Understanding the Argentine Peso's Devaluation in 2014

—Analysis on Argentina's Fiscal Sustainability from 1993 to 2013

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Abstract

This research analyzes the fiscal sustainability of Argentina from 1993 to 2013. Specifically, it explains the peso devaluation in early 2014 and suggests that it is primarily due to the fundamental problems in Argentina's economy. This paper highlights Argentina's inability to enhance its fiscal conditions and suggests possible future economic developments in Argentina. This paper concludes that there is high chance of hyperinflation, debt default, and the eventual dissolution of the managed exchange rate regime in Argentina in the future.

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I. Introduction

In January 2014 Argentina experienced the most drastic devaluation of its currency, the peso, since 2002, stirring up widespread fears and worries. These worries and fears were intensified by Argentina's domestic problems like skyrocketing inflation and widening deficits, which had persisted for more than a decade. The situation was becoming even worse in July 2014, when Judge Griesa of New York ruled in favor of a few "holdout" creditors and compelled Argentina to pay back these investors first before they paid back others. As a result Argentina was forced to default.

Historically, Argentina's economic performance has been very uneven and unstable. From 1975 to 1990, Argentina experienced severe stagflation. In 1991, the Argentine government pegged the peso to the U.S. dollar. After the implementation of the fixed exchange rate, Argentina reduced its hyperinflation significantly but struggled to maintain its overvalued exchange rate. In 2001, the fixed exchange rate collapsed under currency speculation and thereafter Argentina suffered its sharpest decline since 1930. Argentina also defaulted on its international debt and it is one of the largest sovereign defaults in the modern history. Argentina's economy rebounded from 2003 onwards. With the exceptions of 2007 and 2008 when the global financial crisis was happening, Argentina's economic growth looks stable and robust on the surface.

As Argentina's economy performed reasonably well in the past decade, the peso's devaluation in early 2014 came as a shock to many. Argentine peso's devaluation never fails to remind people of the memories of the peso's devaluation and the government's

default on its sovereign debt in 2001. Therefore, many skeptical observers began to worry about that Argentine peso's devaluation probably reveals more fundamental fiscal problems. There are also many others who think there is not much to worry about. They might argue this devaluation is not a big deal as compared to the devaluation in 2001. They might also argue a much weaker currency could boost the economy and potentially reduce the debt. A soaring stock market after the crisis might be arguably the evidence for their argument.

The question that whether the devaluation reveals deep fundamental problems in Argentina's economy or is just a small shock we do not need to worry about remains a question that concerns many people. I attempt to answer this question by analyzing the underlying causes for the drastic devaluation of peso in January 2014 to see whether fundamental problems exist in Argentina's economy.

There is no specific research that directly addresses the topic, but there are a number of relevant studies, which discuss post Bretton Woods era currency crises. Prominent examples of these crises are Chile in 1982, Sweden and Finland in 1992, Mexico in 1994, and Southeast Asia in 1997. It is important to understand the development of the literature on currency crises.

There are two generations of models analyzing currency crises. The first-generation models are mostly extension or simplification of Krugman's work (1979). For example, one of these first-generation papers is Flood and Garber's work (1984), which calculate

the collapse time of a fixed exchange rate regime. In general, the first generation models focus on economic fundamentals to explain the currency crises. They are effective in explaining early currency crises but limited in explaining later crises.

The limitation of the first-generation models gives rise to the second-generation models. The second-generation models focus more on the financial institutions rather than the economic fundamentals. They also emphasize the self-fulfilling characteristic of currency crises. For example, Caballero and Krishnamurthy (2001) discuss emerging market crises with focus on international capital flow.

There is another group of researchers who combine the first-generation and the second-generation models. For example, Corsetti and Machowiak (2006) analyze fiscal imbalances and discuss debt deflation associated with currency devaluation. Burnside, Eichenbaum, and Rebelo (2006) analyze government finance in the wake of currency crises and discuss the idea of implicit fiscal reforms.[1] In terms of research methodology, Burnside (2005) provides an approach called fiscal sustainability analysis, which is very useful in analyzing Argentina's problems.

Nevertheless, all the studies on currency crises are insufficient in understanding Argentine peso's drastic devaluation in 2014. First, during the currency crises, all the countries had fixed exchange rate regimes, but Argentina has a managed exchange rate

[1] The concepts of debt devaluation and implicit fiscal reforms are essential to the analysis in the paper, so I will specifically discuss them in Section III.
[2] Primary deficit is the deficit obtained from deducting the interest payment from total deficit.

regime since 2002. Second, Argentina has a unique economic situation that requires a more focused analysis.

In this paper, I explore what is underneath the peso devaluation in early 2014. I analyze Argentina's fiscal sustainability from 1993 to 2013, so as to generate a detailed and focused analysis of Argentina's economy. By definition, fiscal sustainability is the ability of a country to maintain its current policies while avoiding default now and in the future. There are many tools to analyze fiscal sustainability. I adopt the method of debt dynamics. The method of debt dynamics is the study of the evolution of a country's debt. This method analyzes how much fiscal and monetary policies affect a country's debt and thus how effective these polices are in achieving fiscal sustainability. I choose debt dynamics as my tool deliberately, because Argentina has significant ongoing foreign debt and I believe the debt dynamics analysis can really generate useful insights into Argentina's problems. The twenty-year timeframe is also important, as Argentina's problems are deeply rooted in the 1990s. From the fiscal sustainability analysis on Argentina, we can develop a clearer understanding of the sustainability of its exchange rate system, the feasibility of its fiscal reforms, and reasons for its ongoing inflation. All these issues have close relation to the devaluation of the Argentine peso.

My analysis suggests that the peso devaluation actually reveals deep fundamental problems in Argentina's economy. It is also highly likely that there will be the eventual dissolution of its managed exchange rate regime, ongoing hyperinflation, and even more defaults on its debt in the future.

Section II discusses the relevant literature. Section III explains my theoretic framework and relevant economic concepts. Section IV describes my data, examines all the data sources, and acknowledges any weaknesses of the data. Section V describes how I apply my data and empirically estimate my model. Section VI analyzes the results analysis. VII concludes the paper.

II. Literature Review

Overall, there are not specific studies focusing on Argentina's peso devaluation happening in early 2014. However, there is plenty of research on currency crises, fiscal policies, monetary policies, and exchange rate system. As the issue of peso devaluation is closely related to all these areas, literature in those fields can be very helpful.

The founding work for currency crisis models is Krugman's work (1979). All the first-generation currency crisis models are developed from this paper. The central argument of this paper is, when the government's willingness to use reserves to defend the exchange rate is uncertain, there can be a series of crises in which capital flows out of the country, resulting in the abandonment of the fixed exchange rate regime and huge currency devaluation (Krugman, 1979, p. 324). The government's willingness to use reserves to defend the exchange rate is uncertain when it has fiscal imbalances and weak economic fundamentals. Therefore, the key to avoid speculative currency attack and the resultant currency depreciation is strong economic fundamentals, a large foreign reserve, and a floating exchange rate system. Followers expand Krugman's model through different

ways. For example, Flood and Garber (1984) focus on the collapse time of a fixed exchange rate regime. They construct linear examples to study the issue in great details by discussing both the continuous-time case and the discrete-time case. In summary, although different first-generation models focus on different aspects of Krugman's model, their theoretic framework is primarily built up on Krugman's model and their arguments are consistent with Krugman's major argument.

While the early literature on currency crises mainly focuses on fiscal imbalances and economic fundamentals, the second-generation models focus more on institutional problems. Caballero and Krishnamurthy (2001) belong to the later school of thought. Caballero and Krishnamurthy (2001) discuss the international and domestic collaterals. They emphasize how these two interact with each other. They highlight the problem of debt denominated in foreign currency. This is very relevant to Argentina, because there is a huge portion of foreign debt in its total debt.

The more recent literature focuses on why some currency crises do not generate hyperinflation as predicted by early models. These studies try to explain what early models, particularly the first-generation models, fail to explain. Corsetti and Machowiak (2006) analyze why Krugman's (1979) first-generation currency crisis model is insufficient in analyzing the more recent currency crises. Their focus is on the positive fiscal effects of currency devaluation. They argue that a decrease in the real value of nominal government liabilities, due to huge currency devaluation, could help improve the government's fiscal position. They also write that the fiscal effect of currency

devaluation is more important than that of seigniorage revenues. As a result, governments can use currency devaluation to finance their fiscal imbalances after the currency crises so that it can rely less on seigniorage revenues. Therefore, there would be less inflation after the crisis.

Burnside, Eichenbaum, and Rebelo (2006) make a similar but indeed different argument on the positive effects of currency devaluation and name it as implicit fiscal reform. The implicit reform means that the devaluation in currency can lead to the automatic cut in government transfer spending. To elaborate how implicit fiscal reform worked, Burnside, Eichenbaum, and Rebelo (2006) give three case studies on Korea, Mexico and Turkey. In the paper, they find that the Turkish government relied much more on seigniorage revenues and debt deflation to finance its budget after the crisis, but Korea and Mexico relied more on implicit fiscal reform.

The ideas of debt deflation by Corsetti and Machowiak (2006) and implicit fiscal reforms by Burnside, Eichenbaum, and Rebelo (2006), are very important in the case of Argentina. If Argentina actually has significant debt deflation and implicit fiscal reforms from the peso devaluation, the devaluation in early 2014 is definitely not a big concern as it probably enhances Argentina's fiscal conditions.

The most important and relevant piece of work is a book edited by Burnside (2005). In this book, Burnside compiled his papers and organized his ideas in a very structured order and touched most aspects of the currency issue. It is more detailed and thorough

than his later work (Burnside, Eichenbaum, and Rebelo, 2006), which primarily focuses on the idea of implicit fiscal reform. Burnside (2005) discusses extensively on fiscal sustainability. By building up a model on fiscal sustainability, he provides a concrete theoretical framework to analyze issues including exchange rate regime, currencies, inflation, etc. He suggests debt dynamics, the study of the evolution of the measured debt-to-GDP ratio, as the empirical approach for fiscal sustainability analysis. He analyzes how different fiscal and monetary polices affect debt-to-GDP ratio. By analyzing the effects of fiscal and monetary polices on the debt-to-GDP ratio, he discusses the effectiveness of these polices in achieving fiscal sustainability. In his book, he briefly discusses Argentina's fiscal sustainability with data from 1994 to 2002 and gives many insights to Argentina's problems. In his case study of Argentina, Burnside concludes that, although the Argentina government was able to correct its fiscal imbalances, it did not do so and their inactivity combined with recession led to acceleration of its fiscal problems. As a result, Argentina remained fiscally unsustainable. I build up my paper upon the solid theoretic framework provided by Burnside (2005) and adopt debt dynamics as my primary empirical analytical tool. Nevertheless, I expand my data timeframe to 1993 to 2013 so that I can have more up-to-date analysis. I look at how the problems highlighted by Burnside (2005) evolved after 2002 and how these problems were relevant to answering my research question.

