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Deficit Financed Public Expenditure in Argentina: A Structural Vector Autoregression Analysis

Yuliyán Mitkov¹

Rutgers University
Barcelona Graduate School of Economics

Oswaldo Pericon²

Barcelona Graduate School of Economics

¹ yuliyán.mitkov@barcelonagse.eu Statistician from The American University in Bulgaria. Master in Specialized Economic Analysis from the Barcelona Graduate School of Economics and PhD candidate at Rutgers University.

² osvaldo.pericon@barcelonagse.eu Economist from the Universidad Católica Boliviana and former macroeconomic analyst for the Bolivian Government. Holds post-graduate studies in Economic Policy and a Master in Specialized Economic Analysis from the Barcelona Graduate School of Economics.

I. Introduction

The goal of our research project is to analyze the importance of government debt in the propagation of fiscal shocks in the Argentine economy. For that reason we augment a standard fiscal policy vector Autoregression with the nominal debt to GDP ratio taken from a recently compiled IMF database³. Our focus is on Argentina for a couple of reasons. First, debt is arguably crucial for the conduct of fiscal policy in countries like Argentina, which have undergone through various periods of debt restructuring, nationalization, currency pegs and hyperinflation -events which are connected, in one way or another with the government debt⁴. Second, we were able to collect a relatively long database of annual observations for this country, covering almost a century of data. In addition, Argentina is one of the few developing countries for which the debt to GDP series is relatively uninterrupted and covers a sufficiently long period.

To study the effect of a fiscal shock within a vector Autoregression, we have to place restrictions on the model in order to assign economic interpretations on the estimated impulse responses. There are three main approaches for the identification of fiscal shocks. The first is to assume a delayed response of the fiscal authorities to innovations in the other variables in the system, as in Fatas and Mihov (2001) and Blanchard and Perotti (2002). We do not follow this strategy since our data is annual, and restricting the government not to react to unexpected changes in the economy within the same year is unrealistic. An alternative to assuming lags in the reaction of the government's policy function is the so called dummy variable approach, most notably used by Ramey and Shapiro (1998) and Ramey (2011). The idea is to identify episodes, like wars, which lead to exogenous increases in government spending. However, the informational requirement of this approach makes it unfeasible for our purposes. The third option, and the one we pursue here, is to impose sign restrictions on the impulse response functions following a particular shock, as in Mountford and Uhlig (2009).

In addition, augmenting the model with the debt to GDP ratio is important because, it allows us the keep track of the debt dynamics arising after a fiscal shock and also takes into account that taxes and spending might adjust over time to changes in the level of debt. In

³ <http://www.imf.org/external/pubs/cat/longres.cfm?sk=24332.0>

⁴ The appendix contains a historical overview of the major economic events in the country during the XX century.

addition, Chung and Leeper (2007), point out that rational expectations models imply that economic agents' beliefs about the way fiscal policy will adjust to the innovations in government debt plays a crucial role in determining today's equilibrium allocation. Therefore, not augmenting the vector Autoregression with government debt is equivalent to throwing away information which figures prominently in the information set of the agents. This could lead to a non-invertible moving average representation, with the implication that the estimated dynamic responses from the vector Autoregression would be misleading. Moreover, by not properly controlling for the debt dynamics and its feedback to the other variables, one could fail to take into account the government budget constraint and the restrictions it places on the dynamics of the system.

II. Data and methodology

Description of the data

We have collected annual data for Argentina's government revenues, government expenditures, constant prices GDP, GDP deflator, debt to GDP ratio and population covering a relatively long period beginning in 1915 and ending in 2000. Our observations finish in the year 2000 because we have been unable to consistently extend our sample to the last available observation and still preserve the longer sample. Here we provide a brief description of the main variables we use⁵:

Per capita real Gross Domestic Product (GDP), defined as the nominal GDP, divided by the population and the GDP deflator.

Per capita real Government Expenditures (G), defined as the total nominal government spending (including transfers), divided by the population and GDP deflator.

Per capita real Government Revenues (R), defined as the total nominal government revenues (including transfers), divided by the population and GDP deflator.

Per capita real total deficit (DEF), defined as the difference between real government spending and real government revenues. We point out that we work total rather than primary government deficit, since our measure of government spending includes the servicing of debt as well.

Nominal debt to nominal Gross Domestic Product (D/GDP), defined as the outstanding nominal value of government debt, divided by the nominal Gross Domestic Product.

We use the nominal, rather than the market value of government debt, simply because the latter series was not available. It should be noted that by using the outstanding nominal debt

⁵ Detailed information on the data and its sources is given in the Appendix.

we are not taking into account debt of different maturities, which could have important implications for the behavior of the fiscal authorities. In addition, what matters from theoretical perspective is the market instead of nominal value of debt. On the other hand, one advantage of using the nominal series is that we are not assuming market rationality in order to approximate the market value of debt. In any case, in the empirical part we will show that the behavior of the nominal debt to GDP after deficit fiscal expansion is consistent with the theoretical predictions from an incomplete markets model⁶.

Identification of the government spending shock

We study the dynamic response of a shock to government spending using a vector Autoregressive model with moving average representation of the form:

$$Y_t = C(L)u_t$$

The endogenous variables are

$$Y_t = (g_t, def_t, gdp_t, \frac{d_t}{gdp_t})^T.$$

Where (g_t) is the log *Per capita real Government Expenditures*,

(def_t) is the log *Per capita real total deficit*,

gdp_t is log *Per capita real Gross Domestic Product* and

$\frac{d_t}{gdp_t}$ is log *Nominal debt to nominal Gross Domestic Product*

The covariance matrix of the reduced form residuals is denoted by Ω :

$$Eu_t u_t^T = \Omega$$

Where:

$$C(L) = C_0 + C_1 L^1 + \dots C_k L^k + \dots +$$

$$C_0 = I$$

The moving average terms C_j characterize the propagation of a shock to the system.

Table 1 shows the assumptions we make on the contemporaneous impulse responses. We identify a positive deficit financed government spending shock as one which, during the period of the impact leads to increase in government spending, increase in deficit, increase in GDP and increase in the debt to GDP ratio.

⁶ Marcet and Scott (2009).

