Determinants of Hyperinflation: Case Studies from Latin America

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Economics Senior Thesis

5/14/2013

## Introduction

Hyperinflation is an economic condition in which inflation spirals out of control, making the national currency essentially worthless. In a state of hyperinflation, the prices of goods and services rise rapidly, doubling by the day or even by the hour. The spiraling prices and destruction of purchasing power spreads panic across the economy and destroys the value of savings and investment holdings. Thus, although rare in occurrence, hyperinflation episodes are severely damaging to any economy in which they take root. It is the extreme nature of hyperinflation which makes it a very interesting phenomenon to study, in a similar manner to the way in which the Great Depression is subject of great interest to economists. Periods of runaway inflation offer real-life examples of the disastrous effects that can result from macroeconomic policy failure. Lessons can be learned from these examples in order to prevent future occurrences. In this paper, three case-studies of hyperinflation will be examined, with a particular focus on the factors that contributed to the spiraling of prices. The countries analyzed are Brazil, Argentina and Peru; all of which experienced hyperinflation in the 1980's or early 1990's.

The hyperinflation episodes which took place in Brazil, Argentina and Peru were among the worst in recorded history. In Brazil, the annual inflation rate (measured as the percentage change in the Consumer Price Index) neared 3,000% year over year in 1990 and crossed above 2,000% again in 1994. In Argentina, the inflation rate crossed the 3,000% mark in 1989 and persisted at over 2,000% in 1990. Peru experienced the most dramatic price increases of the three countries; its price level rose over 3,000% percent in 1989 and then over 7,000% in 1990 (World Development Indicators, 2013). These crises devastated the economies of Brazil, Argentina and Peru, wiping out the purchasing power of its citizens and eroding the value of

savings and investments. Economic activity was sharply reduced in the region, as confidence in the national currency and central authority became greatly diminished. Given the serious effects that hyperinflation had on Brazil, Argentina, and Peru, it is important to understand how such crises were able to develop. After reviewing the relevant literature and constructing hypotheses, an explanatory model will be created and tested to show the major factors which contributed to hyperinflation in these three cases.

## Literature Review

There is an abundance of literature on the topic of hyperinflation, and the work of economists will be utilized in developing the hypotheses and model for the causes of hyperinflation in Brazil, Argentina and Peru. A foundational work in the literature on hyperinflation belongs to Phillip Cagan (1956). In his work, Cagan analyzed seven cases of hyperinflation and examined the role of exogenous money supply growth in fueling the price spiral. He found monetary growth to be the main factor contributing to hyperinflation in the cases which he studied, providing evidence for the famous claim that Milton Friedman would make a few years later that "Inflation is always and everywhere a monetary phenomenon." Fittingly, Cagan's paper was edited by Milton Friedman and is a major work in the monetarist theory. His conclusions about the importance of exogenous money growth will be tested for the cases of hyperinflation in Brazil, Argentina and Peru to see if the monetarist credo holds true for the Latin American experience.

In a similarly themed paper, economists Thomas Sargent and Neil Wallace (1981) analyzed the effects of government debt on inflation and tied the story into the monetarist theory. Sargent and Wallace developed a theory for the public finance budget constraint and proposed

that budget deficits must be financed by growth in the monetary base when the interest rate exceeds the growth rate of the economy. This dynamic is known as seigniorage, or the "inflation tax", where the central bank inflates the economy through money growth in order to reduce the public debt burden. Based on these theoretical principles, the issue of public debt will be analyzed in the cases of Brazil, Argentina and Peru for its effects on hyperinflation in these countries. In particular, external debt will be analyzed in the select cases for reasons that will be discussed in the next section.

Danish economist Martin Paldam (1987) analyzed the impact of government structure and regime type on the high inflations of Latin America. Paldam found that higher inflation rates persisted in Latin American countries in times of democratic rule and were generally lower during times of autocratic or military rule. Similarly, Manoel Bittencourt (2010) found that democratic governments of Latin America have been less able and less willing to fight inflation than their autocratic counterparts. He attributes this to their populist nature and the weak institutional structures that they must work with. Based on the work of these economists, the effects of political regime type on inflation will be analyzed for Brazil, Argentina and Peru.