Although all these studies are very relevant to the topic, they do not discuss the effects of managed exchange rate system, because all the currency crises happened when those countries had fixed exchange rate regime. The managed exchange rate regime is the

system in which the exchange rate fluctuates, but the central bank attempts to influence the exchange rate by purchasing and selling currencies. It is a system in between the fixed exchange rate regime and the floating exchange rate regime. The analysis of the currency crises will be more complicated under a managed exchange regime than under a fixed exchange rate regime. For countries adopting managed exchange rate regimes, the extent of government intervention and manipulation varies significantly. The analysis on the fixed exchange rate system can only applied to a country which has a managed exchange rate regime that is close to a fixed exchange rate regime and engages extensively in exchange rate manipulation. In 2002 Argentina gave up its pegging to the US dollar and adopted a managed exchange rate regime. However, currently there are no studies analyzing how much Argentina actually manipulates its peso.

In summary, I try to contribute to the field in two ways. First, by expanding the data timeframe, I attempt to give a more up-to-date analysis specifically looking at Argentina. Second, I attempt to look at the Argentina's devaluation issue under the context of a managed exchange rate system rather than a fixed exchange rate system and analyze how this difference matters.

III. Theoretical Framework

In this section, I lay out the theoretic framework for this paper. I divide this section into two subsections: the exchange rate regime analysis and the fiscal sustainability analysis. The former is instrumental to determining to what extent the exchange rate system of a country is close to a fixed exchange rate system, while the latter is instrumental to

determining whether a country is fiscally sustainable or not. The former is the precondition for the latter. Only if the exchange rate regime analysis shows that a country's managed exchange rate regime is very close to a fixed exchange rate regime, the theoretical theory of fiscal sustainability analysis can be applied to the country well.

1. Exchange Rate Regime Analysis

Theoretically, the model underlying fiscal sustainability analysis depends on the assumption of a fixed exchange rate regime instead of a floating exchange rate regime. In the real world, no countries actually have a perfectly floating or fixed exchange rate. It is a matter of degree. If such a degree is very high for a country, we can apply the fiscal sustainability analysis to this country even if it has a managed exchange rate. To determine the extent to which an exchange rate regime is close to a perfectly fixed exchange rate regime, we can run a regression analysis by using the modified formula of the Taylor Rule as the regression model. The Taylor Rule states for each one-percent increase in inflation, the central bank should raise the nominal interest rate by more than one percentage. The basic Taylor Rule is based on a closed economy. I will modify the basic Taylor Rule by incorporating the change in exchange rate into the Taylor Rule formula, so that the modified formula is applicable to an open economy. If the regression shows that the country obeys the modified Taylor Rule, it means the country's monetary policy mainly targets at inflation. If the regression shows that the country's monetary policy has little relation to inflation, it means the country's monetary policy primarily targets at exchange rate and the country extensively engages in exchange rate manipulation. For the former case, the exchange rate regime is closer to a floating

exchange rate regime. For the latter case, the exchange rate regime is closer to a fixed exchange rate regime.

Empirically, the exchange rate regime analysis requires more than the theory above. As there are no perfect floating or perfect fixed exchange rate regimes in reality, a comparison analysis is really necessary to indicate the degree of "fixedness" of the exchange rate regime. The solution here is to run regression analysis for the target country and its comparable countries, and compare the coefficients of the regression between the target country and its comparable countries. In general, a high coefficient of change in exchange rate indicates a high degree of "fixedness".

2. Fiscal Sustainability Analysis

By definition, fiscal sustainability is the ability of a country to maintain its current policies while avoiding default now and in the future. Intuitively, it means the initial debt must be equal to the revenue or surpluses in the future. In simple words, if a government is not fiscally sustainable, it will eventually default. In real life, government always tries to avoid defaulting because default might exclude the country from international debt market in the future. To avoid defaulting, the government has to achieve fiscal sustainability by making some policy changes to generate revenue or surpluses so as to reduce it primary deficits.[2] Besides economic growth, there are mainly three ways to achieve fiscal sustainability: explicit fiscal reforms, currency devaluation, and increasing seigniorage. (Burnside, 2005, pp. 11-14)

[2] Primary deficit is the deficit obtained from deducting the interest payment from total deficit.

Explicit fiscal reforms refer to raising tax rates and cutting spending. In theory, explicit fiscal reforms can reduce the size of the primary deficits if the government can actually implement them. However, in real life, many countries find explicit fiscal reforms so politically costly that such reforms are not considered a feasible tool to reduce government deficits.

Currency devaluation is another strategy available for the government, which can take actions that lead to the depreciation of the local currency against foreign currencies to reduce deficits. This method reduces deficits in two ways. First, it deflates the foreign currency value of debt denominated in local currency. For example, assume the exchange rate between the local currency and the US dollar is 1:1, and the debt denominated in local currency is worth ten dollar. After depreciation, the exchange rate becomes 10:1. As a result, the debt is only worth one dollar. This will not work well if the debt is primarily denominated in foreign currencies. Secondly, this method may induce implicit fiscal reforms if the government's expenditure is more heavily weighted towards local goods than its revenue is. Implicit fiscal reforms reduce the dollar value of government expenditures. The government can deflate the dollar value of outlays that are fixed at least temporarily, in nominal terms or tied to the consumer price index (CPI) as opposed to the exchange rate. Such outlays include, for example, civil servant wages or social security payments. Furthermore, if non-tradable goods, like expenditures on healthcare and education, are significant component of government spending, a decline in the dollar value of non-tradable goods automatically improves the government's fiscal situation. (Burnside, 2005, p. 234)

Seigniorage is the revenue created by printing money. As this method is easy and involves little political cost, the government has a very strong incentive to print money to reduce its deficits. However, this method is limited and has severe consequences. The method will become increasingly ineffective as the government prints more money. Besides this, the method has two serious fallouts: inflation and unsustainability of the fixed exchange rate system. First, the natural result of printing money to generate revenue is inflation. Second, if a country adopts a fixed exchange rate regime, its sustainability requires the government to balance its inter-temporal budget constraint without resorting to inflation-based revenues. (Burnside, 2005, p. 208) However, a country facing a fiscal sustainability problem will find it infeasible to indefinitely borrow and repay the resources needed to cover the ongoing deficits. The government will eventually have to print money to raise seigniorage revenues. Consequentially, the fixed exchange rate regime collapses.

According to the theoretic framework above, if a country's currency devalues significantly, given the country is fiscally unsustainable, there are two possible reasons. First, explicit fiscal reforms and currency depreciation are ineffective, so the country resorts to printing money. Consequentially, the country could not maintain its fixed exchange rate and has to adopt the floating exchange rate. Such transition is always accompanied by speculative currency attack, which result in huge drop in currency value. Second, the government primarily relies on implicit fiscal reforms and debt deflation to finance its deficits. If this is the case, the government intentionally devalues its currency

significantly to finance its deficits. Under such circumstances, the government should have much better fiscal position and minor increase in inflation after the currency depreciation.

In summary, the two analyses are not separate. The fiscal sustainability analysis is the primary theoretical foundation of the paper. The exchange rate regime analysis is the modification made to the sustainability analysis by loosening the assumption of the perfect fixed exchange rate regime. The more fixed the exchange rate is, the more applicable the fiscal sustainability analysis is.

IV. Data

As both analyses are macroeconomic in nature, I primarily collect macroeconomic data. I also collect two sets of data for the two analyses respectively.

1. Data for the Exchange Rate Analysis

For exchange rate regime analysis, I collect my data from the IMF database and the National Institute of Statistics and Census of Argentina. I collect the data of the industrial output, consumer price index (CPI), interest rates and exchange rates against the US dollar, from Argentina, Brazil, and Chile. I collect data from three countries because I want to compare Argentina to Brazil and Chile. The unit of the data does not matter, as I only care about percentage changes. The primary weakness of my data is that I can only collect data from 2002 rather than 1993, because Argentina only abandoned its fixed

exchange rate regime in 2002. I compensate the shorter data timeframe by collecting monthly data rather than quarterly or annual data.

Table 1 shows the descriptive statistics for my exchange rate regime analysis data. I calculate the mean and standard deviation of the data of three countries to give a rough idea about the industrial output, consumer prices, interest rates, and exchange rates. From the descriptive statistics, we can know that Argentina and Brazil both have high average interest rates but Chile has much lower average interest rates. Chile's currency really varies significantly but Brazil and Argentina do not. From the statistics, we can also know the three countries have different conditions in terms of industrial output, consumer prices, interest rates, and exchange rates, so we are able to draw some meaningful comparisons, as it is really hard to draw any meaningful comparisons between similar countries. In general, information given by the descriptive statistics matches the reality, so the data is operational. Therefore it is appropriate to use these data for analysis.

Table 1

Descriptive Statistics for the Exchange Rate Analysis

Country	Concept	Unit	Mean	Standard Deviation
Argentina	Industrial Production	Index, 2006=100, Seasonally Adjusted	107.19	21.43
	Consumer Prices, All Items	Year-over-Year Percentage Change	10.86	7.67
	Interest Rates, Money	Percent per Annum	11.13	11.92

	Market Rate			
	National Currency/ USD, Period Average	National Currency/U.S Dollar	3.82	1.31
Brazil	Industrial Production	Index, 2006=100, Seasonally Adjusted	91.83	8.16
	Consumer Prices, All Items	Year-over-Year Percentage Change	6.51	2.87
	Interest Rates, Money Market Rate	Percent per Annum	13.62	4.75
	National Currency/ USD, Period Average	National Currency/U.S Dollar	2.24	0.50
Chile	Industrial Production	Index, 2006=100, Seasonally Adjusted	101.20	9.58
	Consumer Prices, All Items	Year-over-Year Percentage Change	3.05	2.40
	Interest Rates, Money Market Rate	Percent per Annum	3.97	1.83
	National Currency/ USD, Period Average	National Currency/U.S Dollar	555.68	74.00

Sources: the IMF and the National Institute of Statistics and Census of Argentina

2. Data for the Fiscal Sustainability Analysis

For fiscal sustainability analysis, I primarily collect the relevant raw data from the World Bank and the IMF databases and the official website of Argentine Ministry of Economy. My data primarily consist of two parts: the debt data and the fiscal data. The fiscal data mainly come from the IMF and the World Bank. It includes nominal GDP, revenue, capital outlays, expenditures, etc. The debt data comes from Argentina Ministry of Economy and mainly consist of foreign and domestic debt with detailed sub-items. Because exchange rates really matter for my analysis and begin to vary since 2002, all the collected data are intentionally and consistently in Argentine peso rather than the US dollar.