Table 1: exogenous deficit financed spending increase: sign restrictions

G on impact	DEF on impact	GDP on impact	D/GDP on impact
+	+	+	+

The restriction of government spending and deficit to increase during the period of the shock follows from the definition of deficit financed expansionary shock. Moreover, as it is shown in Marcet and Scott (2009), with incomplete markets, an assumption which appears to be realistic especially for a developing country like Argentina, a rise in the deficit should lead to immediate and persistent increase in the debt to GDP ratio⁷. The last part of the identifying assumption, namely that output rises in responses to deficit finance fiscal expansion, is consistent both with New Keynesian and Real Business Cycle theories for the effect of increase on government spending on output. (Pappa, 2009).

Imposing the sign restriction⁸

From the moving average representation of the vector Autoregression we have:

$$Y_t = C(L)u_t = C(L)SHH^T S^{-1}u_t = D(L)e_t,$$

with an orthonormal matrix $HH^T = I$, the Cholesky factor S of the reduced form residuals $E[u_t u_t^T] = SS^T$, $e_t = H^T S^{-1}u_t$, S are the structural residuals, whose covariance matrix is identity and $D(L) = C(L)SH$ gives the dynamic propagation of the structural shocks.

We estimate $C(L)$ and $E[u_t u_t^T]$ by approximating the moving average terms by a vector Autoregression of order p ⁹, then we impose a sign restriction on the government spending shock, by ordering this variable in our system first and then employing the following procedure:

- *First*, using the QR factorization draw a random matrix H such that $HH^T = I$, and take the first column of this matrix h_1 corresponding to the government spending shock.
- *Second*, use $D(L) = C(L)Sh_1$ to check whether the restrictions on the impulse responses are satisfied. In particular we check whether the sign of the contemporaneous effect Sh_1 is as expected.

⁷ As was already mentioned, this statement holds for the market value of debt, but nevertheless we use it to motivate the sign restriction we place on the nominal debt to GDP.

⁸ We thank Luca Gambetti for his insights and encouragement on the use of this methodology.

⁹ In our baseline model we select the lag order by maximum likelihood, but the results are robust to different lag orders.

- *Third*, if the sign restrictions are satisfied, save the h_1 vector, otherwise discard it.
- *Fourth*, repeat the previous three steps M times (where M in our case is 2000).

Since this procedure leaves us with many draws satisfying the sign restriction, the model is not exactly identified. Thus, we compute the impulse response functions for each H matrix, consistent with our identification scheme and report the average over the impulse responses.

III. Empirical Analysis

The empirical results are now presented. We begin in section 1 by examining the high frequency dynamics of the data. This is especially important for our purposes since our sample covers most of the 20th century. In section 2 we present the results for our basic model with debt. Section 3 compares the model with and without debt and tries to trace the driving factor behind implications of the two models. In section 4 we attempt to gauge the importance of the identified government spending shock by performing a historical decomposition exercise. Finally, section 5 checks the robustness of our results to different sub-samples and model specifications.

1. High frequency properties of the data

We start the empirical part, by first examining the high frequency properties of the data over the entire sample. Figure 1 shows the growth rate of real GDP and the growth rates of government expenditures, deficit and debt as a fraction of GDP. The horizontal black lines represent ± 2 times the standard deviation, whereas the vertical dashed lines are dating the periods with currency pegs, with two lines of the same color capturing the beginning and the end of a currency peg episode.

The first impression from the figure is that growth rates exceeding 2 times the standard deviation of the respective series are usually occurring within periods with freely floating exchange rates, the only exception being the huge debt to GDP reduction of around 60 percent in 1934 -an isolated event which was probably connected with the end of the Great Depression and the huge jump in the growth rate of GDP during the same year. Also, the debt to GDP series is, by far, the most volatile, with a period of relative stability from the 1940s to the 1970s, followed by very turbulent changes.

Turning to GDP in the third panel, there is only one observation, which according to our procedure should be classified as an outlier. This event is dated in 1947, which was a time where the government of Peron started making its policy reforms, such as the nationalization of the railway companies and strong stimulus policies.

Finally, the top two panels display the growth rate in the government expenditures and the deficit as a fraction of GDP. It is obvious that the currency peg plays an important role in the development of these series – all of the changes in the series in excess of two standard deviations are dated in periods with freely floating exchange rates.

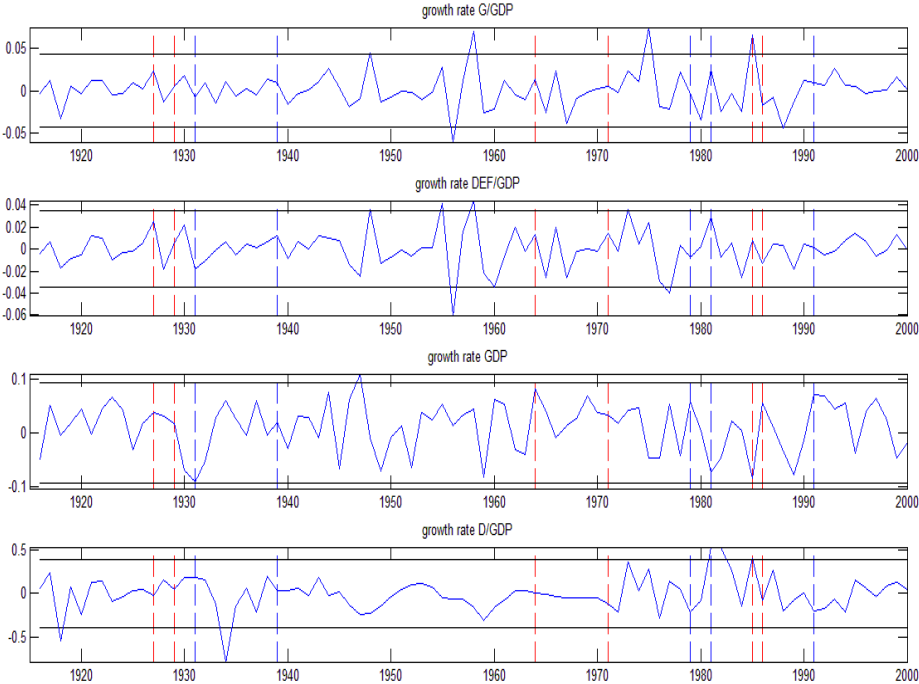


Figure 1: High frequency properties of the data
 Panel 1: growth rate of Government expenditures as a fraction of GDP (G/GDP)
 Panel 2: growth rate of Total Deficit as a fraction of GDP (DEF/GDP)
 Panel 3: growth rate of real per capita GDP
 Panel 4: growth rate of Debt as a fraction of GDP (D/GDP)
 Two vertical lines of the same color mark the beginning and end of a currency peg episode. Horizontal black lines show plus/minus two times the standard deviation of the respective series.

