have eventually converged to it. However, the worsening of the deficit, due to its dependency from inflation precluded this occurrence. It is also possible that a strong shock, produced for instance in the parallel foreign exchange market, could have sent expected inflation above  $p$  and into an

unstable path.

Table 9

Stationary Inflation Rates and Optimal Inflation Taxes  
(Percentages)

Year	Deficit /PIB	Monthly Rates		Optimal Inflation Tax	Actual Inflation	Annualized Rates**		Optimal Inflation Tax	Inflation
		Stationary Rates				Stationary Rates			
		Low Rate	High Rate			Low Rate	High Rate		
1982	5.85	6.05 <sup>a</sup> 5.45 <sup>b</sup>	59.00 <sup>a</sup> 63.38 <sup>b</sup>	26.13 <sup>a</sup> 26.57 <sup>b</sup>	12.20	102.1 <sup>a</sup> 89.0 <sup>b</sup>	26018.0 <sup>a</sup> 30086.1 <sup>b</sup>	1521.1 <sup>a</sup> 1590.3 <sup>b</sup>	296.60
1983	7.92	8.86 <sup>a</sup> 7.75 <sup>b</sup>	48.24 <sup>a</sup> 53.20 <sup>b</sup>	26.13 <sup>a</sup> 26.57 <sup>b</sup>	12.90	176.9 <sup>a</sup> 144.9 <sup>b</sup>	11168.8 <sup>a</sup> 16617.4 <sup>b</sup>	1521.1 <sup>a</sup> 1590.3 <sup>b</sup>	328.50
1984	13.81	Doesn't Exist	Doesn't Exist	26.13 <sup>a</sup> 26.57 <sup>b</sup>	29.80	Doesn't Exist	Doesn't Exist	1521.1 <sup>a</sup> 1590.3 <sup>b</sup>	2177.20
April 84 August 85	n.a.	?	?	26.13 <sup>a</sup> 26.57 <sup>b</sup>	46.01	?	?	5075.0 <sup>a,c</sup> 5390.6 <sup>b,c</sup>	62210.00

Notes: \* December to December rates

<sup>a</sup> Based on the M.L. estimates of Table 6

<sup>b</sup> Based on the I.V. estimates of Table 6

<sup>c</sup> From April 84 to August 85 (17 months)

More important, which the high fiscal deficit of 1984, non-negative steady state rates do not exist and inflationary expectations increase boundlessly.<sup>8</sup> The non-existence of stationary rates meant the highest stage in the inflation process. It is worth noting that in 1984 and a fortiori between April 1984 and August 1985, the actual average monthly inflation rates were well beyond the optimal inflation tax. According to our results, the maximum possible seignorage would have amounted to around 13 percent of GDP.

Since genuine tax resources and the inflation tax were unable to finance the government expenditures. How were the very high deficits then financed? A very plausible explanation is given by the postponement in government payments of accounts due to residents (the so called "floating debt") and a costly accumulation of foreign debt with the building up of arrears.

<sup>8</sup> This possibility is also examined in Dornbusch and Fischer (1985)

#### **IV. Conclusions**

The recent Bolivian high inflation provides an extraordinary experiment to test current theories on inflation. The results included in sections II and IV seem to lend support to the conventional theories that emphasize the role of the fiscal budget, its internal financing with money creation, and the flight away from national money. Even with a process of relatively slow and smooth formation of inflationary expectations, uncontrolled fiscal deficits eventually threw inflation in an unstable path. As the fiscal deficit increased, hyperinflation became a strong possibility as is suggested by our discussion of section III.

More work is needed however on the fiscal budget itself. For instance, a full endogenization of the real deficit to the inflation rate is needed. While the Olivera-Tanzi effect and the enormous difficulties in administering relative prices played on the revenue side, rigidity on the real level of expenditure resulted from the need to service a huge external debt and, possibly, from the mechanism of backward-looking wage indexation, given the weight of the public sector in the economy. Along the same lines, a separate and complete treatment of the effects of exchange rate movements -both official and in the parallel market- on the fiscal deficit would be a welcome complement. Official devaluations of the Bolivian peso originated eventually fully anticipated positive net effects on the budget, while depreciations in the parallel market created surprises, obliging to unplanned money expansions and to (belated) official exchange rate changes.

The political economy of the high inflation period characterizes itself for its many complex elements, that are difficult to incorporate in our formal model of money creation and demand. The discussion included in Section I should help in gauging the more quantitative results.

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