Table 2 and Table 3 show the descriptive statistics for my sustainability analysis data. I calculate the mean to provide a general idea of the data and standard deviation to show much variation is present in the data.

Table 2 shows the descriptive statistics of my raw data. We can know that Argentina is highly indebted and its debt is primary foreign rather than domestic. Its foreign debt varies significantly but its domestic debt remains rather stable. Argentina also has a large monetary base. There is also significant divergence in nominal GDP and real GDP. All the information revealed by the statistics is consistent with Argentina's basic conditions: high debt level and high inflation.

Table 2

Descriptive Statistics of Fiscal Sustainability Analysis' Raw Data

	Unit	Mean	Standard Deviation
Total Debt	Million Pesos	393489.93	312331.87
Domestic Debt	Million Pesos	88848.94	124080.54
Foreign Debt	Million Pesos	304640.99	204454.95
Nominal GDP	Million Pesos	758635.74	700209.42
Real GDP	Million Pesos	312821.96	72682.13
Revenue	Million Pesos	181901.67	186325.56
Expenditure	Million Pesos	188726.97	202591.68
Monetary Base	Million Pesos	85512.14	100614.28
ARS/USD, End of Period	ARS/USD	2.59	1.58
ARS/USD, Period Average	ARS/USD	2.47	1.40

Sources: the IMF, the World Bank, the Argentine Ministry of Economy

Table 3 shows the descriptive statistics of my calculated data. I calculate all these data from the raw data. All these data are essential to the fiscal sustainability analysis. For example, the growth effect indicates how much the GDP growth helps to reduce the debt, the inflation effect indicates how much the seigniorage helps to reduce the debt, and the revaluation effect indicates how much the currency depreciation helps to reduce the debt in terms of debt deflation. However, for these calculated, the mean is not a good indicator, the better way is to look at these data for different periods. I discuss all these data in great detail in Section VI.

Table 3

Descriptive Statistics of Fiscal Sustainability Analysis' Calculated Data

	Unit	Mean	Standard Deviation
Total Debt	% of GDP	57.96	36.50
Domestic Debt	% of GDP	8.19	5.98
Foreign Debt	% of GDP	49.77	34.69
Inflation	%	8.72	8.87
Seigniorage	% of GDP	1.58	1.93
Real GDP growth	%	3.83	5.93
Primary Balance	% of GDP	1.35	1.45
Growth effect	% of GDP	-2.58	4.32
Inflation effect	% of GDP	-0.74	0.78
Revaluation effect	% of GDP	1.41	23.57

Sources: the IMF, the World Bank, the Argentine Ministry of Economy, and my own calculation

Overall, what the descriptive statistics suggest is consistent with the factual knowledge on Argentina. Therefore, descriptive data are operational and it is appropriate to use them for model estimation.

Furthermore, as Argentina is infamous for fabricating its data, the major weakness for my data is that it is really hard to identify any fabricated data collected from Argentine Ministry of Economy. However, I cannot avoid collecting data from this source, as it is the most relevant data source and provides the most details. I minimize the adverse effect by only collecting the most fundamental raw data from this source and calculating my own from the raw data. If I can avoid using the data from Argentine Ministry of

Economy, I do so. For example, I calculate inflation rate by using data from the World Bank and the IMF databases.[3]

V. Empirical Specification

I also divide this section into two subsections. For the exchange rate analysis, I set up a regression model for the exchange rate analysis. I explain all the variables and coefficients in great details.

For the fiscal sustainability analysis, I use the debt dynamics as the empirical approach. The debt dynamics, the study of the evolution of the measured debt-to-GDP ratio, is a mathematical model constructed for calculating key indicators for the fiscal sustainability analysis. I will only state the mathematical equations for the key indicators in the section. The theoretical foundation and mathematical proof is from Burnside (2005). I attach the proof in the appendix.

[3] Although my calculated inflation rate is higher than Argentina's official data, my inflation data can still be considered conservative and reasonable, as inflation data from other sources are even higher than mine.

1. Empirical Specification for the Exchange Rate Regime Analysis

The regression model for the exchange rate analysis is the modified version of Taylor Rule. The formula is as follows.

$$i_t = \beta_0 + \beta_1 i_{t-1} + \beta_2 y_t + \beta_3 \pi_t + \beta_4 \Delta s_t + \mu_t$$

where

i_t is the interest rate,

i_{t-1} is the interest rate one year ago,

y_t is HP filter [ln(output), λ = 129600],

π_t is the year-over-year inflation rate,

Δs_t is the year-on-year percentage change in exchange rate,

μ_t is the residuals,

β_4 is ∞, if the exchange rate is perfectly fixed,

β_4 is 0, if the exchange rate is perfectly floating

For the case of convenience, I will use the following abbreviations in Stata:

i_t = i,

i_{t-1} = r,

y_t = hplny,

π_t = pi,

Δs_t = s

The major difference between my regression model and the Taylor rule formula is that I add the year-over-year percentage change in exchange rate into the model.

In terms of data processing, I use the HP filter to process my output data. The HP filter is a mathematical tool to remove the cyclical component of a time series from raw data so

that my output data can get rid of the short-term fluctuations and represent the long-term trend better. I use $\lambda = 129600$ for the HP filter because I collect monthly data for the regression.

The most important and relevant coefficient in the regression model is the coefficient of the change in exchange rate, which indicates the "fixedness" of the exchange rate. The higher β_4 is, the more fixed the exchange rate is. The coefficient ranges between 0 and infinity, so if it turns out to be negative, it means there is something wrong in the data. The more "fixed" the exchange rate is, the more applicable the fiscal sustainability analysis is to the reality. We can actually rearrange the regression model to have a better idea of what these coefficients mean. The rearranged formula is as follows.

$$i_t - i_{t-1} = \frac{\beta_0}{1-\beta_1} + \frac{\beta_2}{1-\beta_1} y_t + \frac{\beta_3}{1-\beta_1} \pi_t + \frac{\beta_4}{1-\beta_1} \Delta s_t + \nu_t$$

where

$i_t - i_{t-1}$ indicate changes interest rate indicate changes in monetary policy,

$\frac{\beta_2}{1-\beta_1}$ indicates how strongly policy reacts to the output gap,

$\frac{\beta_3}{1-\beta_1}$ indicates how strongly policy reacts to inflation,

$\frac{\beta_4}{1-\beta_1}$ indicates how strongly policy reacts to the exchange rate

After rearranging the equation, we can find out how strongly policy reacts to the output gap, the inflation rate, and the exchange rate. On the left-hand side of the equation are the changes in monetary policies and on the right-hand side of the equation are the output gap, the inflation rate, and the change in the exchange rate. Theoretically the coefficients indicate how responsive is the dependent variable to the independent variables. In the

context of the equation, all these coefficients indicate how strongly the monetary policy reacts to the output gap, the inflation rate, and the exchange rate.

$\beta_4/(1-\beta_1)$ indicates the "fixedness" of exchange rate as well as β_4 does, because dividing β_4 by $(1-\beta_1)$ only scales the coefficient rather than change anything fundamental. By comparing $\beta_3/(1-\beta_1)$ and $\beta_4/(1-\beta_1)$, we can know the government's policy is more inflation-targeted or more exchange rate-targeted.

I run regressions for Argentina, Brazil, and Chile respectively, so as to obtain their coefficients. After that, I compare their coefficients to determine the relative degree of "fixedness" of Argentina's exchange rate regime and to see whether they are more inflation-targeted or more exchange rate-targeted.

2. Empirical Specification for the Fiscal Sustainability Analysis

The mathematical formula for the most important indicators, the inflation effect, the growth effect, and the revaluation effect, are as follows.

The inflation effect = $\frac{\pi_t}{1+\pi_t}\bar{b}_{t-1}$

The growth effect = $\frac{g_t}{1+z_t}\bar{b}_{t-1}$

The revaluation effect = $\frac{S_t-S_{\bar{t}}}{S_t}\bar{b}_t^F + (\frac{S_{\bar{t}}-S_{t-1}}{S_{t-1}}\frac{1}{1+z_t} - \frac{\pi_t}{1+\pi_t})\bar{b}_{t-1}^F$

where,

π_t = the inflation rate

$\bar{b}_t = b_t/y_t$

b_t = the end of period t stock of real debt

y_t = the real GDP

g_t = the growth rate of real GDP

$z_t = (1+\pi_t)(1+g_t) - 1$ = the growth rate of nominal GDP

$S_{\bar{t}}$ = the average exchange rate measured in local currency unit per foreign currency unit

S_t = the end-of-period exchange rate

$\bar{b}_t^F = B_t^F/(P_t y_t)$

B_t^F = the debt issued in foreign currency (measured in local currency)

P_t = the price level

The detailed explanation and mathematical proof for the formula above is in the appendix. I only qualitatively explain the inflation effect, the growth effect, and the revaluation effect here.

In general, the inflation effect, the growth effect and the revaluation effect are measurement of how much economic growth, printing money, and debt deflation can reduce debt. If the calculated result of the inflation is negative, it means inflation reduces the debt; if the calculated result of the inflation is positive, it means inflation increases the debt. The same thing applies to the growth effect and the revaluation effect.

One thing worth highlighting is that revaluation effect that indicated how much debt is reduced by currency devaluation is only in terms of debt deflation. As discussed previously, currency devaluation actually reduces the debt in two ways: debt deflation and implicit fiscal reforms. The revaluation effect only captures the effect of debt deflation rather than the implicit fiscal reforms. I do not have mathematical equations to measure the implicit fiscal reforms here, but I will qualitatively evaluate the implicit fiscal reforms when I discuss my results in the next section.

VI. Results Discussion

In this section, I discuss the results of the exchange rate analysis first because it lays the foundation for the fiscal sustainability analysis. I will also compare my results with the relevant literature discussed in the literature review section.