We will attempt to control for the large spikes in the variables by including dummies in our baseline VAR specification not only for the four series considered above, but also for the price level and the tax revenues. In addition, and since whether the currency is pegged is obviously important for the way fiscal policy is conducted, we have constructed a dummy variable, taking the value of one during periods of currency pegs and zero otherwise. Ilzetzi

et al (2008) show the dates for which Argentina followed different exchange rate regimes, including currency pegs. Finally, we exclude the first five observations from the sample, which coincide with the First World War and include a dummy taking on the value of one from 1939 to 1945, design to capture the effect of the Second World War on the economy.

One practical issue, stemming from our desire to include so many controls in our model is that we end up with eight dummy variables (a dummy for government spending, deficit, taxes, GDP, GDP deflator, debt to GDP, period of currency peg and WWII years). Augmenting our four variables VAR with so many exogenous series will make the parameter estimates imprecise. Moreover, as will become clear below, we would like to add some additional indicator variables. For that reason we have constructed what we call a composite dummy in the following way: we calculate the sum of our eight dummy variables for each observation and assign a separate indicator variable for each value that their sum might take. This procedure leaves us with four exogenous series. One drawback of the way we have constructed our control series is that we do not differentiate between different events. For example we have a control variable, taking on the value of one, given that any two of the eight possible events has occurred. This way, in 1934 there was debt to GDP reduction and a currency peg, hence our dummy is one, but it would have also taken on the value of one if there was currency peg together with a spike in the deficit to GDP ratio.

As another attempt to reduce the bias in our results, we estimate our baseline VAR over the full sample and then compare the average change in the parameters when some observation has been removed from the sample (the average change is calculated excluding the parameters in covariance matrix). The results are shown in figure 2 for each equation in the VAR. The horizontal axis lists the year which was excluded from the estimation sample, the vertical axis on the right shows the average change in the parameters of the model, compared to the full sample, when this year was deleted.

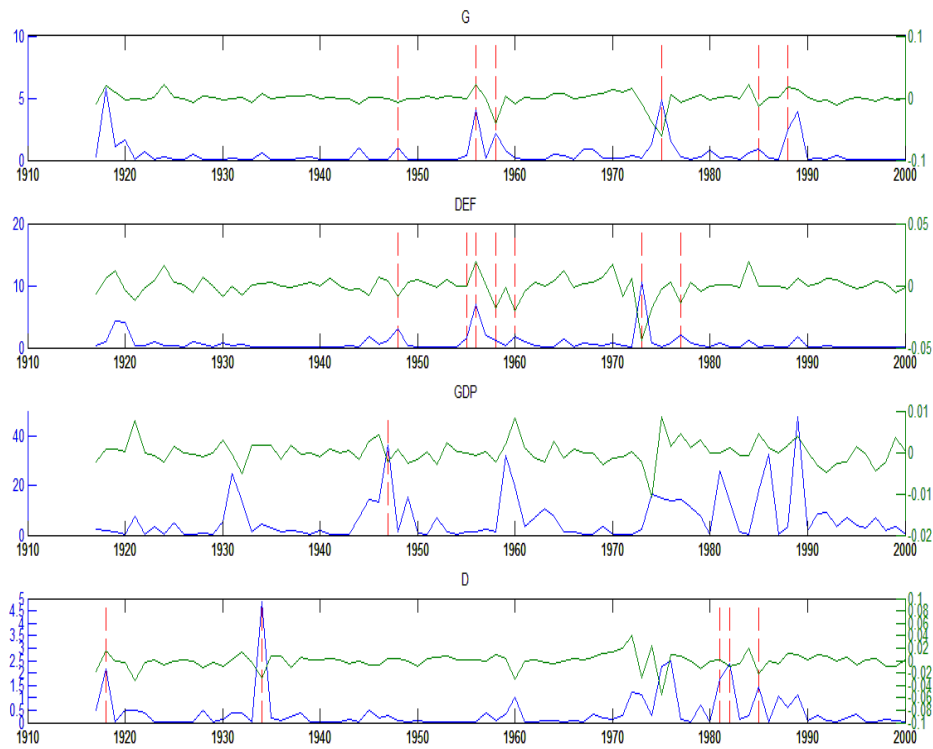


Figure 2: Influential Observations. Cook's distance is on the left Y axis. Average parameter change is on the right Y axis. The four panels in the figure represent the four equations from SVAR; each regressed on a constant, four lags of itself and four lags of the other three variables in the system.

The left axis displays the Cook's distance, which measures the influence each observation had on the final estimates. The vertical dashed red lines are dating the years when the growth rate of the series as a fraction of GDP exceeded two standard deviations and hence this is when the dummy for that particular variable takes on the value of one. As can be seen from the figure, the control variables constructed in the previous section are already capturing most of the influential observations. The main difference is in the beginning of the sample and also for the GDP growth series: while the previous procedure uncovered only one outlier, here we see at least seven.

We have constructed two indicator variables, one for observations with a “relatively high” Cook distance and one for observations with a “relatively high” average change in the estimated parameters, which we have added to our composite dummy variables (where in both cases “relatively high” is defined as exceeding two times the standard deviation of the Cook's distance or the average change in the parameters). Overall, in all the models we estimate we have five dummy variables¹⁰.

¹⁰ The basic results in our paper are relatively robust to variations in the exogenous variables.

2. Dynamic responses to government spending shock: Baseline model with debt

In this section we estimate our basic Structural VAR, consisting of real government expenditure, total deficit (defined as real government expenditures minus real government revenues), real GDP and debt to GDP ratio. The sample begins in 1920 and runs through 2000.

Our identification of exogenous financed deficit rise in government spending is such that government spending, deficit, output and debt to GDP are all positive on impact. Figure 3 reports the median over the sign identified impulse responses (green line) and the 95 per cent bootstrapped confidence bands computed over 200 bootstrapped samples.