Finally, Aisen and Veiga (2006) analyzed the inflation rates of around 100 countries from the period 1960-1999 and proved their main hypothesis that political instability leads to higher inflation. The conclusions of Aisen and Veiga will be tested in this analysis to see if political instability was an important contributor to hyperinflation in the specific cases of Brazil, Argentina and Peru. The authors also examined the effects of regime type and used polity ratings obtained from the Polity IV Project as a proxy. The polity rating proxy will be used in this analysis in order to quantify and examine the relationship between political regime type and inflation for the selected cases.

**Hypotheses**

Based on the foundations of economic theory and the work previously discussed, a number of hypotheses are generated for the determinants of hyperinflation in Brazil, Argentina and Peru. It is proposed that the hyperinflation episodes of these countries were at least in part a result of policy failure, namely in central governments becoming excessively indebted and relying on seigniorage to remain solvent. It is proposed that the central banks of these countries, either due to a lack of independence or the pursuit of nationalist goals, contributed to the hyperinflations by excessively growing the supply of money to monetize fiscal imbalances.

On the monetary front, it is hypothesized that the growth rate in the monetary base was a major factor in the high rates of inflation experienced in the countries. The analysis of monetary base growth as opposed to money supply growth will allow for the isolation of conscious central bank policy-making without the effects of endogeneity that may be found in the money supply growth (i.e. with increased money demand during inflationary conditions leading to increased credit money). On the fiscal front, it is hypothesized that external debt was a particularly important contributor to hyperinflation for two reasons: First, these particular countries became heavily indebted to foreign creditors in the 1960's and 1970's during a boom period for the debt of developing nations. Second, governments have a much greater incentive to inflate away debt burdens held by foreigners than they do for debt held by their own citizenry. Central governments would be much more concerned with the negative reaction and unrest caused by citizens of their own country as a result of seigniorage than they would in the case of foreign protest.

Additionally, based on the work of Aisen and Veiga, it is hypothesized that during times of political instability and unrest, inflation rates were higher in the three countries. The relative frequency of coup d'états (both successful and unsuccessful) will be used as a proxy for political instability. The recent occurrence (within the past 3 years) of a coup d'état is proposed to be a significant factor in high inflation rates due to the fear it strikes in the ruling regime of losing power and the resulting lack of will to implement the tough measures necessary to curtail inflation. Based on the theory established separately by Paldam and Bittencourt, it is hypothesized that inflation was also higher during times of democratic rule than during times of autocratic rule in Brazil, Argentina and Peru. The polity rating takes on the value of -10 for a hereditary monarchy and the value of +10 for a consolidated democracy. Thus, it is proposed that for the selected cases, a higher rating will be associated with higher inflation.

### Data Collection

The analysis is carried out using panel data with three countries (Brazil, Argentina and Peru) examined over a twenty-six year period (1981-2006). The rate of inflation is the dependent variable in the model. It is measured as the annual percentage change in the consumer price index for the respective countries. This data was obtained from the International Monetary Fund. Data on the monetary base was obtained for each of the three countries. For Brazil and Peru, monetary base data was obtained from their respective central banks. Argentine monetary base data was obtained from the Central Bank of Argentina as well from the Federal Reserve Bank of St. Louis. External debt data in current dollars for each of the countries came from the World Bank's "World Development Indicators", as did the real GDP growth of the respective countries and total GDP in current dollars (for purposes of an external debt to GDP ratio calculation). Real GDP growth was added to the model to control for economic performance in