1. Results for the Exchange Rate Regime Analysis

For the exchange rate regime analysis, I primarily collect relevant data from the IMF database. Tables are all based on data collected and the author's own calculations.

a) Basic Regression Results for Chile

Table 4 is the regression results for Chile. From Table 4, we can know that both the output (hplny) and the inflation (pi) are significant predictors of the interest rate of Chile, but the change in exchange rate (s) is not at the 5% significance level. From the observation on the significance level, we can know that Chile's monetary policy probably focuses more on inflation rather than exchange rate. However, a more definite conclusion can be only drawn from the comparison between the coefficients of Chile and those of other two countries.

Table 4

Regression Results for Chile

			Coefficient Estimate	Standard Error	95% Confidence Interval	
r	i_{t-1}	Interest rate one year ago	0.0935	0.0511	-0.0075	0.1946
hplny	y_t	HP filter [ln (output), λ=129600]	16.3470**	2.5049	11.3938	21.3003
pi	π_t	The year-over-year inflation rate	0.4605**	0.0404	0.3806	0.5403
s	Δs_t	The year-over-year percentage change in exchange rate	0.0161	0.2739	-0.0015	0.0338

**Coefficient estimates are significant at the 1% level

*Coefficient estimates are significant at the 5% level

b) Basic Regression Results for Brazil

Table 5 is the regression results for Brazil. From Table 5, we can know that both the inflation (pi) and the change in exchange rate (s) are significant predictors of the interest rate of Brazil. It is hard to determine Brazil's monetary policy is primarily inflation focused rather than exchange rate focused by only looking at the significance level, as both are significant predictors of the interest rate. We need to compare all the coefficients of Brazil with those of the other two countries to draw more conclusions.

Table 5

Regression Results for Brazil

			Coefficient Estimate	Standard Error	95% Confidence Interval	
r	i_{t-1}	Interest rate one year ago	0.4428**	0.0418	0.3614	0.5242
hplny	y_t	HP filter [ln (output), λ=129600]	-12.6526*	6.1676	-25.0478	-0.6573
pi	π_t	The year-over-year inflation rate	1.0309**	0.0686	0.8952	1.1666
s	Δs_t	The year-over-year percentage change in exchange rate	-0.0466**	0.1395	-0.0741	-0.0190

**Coefficient estimates are significant at the 1% level

*Coefficient estimates are significant at the 5% level

c) Basic Regression Results for Argentina

Table 6 is the regression results for Argentina. From Table 6, we can know that both the inflation (pi) and the change in exchange rate (s) are significant predictors of the interest rate of Argentina. It is hard to determine Argentina's monetary policy is exchange rate focused or not by simply looking at significance level|, as both are significant predictors of the interest rate. We need to look at the coefficients of all the three countries at the same time to have a better understanding of Argentina's situation.

Table 6

Regression Results for Argentina

			Coefficient Estimate	Standard Error	95% Confidence Interval	
r	i_{t-1}	Interest rate one year ago	0.5325**	0.0589	0.4158	0.6492
hplny	y_t	HP filter [ln (output), λ=129600]	-0.7352	7.4099	-15.4128	13.9424
pi	π_t	The year-over-year inflation rate	0.5564**	0.0819	0.3942	0.7187
s	Δs_t	The year-over-year percentage change in exchange rate	0.1557**	0.0299	0.0966	0.2149

**Coefficient estimates are significant at the 1% level

*Coefficient estimates are significant at the 5% level

d) Comparison of Regression Results

Table 7 is the summary of the coefficients of all the three regressions on Argentina, Brazil, and Chile. The results are unclear if we only look at each set of regression results separately, so I summarize the results in Table 6 in order to draw a clearer and more concrete conclusion.

Both β_4 and $\beta_4/(1-\beta_1)$ are indicators of the "fixedness" of the exchange rate. Table 7 shows Argentina has the highest value of β_4 and $\beta_4/(1-\beta_1)$ among the three countries. The β_4 value for Argentina is around 4 times that of Brazil and 10 times that of Chile. The $\beta_4/(1-\beta_1)$ value for Argentina is around 4 times that of Brazil and 20 times that of Chile. Both indicators suggest Argentina has a much more "fixed" exchange rate regime than Brazil and Chile do.

In recent years, both Brazil and Chile made public announcement that they managed their exchange rate occasionally or at a certain point of time. In early 2011, Chile announced $12 billion currency intervention. (The Wall Street Journal, 2011) In late 2012, Brazil admitted tight hold over its exchange rate by its finance minister. (Financial Times, 2012) By contrast, Argentina made no announcement on its exchange rate system, but given what actually happened in Chile and Brazil and the regression results, it is reasonable to say that Argentina intervenes in its exchange rate very intensively. It is also justified to say that Argentina's exchange rate intervention is so intensive that we can assume Argentina's exchange rate regime is rather "fixed" for the fiscal sustainability analysis in the following section.

Table 7

Regression Summaries for Argentina, Brazil, and Chile

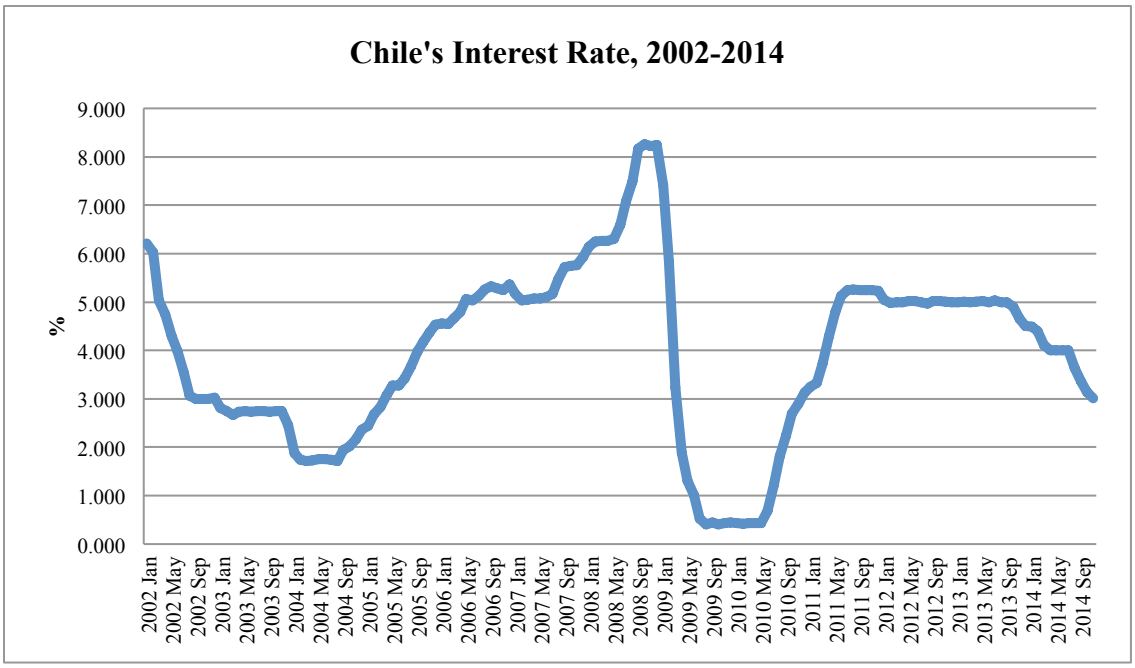
		Argentina	Brazil	Chile
β_2	Coefficient of the output	-0.7352	-12.8526	16.3470
β_3	Coefficient of the inflation	0.5564	1.0309	0.4605
β_4	Coefficient of the exchange rate/ "fixedness" of the exchange rate	0.1557	-0.0466	0.0161
$\beta_2/(1-\beta_1)$	How strongly policy reacts to the output	-1.5726	-23.0673	18.0341
$\beta_3/(1-\beta_1)$	How strongly policy reacts to the inflation	1.1902	1.8502	0.5080
$\beta_4/(1-\beta_1)$	How strongly policy reacts to the exchange rate changes	0.3331	-0.0836	0.0178

e) Unexpected Regression Results

The most unexpected regression results are the coefficients of output (hplny) for Brazil and Argentina. Conventionally, the coefficients of output are positive because as output increases most countries increase the interest rate and as output decreases they decrease the interest rate. However the coefficients for Argentina and Brazil are negative. This result suggests that either my data set is problematic or Brazil and Argentina have unconventional monetary policies. Although these unexpected regression results are not directly related to my analysis, I need to show that my data set is not problematic by showing that such unexpected results simply arise from Argentina and Brazil's unconventional policies.

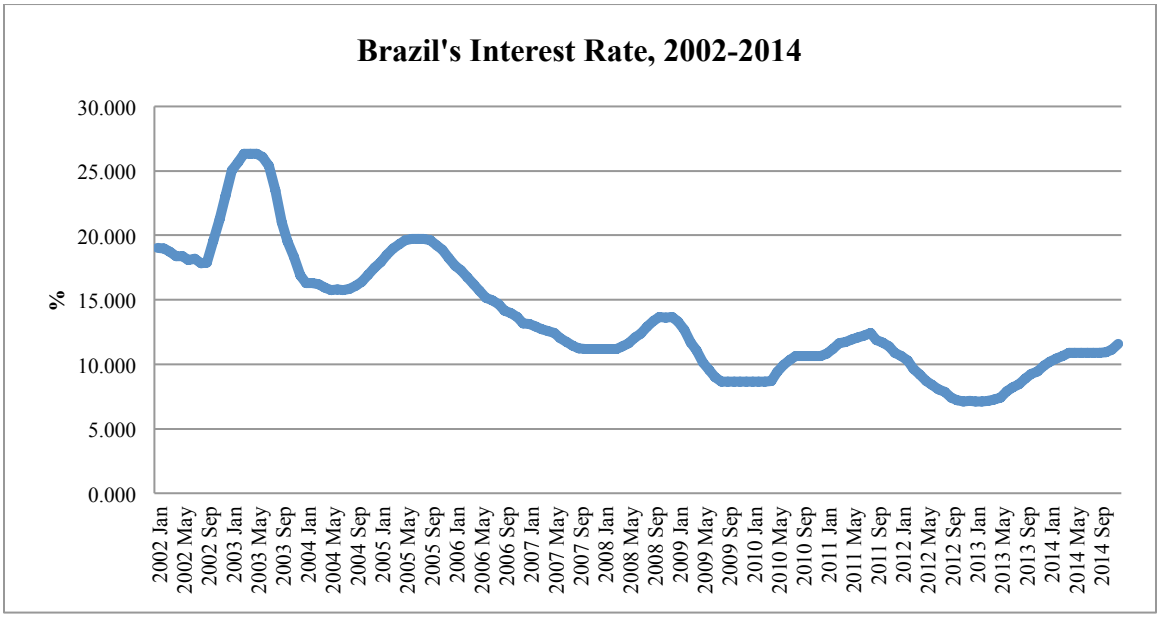
Chart 1 to Chart 3 show the interest rates of Argentina, Brazil and Chile from 2002 to 2014. The interest rate of Chile is mainly cyclical and shows that Chile uses the more conventional policy of raising interest rate in good times and lowering interest rate in bad times. This is why the coefficient of output in the case of Chile is positive. However, for Brazil and Argentina, their interest rates' trends appear totally non-cyclical. In the case of Brazil, we can see an overall downward trend for its interest rates in the past twelve years. In the past twelve years, as one of powerhouses of the emerging markets, Brazil's economy is doing very well. The two facts suggest that even when the economy is good, Brazil still attempts to lower interest rates or maintain a low interest rate. As a result, the coefficients of the output in my regression analysis are negative. In the case of Argentina, the trend for its interest rates is non-cyclical as well. It has huge hike and drop thereafter in early 2000s. As the interest rate is too low in early 2000s, its interest rate has an overall upward trend in the past ten years regardless of the economic conditions. Besides the huge hike and drop in early 2000s, hyperinflation in Argentina also makes the nominal interest rate extremely non-cyclical. In summary, as both Argentina and Brazil have unconventional policies and conditions, it is not surprising we find out the coefficients of output in my regression analysis are negative and hence the negative signs of the coefficients does not suggest any problems with the data set.