By assumption government spending reacts positively on impact, increasing by 0.8 percent and then gradually falls back towards its steady state. It is worth pointing out that government spending displays relative persistency and is statistically different from zero even four years after the shock has occurred.

During the impact year, deficit rises, on average by 0.5 percent followed by steady decrease towards zero. This reflects the fact that government revenues, which are initially restricted to decrease or at least increase less than the government spending are rising after the impact period and hence pushing down the deficit. Since our measure of deficit is the total, rather than the primary deficit, the fact that the deficit is above zero for the entire horizon of the impulse response does not necessary imply that the fiscal policy is on an unsustainable path.

Turning to GDP, during the year of the shock GDP is increasing by around 0.1 percent, implying an impact elasticity of output of roughly 12 percent, given that the average ratio of government spending to GDP during the period of the sample has been 11 percent this translates into government spending multiplier of about 1.06. Following the first year, GDP is steadily decreasing and after two years is not statistically distinguishable from zero.

The reaction of debt/GDP is relatively persistent –the variable remains significantly positive four years after the shock to government spending, consistent with the theoretical predictions of the incomplete markets model of fiscal policy¹¹. It is worth pointing out that we uncover this relation even though we use nominal debt to GDP and the total value of the government deficit, whereas the theoretical counterparts are the primary deficit and the market value of debt.

¹¹ Marcet and Scott (2004).

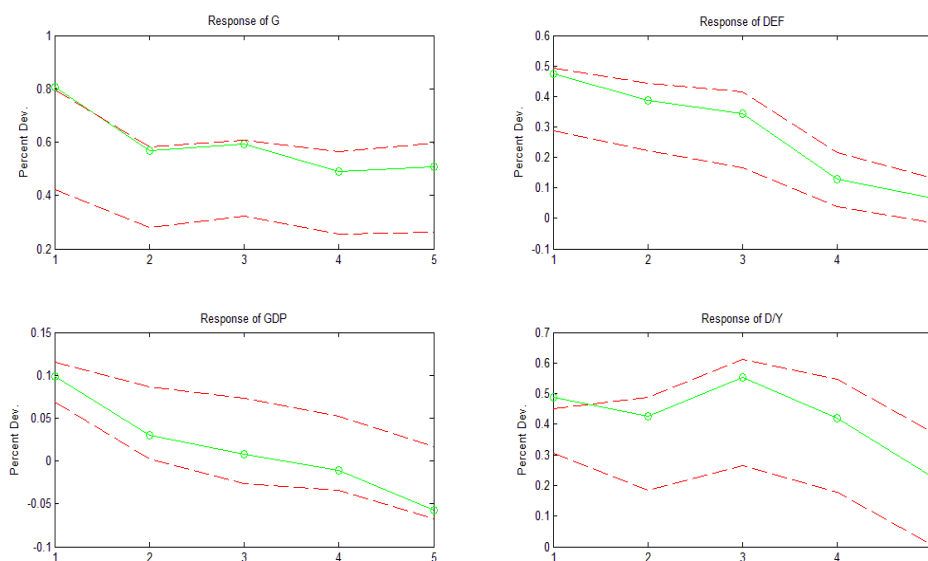


Figure 3: Impulse responses from a Structural Vector Autoregression of order four, with endogenous variables – G, DEF, GDP and D/GDP, a constant, a composite dummy indicator and one lag of the composite dummy indicators. The figure shows the average of the dynamic responses of a deficit financed shock to government spending, identified through sign restrictions, where all endogenous variables in the system are restricted to increase in the period of the shock. The red lines represent 95 percent bootstrapped confidence bands from 200 samples.

G – Per capita real government spending. DEF – per capita real total deficit
 GDP – per capita GDP (1970 local prices). D/GDP – Debt to GDP ratio

In figure 4, the green line is the cumulative elasticity of GDP with respect to the deficit financed government spending increase, whereas the broken lines give the 95 percent bootstrapped confidence bands. The cumulative elasticity is calculated as the sum of the dynamic responses of output, divided by the sum of the dynamic responses of government spending. The advantage of this measure is that it takes into account that the government spending is usually not carried out at once, but it takes time, something which can be especially important for developing countries like Argentina. In fact, as can be seen from the figure 3, government spending rises very persistently after the initial shock. Taking into account that the average fraction of government spending to GDP has been 11 percent during our sample, implies that the fiscal multiplier is equal to 1.06 in the year of the impact, and after that it is always below one. For example three years after the shock, the cumulative elasticity is 5 percent, leading to fiscal multiplier of 0.43. This means that a deficit financed expansion, leading to total increase in the government spending of one currency unit after three years had crowded out *about* one half currency units of private spending for the same period of time.

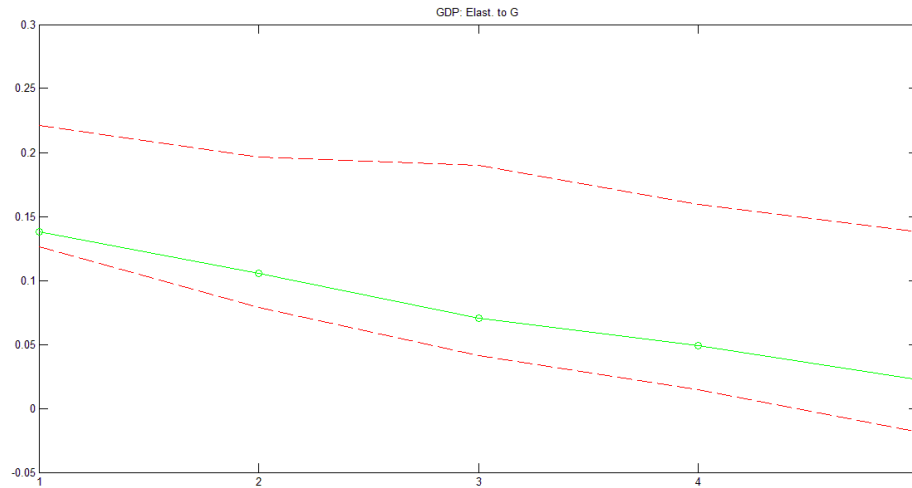


Figure 4: Cumulative elasticity of GDP to government expenditure shock, calculated as the sum of the dynamic response of GDP divided by the sum of the dynamic response of government spending. Red lines – 95 percent bootstrapped confidence bands from 200 samples.