the level of prices. Data on political regime type was obtained from a database called the "Polity IV Project" which is maintained by Societal-Systems Research Inc. and Colorado State University. This variable is coded as an index from -10 to +10 where -10 stands for hereditary monarchy and +10 stands for established democracy. The polity rating is computed as an aggregate of values taken to represent specific qualities of government. The following governmental qualities are evaluated in the coding process: the ability of the populace to select leadership, the extent of institutional constraints on executive power, and the extent to which civil liberties are guaranteed both in daily life and in political participation. Countries achieve high polity ratings when the citizenry is responsible for choosing leaders (free elections), executive power is limited by constitutional or other constraints and civil liberties are institutionally guaranteed to the populace. For countries in which the opposite conditions are true, the polity rating is low (approaching -10). Coup d'états and attempted coup d'états are used as a proxy for political instability. A dummy variable was created taking on a value of 1 if a coup or attempted coup took place within the previous three years, and a value of 0 was taken otherwise. Data on coup d'états was obtained from a dataset run by the Integrated Network for Societal Conflict Research. Descriptive statistics for all of the data can be found in Appendix A.

**Model & Results**

A model was created to test the hypotheses previously discussed. The dependent variable in the model is the annual percentage change in the consumer price index, coded as "CPI". The model contains five independent variables, or five factors which potentially affected the rate of inflation in Brazil, Argentina and Peru from 1981-2006. The independent variables in the model are as follows: "MB" is the annual percentage change in the monetary base, "GDP" is the annual growth rate in real GDP, "ExDebt" is the ratio of external debt to GDP, "Polity" is the value

taken from the Polity IV database which is used as a proxy for political regime type and "Coup"

is a dummy variable used as a proxy for political instability where a value of 1 is taken if a coup

d'état occurred in the previous three years and a value of 0 is taken otherwise.  The external debt

variable was converted to a ratio of GDP in order to achieve a more accurate measure of the debt

burden and to control for differences in the size of the economy.  Again, the variable "GDP" was

added to the model to control for economic performance.  Thus, the model in equation form

looks like the following: $CPI = \beta 0 + \beta 1(MB) + \beta 2(GDP) + \beta 3(ExDebt) + \beta 4(Polity) +$

$\beta 5(Coup) + u$, where "u" is equal to the variance not explained by the model, $\beta 0$ is equal to the

intercept term and $\beta 1$-$\beta 5$ represent the slope parameters for each variable when all other

variables are held constant.

After controlling for fixed effects so that the differences between countries would not

affect the model predictions, a regression was run with the previously discussed variables. The

resulting F statistic shows that the model has explanatory power at the 1% level, meaning the

hypothesis that all slope parameters are equal to zero is rejected.  The R squared value is about

19%.  The monetary base, external debt to GDP, polity rating and coup variables all take on their

expected signs (all positive); however, of these, only the polity rating variable is significant at

the 10% level.  The real GDP growth variable takes on a negative parameter and is significant at

the 1% level. Unfortunately, the estimates of the model are likely distorted by autocorrelation

and heteroskedasticity effects which must first be corrected for before inferences can be made.

A Woolridge Test for autocorrelation is run to test for the presence of correlation between

the error terms for the variables over time.  The hypothesis that autocorrelation is not present in

the model is rejected at the 1% level, meaning autocorrelation is present and must be corrected

for.   The model is also found to be heteroskedastic, meaning that the variances of the error terms

are not constant over time. This makes sense given the extreme variation in the values of the data during hyperinflation. A feasible generalized least squares model is then used as opposed to ordinary least squares, since the ordinary least squares model would be biased given the violated assumptions in this case. Using the feasible generalized least squares model and correcting for autocorrelation and heteroskedasticity, new results are generated that can be reliably be used for inference and estimation.

The new regression results can be observed as the second column of Table 1 in Appendix B. The Wald test takes the place of the F test in the FGLS model and is significant at the 1% level, meaning the model has significant explanatory power. The monetary base, polity rating, and real GDP growth variables are significant at the 10% level, and retain their positive signs. The insignificance of the external debt to GDP variable is very surprising given the strong evidence in support of its role in hyperinflation from economic theory and earlier studies. Thus, a new regression model is run with the external debt to GDP variable lagged by one period to account for the time effect between an excessive debt burden and a subsequent crisis (variable denoted as "Lag ExDebt" in Table 1). Additionally, the coup dummy variable is dropped given its insignificance. The result of this second regression equation can be observed in column three of Table 1.