Chart 1



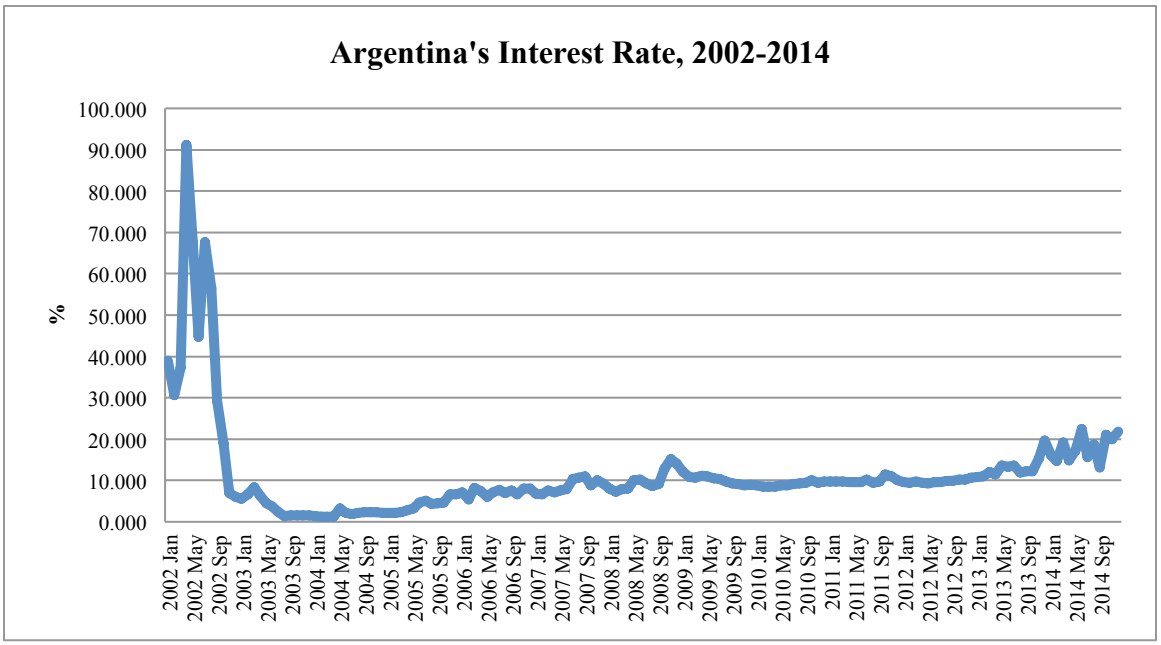
Source: IMF database

Chart 2



Source: IMF database

Chart 3



Source: IMF database

2. Results for the Fiscal Sustainability Analysis

As the exchange rate regime analysis above shows that Argentina's exchange rate is very "fixed", the fiscal sustainability analysis is hence very applicable to the context of Argentina. I use subsections to discuss my major findings from the fiscal sustainability analysis separately. For the fiscal sustainability analysis, I primarily collect the relevant data from the World Bank and IMF databases and the official website of the Argentine Ministry of Economy. Graphs are all based on the data collected and my calculations.

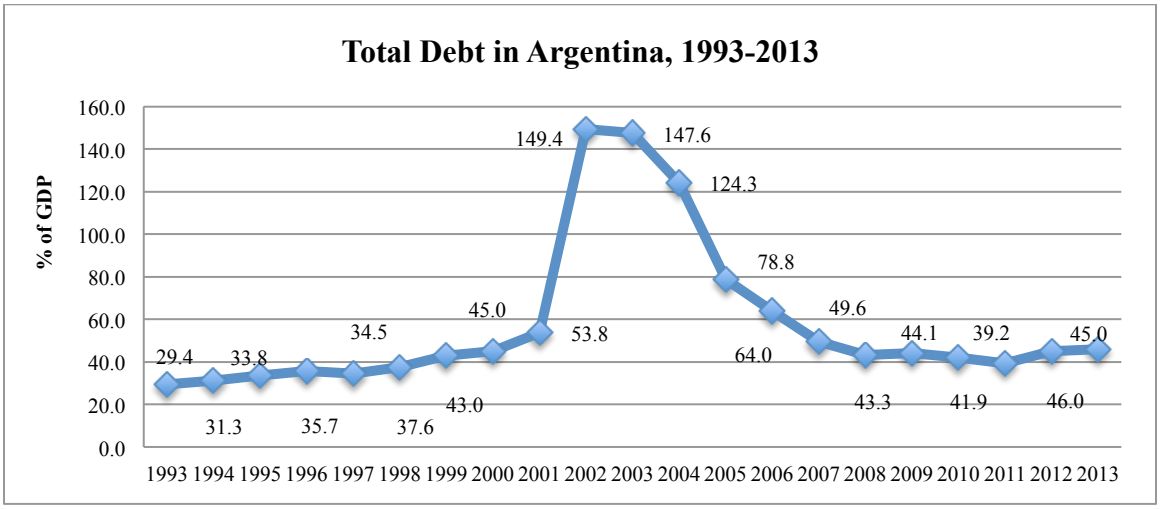
a) Ongoing Debt and Deficits

Chart 4 shows the trend of Argentina's total debt from 1993 to 2013 in terms of percentage of total GDP. As Chart 4 shows, Argentina gradually accumulated debt,

beginning from a stock of 29.4 percent of GDP in 1993 to 37.6 percent of GDP in 1998. However, the process accelerated from 1999 (recession) to 2001 (deepening recession). After that comes a sudden skyrocketing rise in 2002 to 149.4 percent of GDP. Only from 2005, debt decreases below total GDP. From 2007 to 2013, debt remains rather stable in between 40 percent and 50 percent of GDP. Generally, debt remains a large portion of total GDP from the 1990s until now.

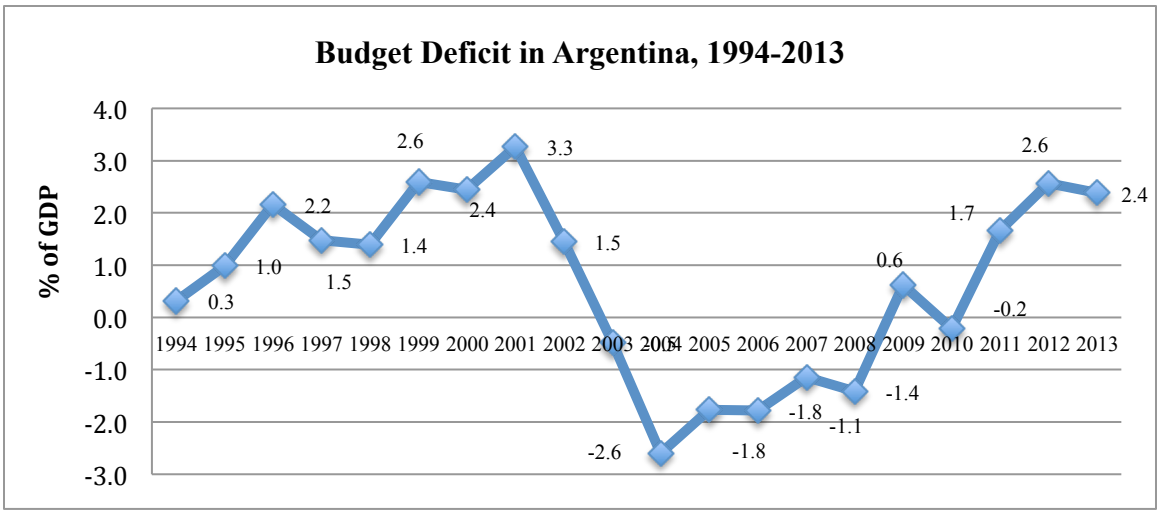
Chart 5 shows the trend of Argentina's budget deficits from 1994 to 2013. From the chart, we can see from 1994 to 2001, Argentina's budget deficits grew steadily. From 2002 to 2004, Argentina had a period of decreasing budget deficits. However after 2004, the budget deficits began to rise significantly again. In general, Argentina has a problem of ongoing government deficits. Argentina's debt level and its deficits declined temporarily mainly due to default and increasing seigniorage.