3. Effects of deficit financed government expansion from a model with and without debt feedback

Next, we compare the dynamic response to a government spending shock from a vector Autoregressive model with debt to one without debt. The results are shown in figure 5. The broken blue line is the point estimate of the impulse response from the model without debt, the green line is the point estimate from the model with debt, and the broken red lines are the 95 percent bootstrapped confidence intervals from the model without debt. When the feedback of debt to GDP is not taken into account, the model predicts the dynamic response of each of the variables, not only to be higher on impact but to remain above the response from the model with a debt feedback. The difference is particularly striking for the response of GDP - according to the model without debt feedback GDP should remain positive and significantly above the dynamic response calculated from the model with debt for all four years after the government spending shock. The discrepancy between the implications from the two models is also evident in the cumulative elasticity to the government expenditure shock. According to the SVAR without debt, the elasticity of output to government spending is much higher, especially in the long run, where the models implies cumulative elasticity in the range between 0.2 and 0.3 percent compared to a point estimated which is below 0.1 for the debt augmented vector Autoregression.

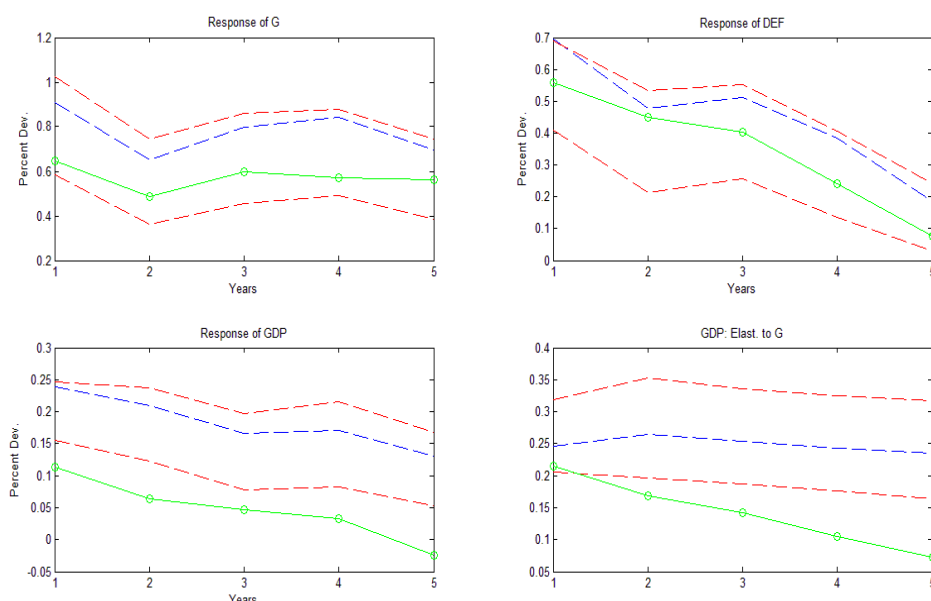


Figure 5: dynamic responses from a vector Autoregression with and without debt to GDP ratio. Blue line - point estimate from a three variable SVAR(4) featuring G, DEF and GDP. Red broken lines – 95 percent confidence bands from 200 bootstrapped samples. Green line – point estimate from a four variable SVAR(4) consisting of G, DEF, GDP and D/GDP. Both models contain a constant and five composite dummy indicators contemporaneously and lagged once.

One possible explanation for the divergence of the results from the two models is that the model without debt feedback is not taking into account that a deficit financed fiscal expansion implies increase in the debt to GDP ratio, which in the future has to be met by rise in the surpluses if the government is to remain solvent, and the implications this could have on the variables featured in the model. Secondly and related to the first argument, the debt to GDP ratio is arguably informative for the future actions of the government, including the possibility of default and therefore the expected behaviour of the government will translate to today's actions from the private sector. In this case, omitting debt to GDP from the vector Autoregression might introduce a bias in the estimated parameters.

In order to gain a better understanding of the mechanism driving the difference between the two models we calculate the so called pure dynamic responses of the variables in the system to exogenous government deficit financed shock as in Perroti 2004. This is done by first estimating the model featuring debt feedback, but then restricting the dynamic response of the debt/GDP ratio after a government shock to be zero for each horizon. The results of this exercise are presented in figure 6. In the upper panel the blue line is the dynamic response of GDP to shock in the government spending from the SVAR, where debt is restricted to remain constant for the horizon of the impulse response, the green line and the red broken lines are respectively the point estimate from the unrestricted model and the 95 per cent

confidence bands. The main message is that after performing the counterfactual experiment of restricting debt/GDP not to react to deficit financed government spending increase we recover, to a large extent, the results from the model where debt to GDP ratio was omitted. This implies that the main difference between the two models stems from the conditional correlation of the other variables in the system with the debt to GDP ratio. The dynamic response of the variables from a vector Autoregression with no debt feedback is as if debt to GDP were not reacting after deficit financed government expansion, which is in direct contradiction to what we expect from incomplete markets model¹².