The lag of the external debt to GDP variable has a significant impact. The variable becomes significant at the 1% level with the expected positive sign. A one percent increase in the external debt to GDP ratio was responsible for an over 1000 percent increase in CPI. The extreme nature of the CPI data for these countries in times of hyperinflation clearly elevates the coefficients to very high levels, so this estimate would not hold in times of stability. However the significance of the variable does point to the fact that the external debt burden played a major

role in the hyperinflations of Brazil, Argentina and Peru.  The percentage change in the monetary base is also significant at the 1% level with a positive sign, confirming the earlier hypothesis that the growth of the monetary base was a significant factor in the hyperinflation of the selected countries.  The positive sign and near significance of the polity rating variable does not confirm the hypothesis of a positive relationship between democratic rule and inflation rates, but it does indicate that such a relationship exists.

## Conclusion

Based on the results of the second regression model, the hypotheses regarding external debt and monetary base growth are confirmed.  The result of the external debt variable shows that each of the three countries took on excessive levels of external debt (as was true for most of Latin America) which eventually contributed to spiraling inflation.  This was the predicted relationship.  The result of the monetary base variable confirms that exogenous money growth carried out by the central banks greatly contributed to rising inflation in the three countries.  Thus, the hyperinflation cases of Brazil, Argentina and Peru can be entered into the same category as the seven cases of hyperinflation analyzed by Cagan (1956) in terms of the important role played by exogenous money growth in fueling hyperinflation.  Taken together, the positive signs of the external debt and monetary base variables indicate that the theoretical story outlined by Sargent and Wallace (1981) can be applied to the cases of Brazil, Argentina and Peru in the 1980's and early 1990's.  In line with their theoretical predictions, the three countries took on excessive debt (in this case external), which they financed through money creation and inflation.  These were policy failures that led to runaway inflation in each of the three countries.  The positive sign and marginal significance of the polity rating variable indicates that democratic regimes in Brazil, Argentina and Peru were less able or willing to fight inflation than autocratic

regimes in the time period, as was predicted. This indicates that the democratic leaders of Brazil, Argentina and Peru relied more heavily on seigniorage and less on tax revenue to finance debt than their autocratic counterparts.

Given the conclusions of this analysis, a few lessons can be learned. The monetization of debt is the key factor leading to hyperinflation, and governments must refrain from using this tool. Although it can be appealing to governments who are unwilling to tax their populace and take austerity measures, the results of prolonged monetization are clearly devastating. From this analysis it also follows that governments must not take on excessive debt burdens that would lead to the appeal of monetization in the first place. Finally, the strength of democratic institutions is particularly important in regard to a democracy's ability to fight inflation. Democratic rulers that govern with weak institutional structures are less likely to fight inflation for two reasons: First, tax collection is limited by weak institutions which lowers tax revenue and increases the dependence on seigniorage. Second, the measures necessary to cut rampant inflation such as fiscal austerity and monetary discipline are less appealing when the possibility of a coup or some other upheaval exists. Such lessons are particularly important for developing countries such as those studied, where cases of hyperinflation are most likely to occur.

## Appendix A

**Descriptive Statistics:**

| All Countries | CPI | MB | GDP | ExDebt | Polity | Coup |
|---|---|---|---|---|---|---|
| mean | 420.4618 | 0.125841 | 0.021053 | 0.32449 | 6 | 0.128205 |
| median | 37.2345 | 0.218876 | 0.030077 | 0.301964 | 8 | 0 |
| standard deviation | 1087.581 | 1.779321 | 0.055146 | 0.173647 | 3.960847 | 0.336482 |
| variance | 1182832 | 3.165984 | 0.003041 | 0.030153 | 15.68831 | 0.11322 |
| range | 7482.867 | 10.20705 | 0.246201 | 0.931121 | 17 | 1 |
| min | -1.167 | -6.23408 | -0.12556 | 0.077648 | -8 | 0 |
| max | 7481.7 | 3.972969 | 0.120638 | 1.008768 | 9 | 1 |