Chart 4



Sources: Argentina Ministry of Economy and Production (2014) and author's calculations

Chart 5

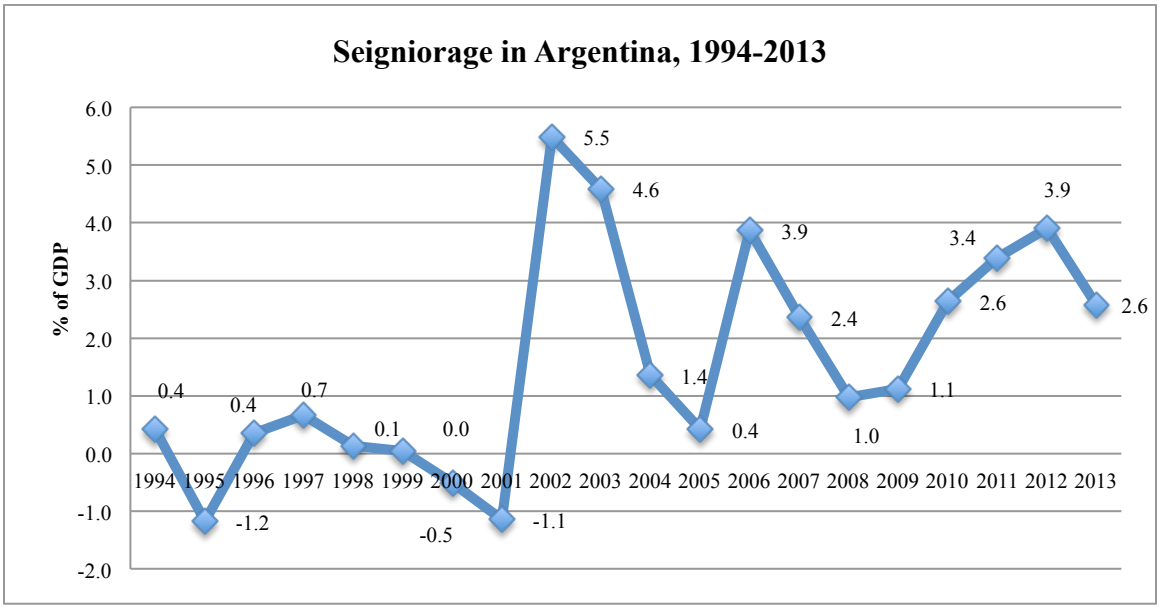


Sources: Argentina Ministry of Economy and Production (2014), IMF (2014) and author's calculations

b) Increasing Seigniorage and Rising Inflation

From 2002, Argentina's deficits decrease. And from 2007 to 2013, debt remains rather stable in between 40 percent and 50 percent of GDP. At first glance, it looks as if Argentina was on the right track for fiscal responsibility. However, a closer look suggests that this is not the case. Argentina actually printed money to finance its deficits. From Chart 6, which shows Argentina's seigniorage from 1994 to 2013, we can clearly see that from 2002, Argentina has been relying very heavily on seigniorage for revenue. The percentage of seigniorage over total GDP fluctuates around 3 percent with highest rate at 5.5 percent in 2002. These numbers are very significant if we consider how much inflation the seigniorage caused.

Chart 6



Sources: Argentina Ministry of Economy and Production (2014), IMF (2014) and author's calculations

Chart 7 indicates Argentina's inflation rate from 1994 to 2012. Chart 7 shows that inflation stayed at a very high level from 2002 and has not shown signs of slowing down. The inflation rate fluctuates around 15 percent with highest rate 30.6 percent at in 2002. Since 2007, Argentina had published inflation data, which fluctuate between 5 percent and 11 percent. Almost nobody believed Argentina's data. My calculations exactly prove most people's suspicion of Argentina's data is right. According to Chart 4, since 2007, Argentina's inflation rate actually had fluctuated between 14.3 percent and 19.5 percent. Argentina actually artificially lowered 10 percent on their inflation statistics.

Chart 7

Sources: IMF (2014) and author's calculations

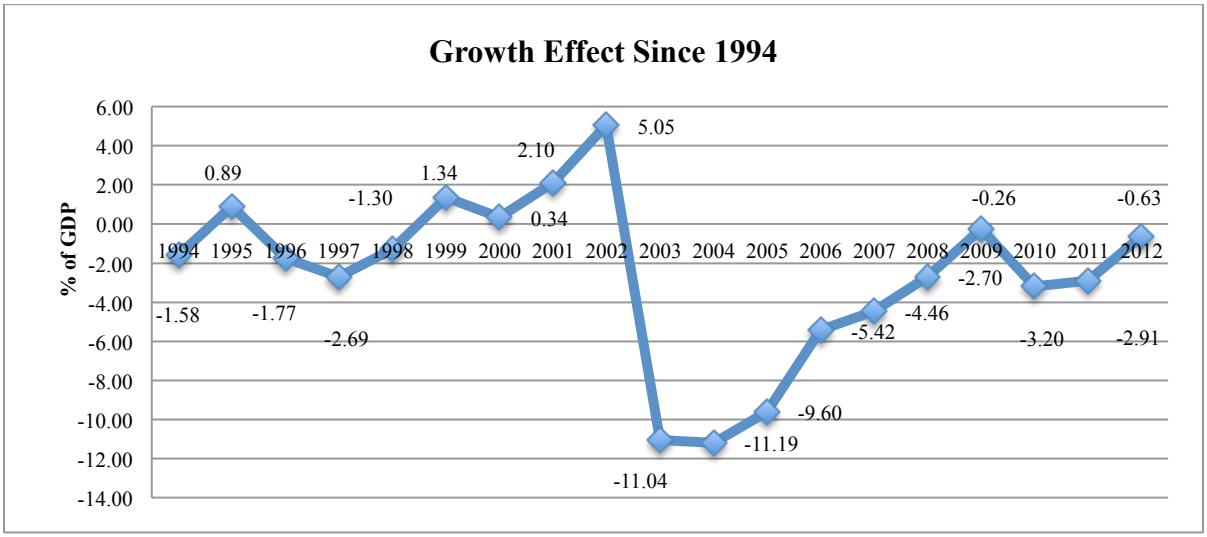
c) Growth Effects, Inflation Effects, and Revaluation Effects

I have plotted my calculated results for the growth effect the inflation effect, and the revaluation effect in Chart 5, Chart 6, and Chart 7 respectively.

From the Chart 8, Chart 9, and Chart 10, growth effect, inflation effect, and revaluation effect have been effective between 2003 and 2007. However, after 2007 Argentina could barely reduce its debt by economic growth and currency devaluation, so it began to primarily rely on seigniorage to reduce its debt after 2007. However, printing money is

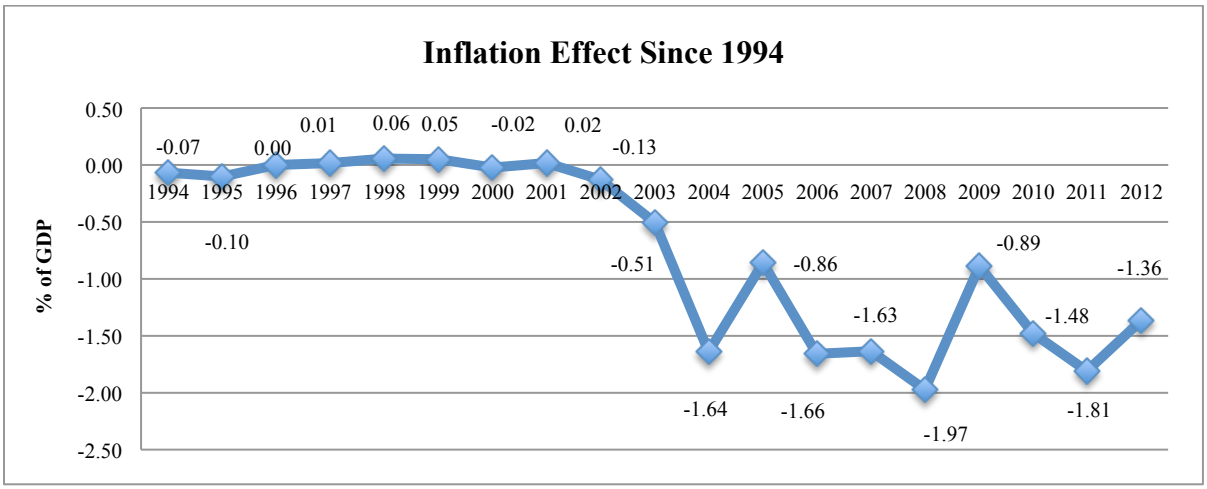
simply insufficient. From Chart 5, we can find that Argentina's government deficits began to rise very rapidly in recent years.

Chart 8



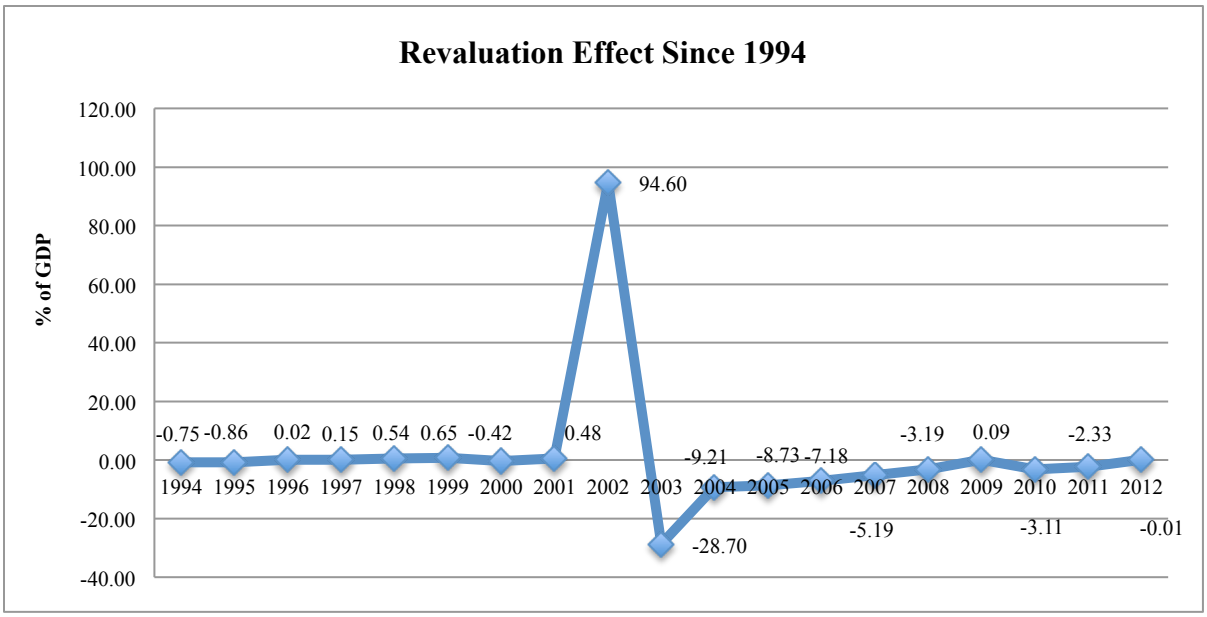
Sources: Argentina Ministry of Economy and Production (2014), IMF (2014) and author's calculations

Chart 9



Sources: Argentina Ministry of Economy and Production (2014), IMF (2014) and author's calculations