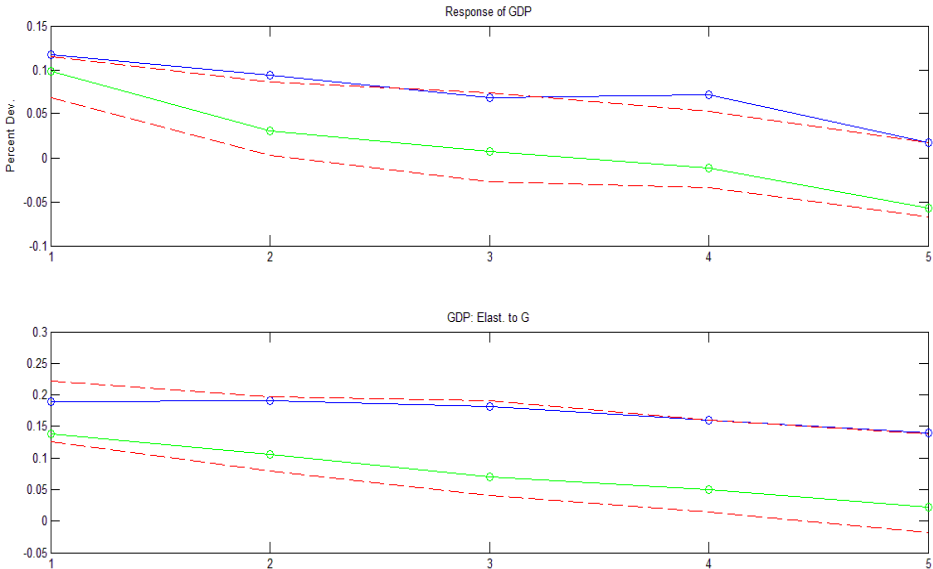


Figure 6: Pure Impulse Responses. The green line is the point estimate from the baseline four variables SVAR. Red broken lines – 95 percent confidence bands from 200 bootstrapped samples. The blue line is the point estimate from the SVAR but with debt to GDP restricted not to react to government spending shocks. On the upper panel is the impulse response of GDP, and on the lower panel we have the cumulative elasticity of GDP to government spending shock.

4. Historical Decomposition of the government spending shocks

In this section, we try to gain more insight for the importance of exogenous government spending shocks, by historically decomposing the series. The results of this exercise are shown in figure 7. For example the third panel on the left reports the difference between the actual realization of real GDP and the counterfactual one where the sign identified government spending shocks had been switch off, the vertical lines are dating the periods of currency pegs, with two lines of the same colour marking the beginning and the end of a currency peg episode. On the right panel are the impulse responses, where the green line is the point estimate, the red broken lines are the 95 per cent confidence bands and the blue

¹² In contrast in complete market models, we would expect debt to GDP to decrease after positive deficit financed spending shock. In either case the theory is not predicting debt to remain constant.

line the point estimate from the vector Autoregression, estimated using the historically decomposed series¹³.

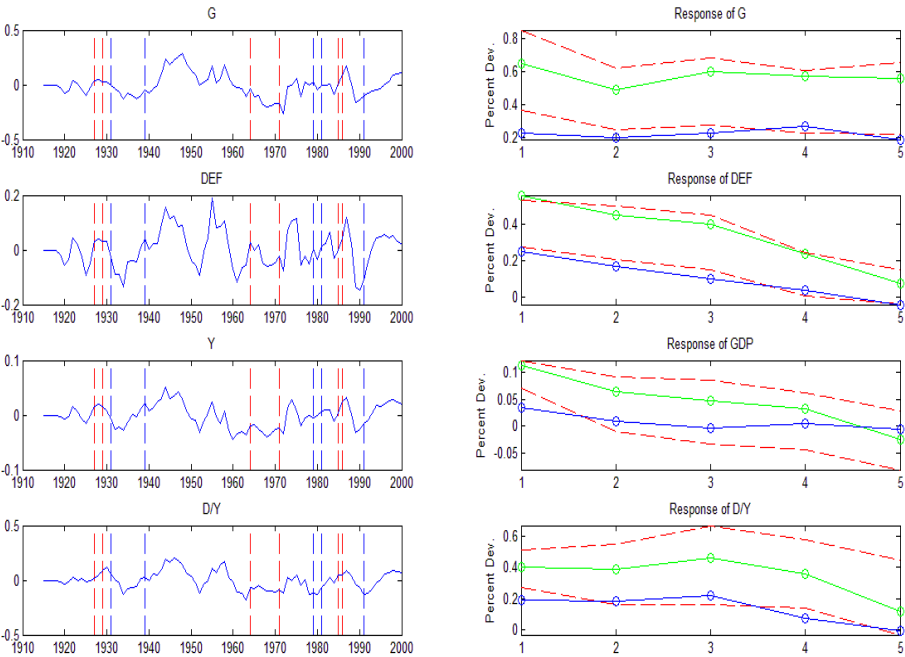


Figure 7: The figures on the left panel show the average difference between the actual and the historically decomposed series, without the sign identified government spending shock. The vertical lines are dating period of currency peg, with two lines of the same colour marking the beginning and the end of a period when the currency was pegged. The figures on the right panel show the estimated impulse responses from vector Autoregression using the actual series (green line) and the historically decomposed series (blue line). The red lines are the 95 percent confidence bands from 200 bootstrapped samples, computed using the actual realizations of the series.

Using the historically decomposed series, we find that the debt to GDP ratio rises by 0.2 per cent during the year of the spending shock, compared to 0.4 per cent, when the model is estimated over the actual series. After the first year, the counterfactual debt to GDP ratio persistently remains below the estimated reaction from the actual series.

Consistent with the counterfactual behaviour of the debt to GDP series after a spending shock, the increase in the deficit is smaller and towards the end of the horizon of the impulse response no longer statistically distinguishable from zero.

The effect on the government spending is relatively small - expenditure rise by about 0.2 percent compared to a surge of 0.6 percent in the actual series.

¹³ Since we use sign restrictions to identify exogenous rise of government spending, our model is not exactly identified, that is we do not have a unique realization of the structural government spending shocks consistent with our identification scheme. For that reason, and similarly to the impulse responses, we report the average over the historically decomposed series, where the average is taken over different realization of the shocks, consistent with our sign restrictions.

Finally, on impact, GDP rises by less, but after the first year the difference between the two impulse responses is not statistically significant.

The main conclusion we draw from the historical decomposition of the government spending shocks is that the cumulative effect of deficit financed spending would have been bigger, if the government had had less discretion in the past. This could be seen by comparing the dynamic response of GDP and the dynamic response of government spending after the shock.

5. Robustness analysis

Stability over sub samples

In this section we check the robustness of our results by first asking to what extent the estimated dynamic responses are stable across sub samples. This question is especially relevant for us since we use a relatively long sample, featuring government defaults, currency pegs, WWII and other events we might not be aware of that could have influenced our results so far. Another concern is that due to the long period which we have use to estimate our baseline vector Autoregression we might end up conflating different regimes, which generated the observations and hence the dynamic responses we compute would not represent the typical response during the period of the sample, but an average across different regimes and hence hard to analyse.