| Brazil | CPI | MB | GDP | ExDebt | Polity | Coup |
|---|---|---|---|---|---|---|
| mean | 453.5696 | -0.06027 | 0.022317 | 0.195249 | 6.153846 | 0 |
| median | 101.1 | 0.209883 | 0.028644 | 0.185121 | 8 | 0 |
| standard deviation | 781.9397 | 2.082575 | 0.032062 | 0.073537 | 4.105531 | 0 |
| variance | 611429.7 | 4.337118 | 0.001028 | 0.005408 | 16.85538 | 0 |
| range | 2944.53 | 8.717752 | 0.121781 | 0.256559 | 12 | 0 |
| min | 3.2 | -5.53797 | -0.04493 | 0.077648 | -4 | 0 |
| max | 2947.73 | 3.179787 | 0.076853 | 0.334207 | 8 | 0 |

| Argentina | CPI | MB | GDP | ExDebt | Polity | Coup |
|---|---|---|---|---|---|---|
| mean | 313.6582 | 0.312679 | 0.018165 | 0.349729 | 6.384615 | 0.192308 |
| median | 21.706 | 0.213603 | 0.033232 | 0.307234 | 8 | 0 |
| standard deviation | 733.6204 | 1.477971 | 0.066254 | 0.183986 | 4.262177 | 0.401919 |
| variance | 538198.8 | 2.184399 | 0.00439 | 0.033851 | 18.16615 | 0.161539 |
| range | 3080.622 | 9.227868 | 0.234639 | 0.722421 | 16 | 1 |
| min | -1.167 | -5.2634 | -0.11535 | 0.136281 | -8 | 0 |
| max | 3079.455 | 3.964468 | 0.11929 | 0.858701 | 8 | 1 |

| Peru | CPI | MB | GDP | ExDebt | Polity | Coup |
|---|---|---|---|---|---|---|
| mean | 494.1577 | 0.125112 | 0.022679 | 0.428491 | 5.461538 | 0.192308 |
| median | 36.15 | 0.227316 | 0.034305 | 0.377486 | 7 | 0 |
| standard deviation | 1573.164 | 1.776903 | 0.062736 | 0.155984 | 3.580288 | 0.401919 |
| variance | 2474844 | 3.157385 | 0.003936 | 0.024331 | 12.81846 | 0.161539 |
| range | 7481.5 | 10.20705 | 0.246201 | 0.768421 | 12 | 1 |
| min | 0.2 | -6.23408 | -0.12556 | 0.240347 | -3 | 0 |
| max | 7481.7 | 3.972969 | 0.120638 | 1.008768 | 9 | 1 |

**Appendix B**

**Regression Results:**

### Table 1

**Dependent Variable: CPI Annual Percent Change**
**FGLS equations, z statistics in parentheses**

| Variable | Equation 1 | Equation 2 |
|---|---|---|
| MB | 109.10 | 145.02 |
| | (2.65)*** | (3.71)*** |
| GDP | -4340.98 | -4730.09 |
| | (-2.77)*** | (-3.35)*** |
| ExDebt | 168.35 | |
| | (-0.26) | |
| Lag ExDebt | | 1565.12 |
| | | (2.73)*** |
| Polity | 44.58 | 41.09 |
| | (1.71)* | (1.52) |
| Coup | 223.69 | |
| | (-0.71) | |
| Constant | 64.04 | -339.32 |
| | (-0.25) | (-1.24) |
| Wald Statistic | 20.42^ | 31.05^ |
| Number of Observations | 78 | 75 |

\* significant at 10% level; two-tailed test for z-statistic
\*\*\* significant at 1% level; two-tailed test for z-statistic
^ significant at 1% level; one-tailed test for chi-square statistic

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