Chart 10



Sources: Argentina Ministry of Economy and Production (2014), IMF (2014) and author's calculations

d) Explicit Fiscal Reforms and Implicit Fiscal Reforms

Another tool for Argentina to enhance its fiscal position is explicit fiscal reforms. However, this tool is very limited. In Argentina, corporate income tax rate is 35%, the general value added tax is 21%, and the income tax rates are 9%-35% for residents and 24.5% for nonresidents. (Deloitte, 2014) In general, Argentina' tax rate is pretty high, so there is little room to raise tax rate. Argentina did not have much incentive to cut its spending as well. Argentina actually did the contrary. In recent years, President Cristina Kirchner had sharply increased spending on subsidies, social programs, and pensions. (The Wall Street Journal, 2014) The president needs massive social programs to maintain her political control over the country and to uphold her legitimacy. Such legitimacy is particularly important for the current president as she "inherited" the presidential power from her passed husband, who is the former president of Argentina. Therefore, it is

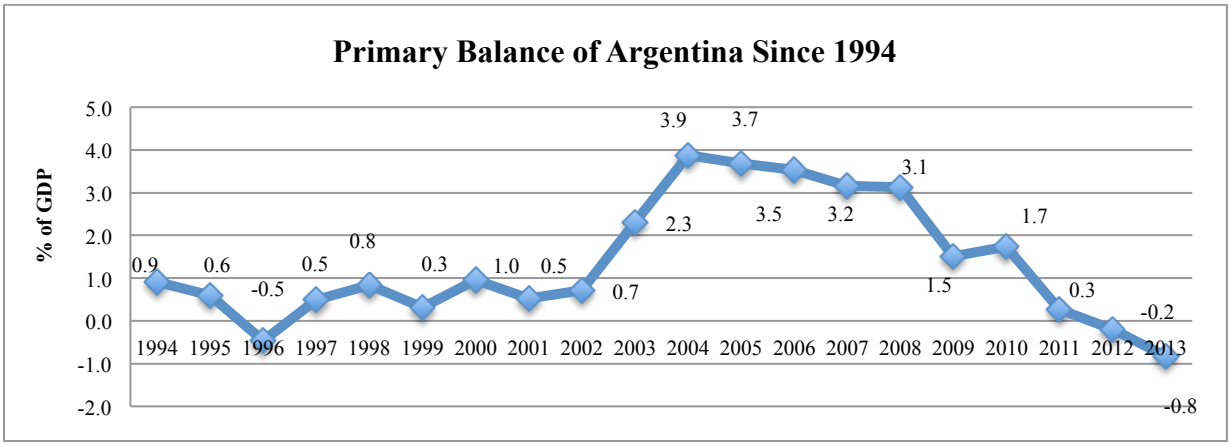
highly impossible that Argentina can carry out explicit fiscal reforms to raise tax rates and cut spending.

The last tool for the government is implicit fiscal reforms. I do not have mathematical models to calculate the effectiveness of implicit fiscal reforms directly, but I develop two ways to evaluate it indirectly. The first method I use to evaluate the implicit fiscal reforms is to compare the trend of the primary balance and the trend of the three effects.

Primary balance is the sum of interest payments and government deficits/surplus. It is an indicator of how much revenue the government actually generates. Chart 11 shows that after 2002, Argentina's primary balance enhances but deteriorates since 2004. I compare the trend of the primary balance and the three effects since 2004 so as to obtain a rough idea of the effectiveness of implicit fiscal reforms. For the Argentine government, they have several ways to enhance its fiscal condition and better its primary balance: the seigniorage, economic growth, debt deflation, explicit fiscal reforms, and implicit reforms. As the inflation effect, the growth effect, and the revaluation effect are very limited since 2004, it means that seigniorage, economic growth, and debt deflation are ineffective to better the primary balance. The explicit fiscal reforms are also limited as discussed previously. Therefore, the trend of the primary will indirectly reflect the effectiveness of the implicit fiscal reforms. If implicit fiscal reforms were effective, we would not see the primary balance to deteriorate; if implicit fiscal reforms were ineffective, we would see the primary balance to deteriorate or at least not to become better. What we see from Chart 11 and Chart 12 is that the primary balance of Argentina

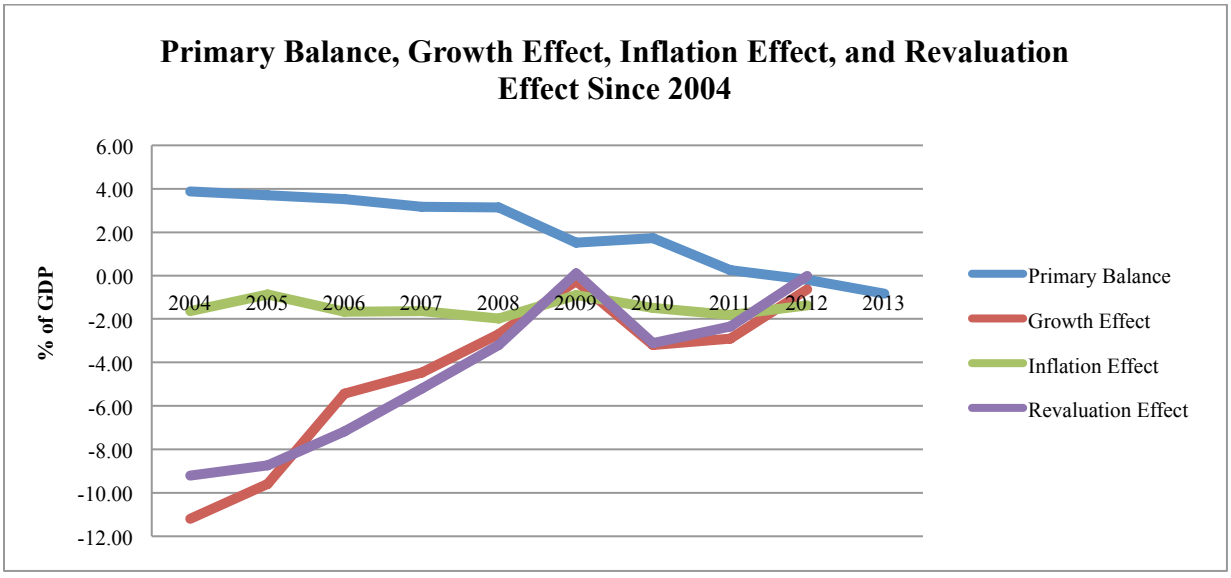
actually deteriorates since 2004, so it is justified to conclude that the implicit fiscal reforms in Argentina are also limited.

Chart 11



Sources: Argentina Ministry of Economy and Production (2014), IMF (2014) and author's calculations

Chart 12

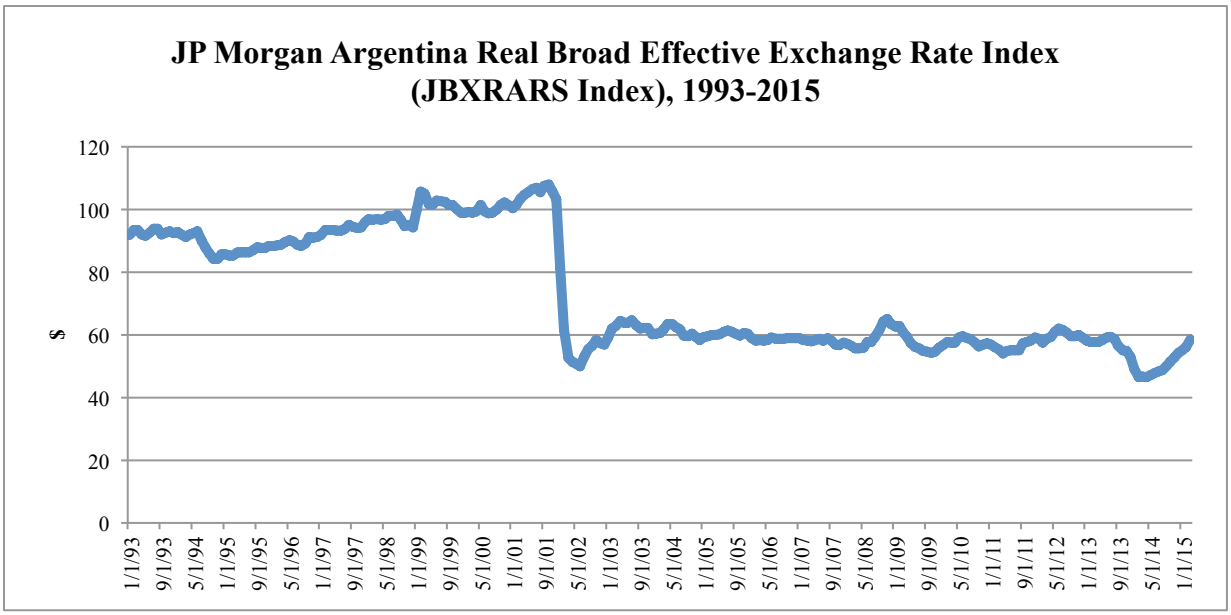


Sources: Argentina Ministry of Economy and Production (2014), IMF (2014) and author's calculations

The second method I use to evaluate implicit fiscal reforms is to look at the effective exchange rate of Argentina instead of the nominal exchange rate. I choose to use JP Morgan Argentina Real Broad Effective Exchange Rate Index (JBXRARS), which tracks the real exchange rate of Argentina, as a proxy of Argentina's real exchange rate.

Chart 13 shows the trend of Argentina's real exchange rate since 2015. After the huge drop in 2001, Argentina's real exchange rate is actually rather stable with a few fluctuations. Although throughout 2013, the real exchange rate drops but rises back in the whole year of 2014. What the trend implies is that there was limited implicit fiscal reforms in Argentina from 1993 to 2012, as implicit fiscal reforms require significant drop in the real exchange rate. There might be implicit fiscal reforms in 2013 but its effects are probably offset by the significant rise in real exchange rate in 2014. Therefore, like the first method, the second method also shows that Argentina has limited implicit fiscal reforms in the past twenty years.

Chart 13



Source: Bloomberg

e) Future Defaults and Eventual Dissolution of the Managed Exchange Rate

For Argentina, it is really hard to implement explicit fiscal reforms. The effectiveness of implicit fiscal reforms, debt deflation, economic growth, and seigniorage is also limited. As a result Argentina is increasingly incapable of paying back its debt and the natural outcome for Argentina is default. The reason why Argentina did not default in recent years might be the low interest rate in the US and other major economies. After 2007-2008 Financial Crisis, major economies, particularly, the US, adopted an extremely low interest rate. As a result, investors and creditors were still willing to lend and invest in countries like Argentina for relatively high returns. However, as the US and other major economies are recovering from the financial crisis, due to its bad record of default Argentina will face a much tougher situation, which could eventually lead to default.