The approach we follow to gauge the stability of our results is to estimate the baseline model featuring debt, but by eliminating some years from the data and then comparing the impulse responses with the ones from the model estimated over the full sample¹⁴. The hope of this procedure is to eliminate events, like government default or a political regime, which could have significantly biased the dynamic responses of the variables in the system to government spending shock. The results are shown in figure 8. For instance, the upper left panel compares the dynamic response of GDP to government spending shock estimated over the full sample (green line) the blue line is the response of GDP when the years 1921 to 1930 were dropped from the sample, and the red broken lines are the 95 per cent bootstrapped confidence bands from the vector Autoregression using all the observations.

¹⁴ The same the strategy was applied by Blanchard and Perotti (2002)

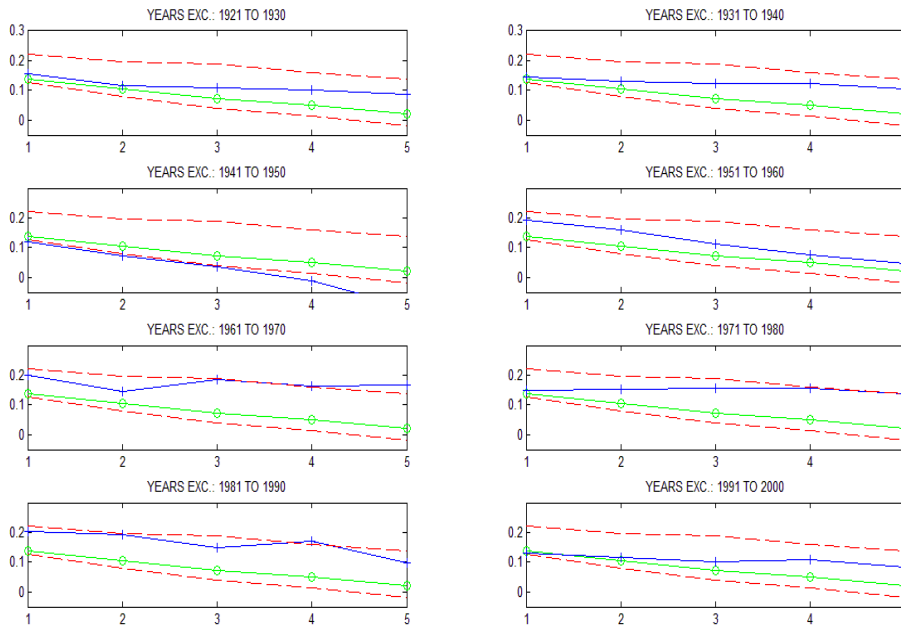


Figure 8: *Stability of the dynamic responses. Each panel in the figure shows the estimated impulse responses of output to government spending shock from the vector Autoregression using the full sample (green line) and excluding a particular period (blue line), with 95 percent confidence bands, computed using 200 bootstrapped samples from the full sample model. The SVAR is of order four and consists of G , DEF , GDP and D/GDP , a constant and five dummy variables entering contemporaneously and lagged once.*

As can be seen from figure 8, the estimated impulse responses exhibit relative stability, with the dynamic response estimated over the restricted sample remaining within the 95 percent confidence bands from the full sample model. The only decade for which the estimated response over the sub sample is outside the confidence bands over the entire horizon of the impulse response function is from 1941 to 1950¹⁵.

Figure 9 displays in greater detail the difference between the dynamic responses estimated over the full sample with observations from 1941 to 1950 being excluded. First, from the upper right panel we see that removing the aforementioned period leads to the response of the debt/GDP ratio after deficit finance expansion to be greater on impact, to increase more rapidly after the year of the shock and to remain persistently higher compared to the dynamic

¹⁵ In 1943, a coup took place, in which the figure of Domingo Peron rose, finally taking office from 1946 to 1955. The populist policies of the time had a significant impact on public expenditure and on the share of the state in the aggregate economy, with stimulus policies on the national industries and markets, import substitutions, and nationalization of private foreign-owned companies such as the railway enterprises owned by British and French interests. The Central Bank –which was totally controlled by the government- became heavily indebted to the Bank of England. Government expenditure grew through public investment in health and education, with the construction of schools and hospitals, as well as social welfare programs.

response of the debt/GDP ratio estimated over the unrestricted sample. Equivalently, adding this particular period to the sample results in underestimation of the response of debt to GDP ratio to an exogenous increase in government spending. Second, the response of deficit reported in the lower left panel with the decade 1941 – 1950 removed from the sample is significantly higher on impact: with a rapid decrease towards zero and after three years it becomes negative, whereas the dynamic effect on the deficit over the full sample remains positive across the entire horizon of the impulse responses. Third, the effect on GDP is initially above its full sample counterpart (but not statistically different), and then swiftly turns negative and much more so, than what we would observe if all observations were used in the estimation. Finally, the cumulative elasticity of GDP to government spending shock is consistently below what the SVAR would imply had it been estimated over the unrestricted sample. In addition, the fiscal multiplier never exceeds one and turns negative towards the end of the horizon of the impulse responses, although it is also not statistically different from zero.

We consider the driving force behind the difference between the model estimated over the full sample and the model estimated over the restricted sample to be in the behaviour of the debt to GDP ratio after the exogenous spending increase. When the model is estimated over the full sample, the increase in debt to GDP ratio after the spending shock is less compared to the model estimated using the restricted sample. This translates into the dynamic response of the other variables in the system. In particular, deficit increases by less on impact and does not decrease as fast as in the restricted sample model.

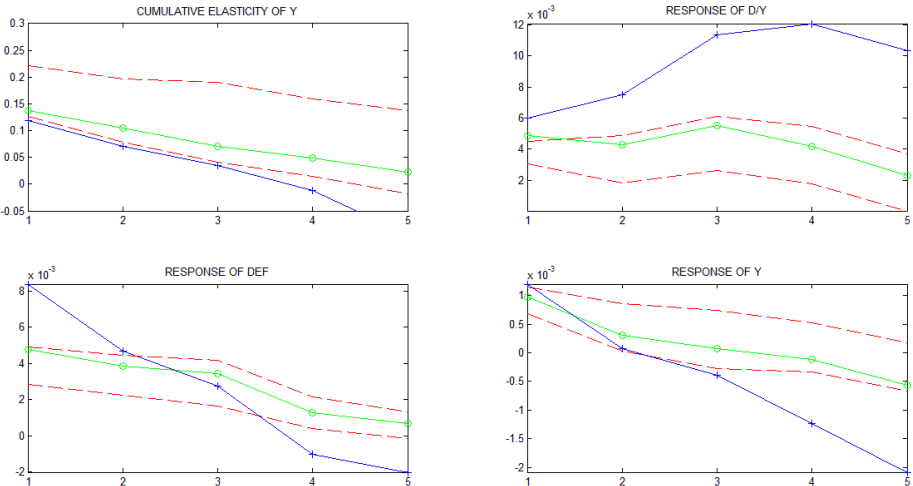


Figure 9: Impulse responses to government spending shock from the model estimated over the full sample (green line) and with the period 1941 – 1950 being excluded (blue line). The red lines are 95 percent confidence bands from 200 bootstrapped samples using the all the observations.