Another outcome is the gradual dissolution of the managed exchange rate. Although seigniorage is increasingly ineffective for Argentina, it is still more effective and easier as compared to other methods. Therefore, Argentina will probably continue printing a large amount of money to finance its budget in the future. If they want to manage their exchange rate regime, they have to restrain money printing. Their heavy reliance on printing money will gradually erode the foundation of their managed exchange rate regime and lead to the eventual dissolution of the managed exchange rate.

3. Comparison with Other Literature

The results I find are primarily in alignment with the first-generation models, which predict high inflation after the currency crisis. However my analysis is different from the fist-generation model by my analysis of the managed exchange rate regime. My analysis does not predict the sudden collapse of the exchange rate as predicted by the first-generation models, but rather suggests a gradual dissolution of the managed exchange rate.

Although I use Burnside's model on fiscal sustainability (Burnside, 2005) as my theoretical framework, my results are actually very different from what Burnside found in South Korea, Mexico and Turkey. In these three countries, Burnside found evidence of either strong implicit fiscal reforms or strong debt deflation. However, in the case of Argentina, both the implicit fiscal reforms and the debt deflation are limited.

It is very interesting that this paper finds out that Argentina actually does not have significant positive fiscal effects from currency devaluation. It is an issue worth discussing and analyzing in the future.

VII Conclusion

By analyzing the fiscal sustainability of Argentina, I found out that the currency devaluation in early 2014 actually reveals deep fundamental problems in Argentina's economy and policies. It is extremely hard for the government to find an effective tool to increase its primary balance and reduce its debts. As a result of the insufficiency of fiscal tools, Argentina will probably mainly rely on printing money to finance its budget in the future. In consequence, its managed exchange rate will likely gradually and eventually dissolute. Moreover, because of the heavy reliance on seigniorage, the country will likely face ongoing hyperinflation.

Given all these findings, I conclude that the peso's devaluation in early 2014 is not a deliberate action by the government to enhance its fiscal conditions, as currency devaluation is not effective at all to enhance Argentina's fiscal conditions. There are three possible driving forces underlying the peso devaluation based on my findings. First, the investors were increasingly aware of fiscal difficulties faced by Argentina so capital outflowed from Argentina. Second, the speculators were betting on Argentina's inability to maintain its managed exchange rate regime and speculated on Argentina's peso. Third, local Argentines realized hyperinflation would become even worse and the government

had no incentive to curb hyperinflation, so they sold their pesos for US dollars as a store of value.

Besides all the implications stated above, my analysis also suggests how Argentina might deal with its creditors in the international bond market. The bond issue dates back to 2001 when the government defaulted on $100 billion of debt. Most bondholders accepted a swap on their investments in 2005 and 2010, losing money in the process. However, a small group of "holdout" creditors led by Elliot Management are fighting for full repayment and took the case to New York, where Judge Griesa ruled in their favor, preventing Argentina from making interest payments on any bonds unless it also repaid hedge funds $1.3 billion plus interest in full. The ruling led to Argentina's default last July — its second in 13 years. (Financial Times, 2015) My analysis suggests that Argentina really has limited resources so that it is extremely hard for them to actually pay these "holdout" creditors rather than other small creditors first. A more possible outcome might be that Argentina will negotiate with the "holdout" creditors and asked for debt restructuring for which they can pay less. If such negotiation could not succeed and Argentina end up paying the "holdout" creditors in full, there will be extremely high chance that Argentina will default on the debt owed to those creditors who actually participated in Argentina's debt restructurings in early 2000s.

In summary, Argentina is facing and will continue facing a very tough time domestically and internationally. First, Argentina will remain inaccessible to the international bond market. Argentina is unable to pay back "holdouts" credits like Elliot Management due to

its incapability of raising revenue. Even if they pay back those "holdouts" creditors, they will probably default on the debt owed to other creditors. As a result, they will remain incapable of borrowing in the international bond market. Second, the inflation rate in Argentina will continue to rise and Argentina will become increasingly incapable of maintaining its managed exchange rate regime. Hyperinflation and a crippled exchange rate regime will further undermine Argentina's economic competiveness. All these factors combined together might drag Argentina into another decade-long recession.

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Appendix

The appendix section explains the theoretic model developed in Burnside (2005) to analyze fiscal sustainability. The whole appendix section is a simplified version of Burnside (2005). I divide it into two subsections. One subsection is on the long-run fiscal sustainability condition. The other subsection is on the debt dynamics, the empirical approach for fiscal sustainability analysis.

I. The Long-Run Fiscal Sustainability Condition

We can write the government's flow budget constraint as

$$b_t = (1+r)b_{t-1} - x_t - \sigma_t \tag{1}$$

where

b_t is the end of period t stock of real debt,

x_t is the real primary surplus,

σ_t is the real value of seigniorage revenue

$$\lim_{j\to\infty}(1+r)^{-(j+1)}b_{t+j} = 0 \tag{2}$$

The forward iteration on (1) combined with the condition (2) implies

$$b_{t-1} = \sum_{i=0}^{\infty}(1+r)^{-(i+1)}(x_{t+i} + \sigma_{t+i}) \tag{3}$$

The equation (3) is the government's lifetime budget constraint, which states that the government finances its debt at the end of period $t-1$ by (from date t forward) raising seigniorage revenue and running primary surpluses with an equal present value.

Rewrite (3) in terms of stocks and flows expressed as fractions of GDP. Let y_t represent real GDP. Define $\overline{b}_t = b_t/y_t$, $\overline{x}_t = x_t/y_t$, and $\overline{\sigma}_t = \sigma_t/y_t$. Given the notations, rewrite (3) as

$$\overline{b}_{t-1} = \sum_{i=0}^{\infty}(1+r)^{-(i+1)}(\overline{x}_{t+i} + \overline{\sigma}_{t+i})\frac{y_{t+i}}{y_{t-1}} \tag{4}$$

Assume a steady state where real GDP grows at a constant rate g, so that $y_t/yt - 1 = 1 + g$; the primary surplus as a fraction of GDP is a constant $\overline{x}$; and seigniorage as a fraction of GDP is a constant $\overline{\sigma}$. Hence (4) is reduced to

$$\overline{b}_{t-1} = \sum_{i=0}^{\infty}(\frac{1+g}{1+r})^{(i+1)}(\overline{x} + \overline{\sigma}) \tag{5}$$

Assume $r > g$, (5) is reduced to

$$\overline{b}_{t-1} = b_t \equiv (\overline{x} + \overline{\sigma})/\overline{r} \tag{6}$$

where $\overline{r} = (r-g)/(1+g)$

There are two interpretations of (6) to assess fiscal sustainability. First, one could base on the historical values of seigniorage revenue, the real interest rate, and the real growth rate, to estimate $\bar{b}$ using (6). If the government's actual debt exceeded this estimate $\bar{b}$, the government's finances could be argued to be unsustainable.

We can rewrite (6) to draw the second interpretation

$$\bar{x} = \bar{r}\bar{b}_{t-1} - \bar{\sigma} \tag{7}$$

With estimates of $\bar{r}$ and $\bar{\sigma}$ and the government's actual debt stock, $\bar{b}_{t-1}$, (7) can be used to determine the necessary size of primary balance to ensure fiscal sustainability. If the government's actual primacy balance is below the estimate, the government's finances should be argued to be unsustainable.

II. Debt Dynamics

The term "debt dynamics" refers to the study of the evolution of the measured debt-to-GDP ratio. The fundamental equation for debt dynamics analysis is

$$B_t - B_{t-1} = I_t - X_t - (M_t - M_{t-1}) \tag{8}$$

where $B_t - B_{t-1}$ = net debt issued,

I_t = interest payments,

X_t = primary surplus,

$M_t - M_{t-1}$ = seigniorage revenue

If the government issues debt both in domestic and foreign currency, we can write (8) into

$$B_t^D - B_{t-1}^D + (B_t^F - B_{t-1}^F)S_{\bar{t}} = I_t - X_t - (M_t - M_{t-1}) \tag{9}$$

where $B_t^D - B_{t-1}^D$ = net debt issued in domestic currency,

$(B_t^F - B_{t-1}^F)S_{\bar{t}}$ = net debt issued in foreign currency,

$S_{\bar{t}}$ = the average exchange rate measured in local currency units per foreign currency unit

Rewrite (11) as

$$\bar{b}_t - \bar{b}_{t-1} = \bar{i}_t - \bar{x}_t - \bar{\sigma}_t - \frac{\pi_t}{1+\pi_t}\bar{b}_{t-1} - \frac{g_t}{1+z_t}\bar{b}_{t-1} + \frac{S_t - S_{\bar{t}}}{S_t}\bar{b}_t^F + \frac{S_{\bar{t}} - S_{t-1}}{S_{t-1}}\frac{1}{1+z_t}\bar{b}_{t-1}^F \quad (12)$$

or

$$\bar{b}_t - \bar{b}_{t-1} = \bar{i}_t - \bar{x}_t - \bar{\sigma}_t - \frac{\pi_t}{1+\pi_t}\bar{b}_{t-1} - \frac{g_t}{1+z_t}\bar{b}_{t-1} + \frac{S_t - S_{\bar{t}}}{S_t}\bar{b}_t^F + (\frac{S_{\bar{t}} - S_{t-1}}{S_{t-1}}\frac{1}{1+z_t} - \frac{\pi_t}{1+\pi_t})\bar{b}_{t-1}^F \quad (13)$$

The difference between (12) and (13) is that by rearrangement (13) singles out the real revaluation effect. However, (12) only shows the nominal revaluation effect. In summary, the change in the debt-to-GDP ratio is the sum of six components:

1. Iterest payments, $\bar{i}$
2. The primary balance, $\bar{x}_t$
3. Seigniorage, $\bar{\sigma}$
4. The inflation effect, $\frac{\pi_t}{1+\pi_t}\bar{b}_{t-1}$
5. The growth effect, $\frac{g_t}{1+z_t}\bar{b}_{t-1}$
6. The revaluation effect, $\frac{S_t - S_{\bar{t}}}{S_t}\bar{b}_t^F + (\frac{S_{\bar{t}} - S_{t-1}}{S_{t-1}}\frac{1}{1+z_t} - \frac{\pi_t}{1+\pi_t})\bar{b}_{t-1}^F$

In conclusion, the country can reduce its debt by reducing interest payments, enhancing primary balance, printing money and boosting economic growth. If the real exchange rate depreciates, the debt increases. However, as the real exchange rate depreciates, the debt will also decrease through implicit fiscal reforms.