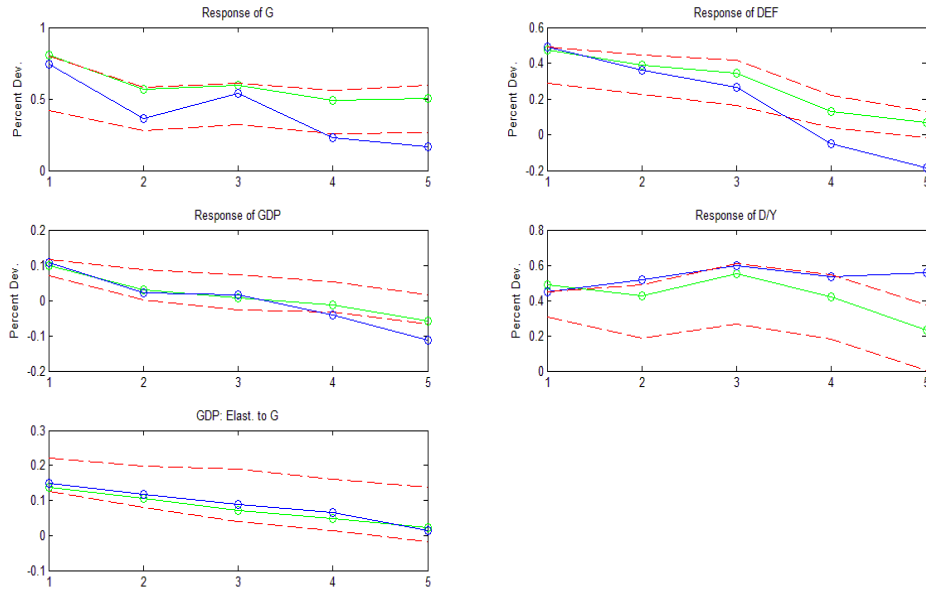


Figure 10: Dynamic responses to an exogenous increase in the government spending, estimated over the full (green line) and the post WWII sample (blue line), with 95 percent bootstrapped confidence bands, computed over the full sample.

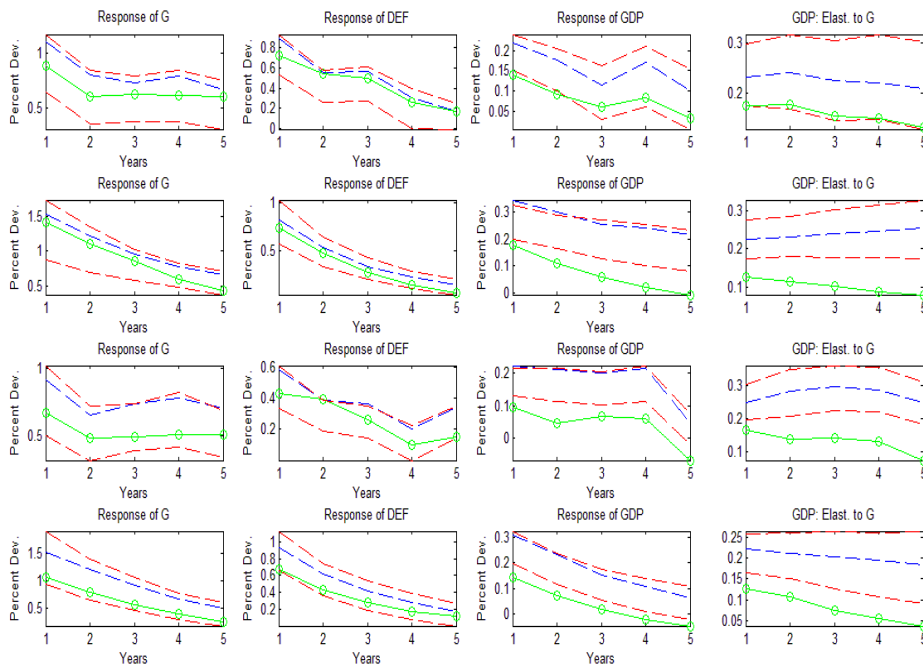


Figure 11: Dynamic response of G , DEF , GDP and D/GDP to an exogenous positive increase in G from models with different specifications.

First row: linear trend is subtracted from G and GDP and a quadratic trend is subtracted from D/GDP .

Second row: model estimated in levels with lag order equal to one.

Third row: model estimated in levels with lag order equal to six.

Fourth row: SVAR(4) augmented with the GDP deflator.

In addition all specifications contain a constant and four composite dummy indicators, entering contemporaneously and lagged once.

IV. Conclusion

We assessed the dynamic effect of deficit financed government spending on economic activity in Argentina using a sign identified Vector Autoregression. We focused on Argentina for two reasons, first as a country which has undergone through a various episodes of fiscal adjustments, the level of debt (as percentage of GDP) is arguably of central importance to the conduct of fiscal policy. The second reason is data availability – Argentina is one of the few developing countries for which we were able to collect relatively long and uninterrupted data for the public debt.

The main finding is that government debt has a crucial role for the implications of the model, and that the omission of the feedback of the debt (as a ratio of GDP) to the other variables in the system leads to very different conclusions for the effect of deficit finance government spending on the economy. In particular, the effect of government spending shock on GDP is predicted to be larger on impact, more persistent and to remain positive even five years after the initial shock in the model without debt feedback compared to the one where such feedback is allowed. Similarly, the elasticity of GDP to government spending in the model without debt is much higher over the horizon of the impulse responses, implying that the fiscal multiplier will remain above one over the same time span, whereas in the debt augmented vector Autoregression, the fiscal multiplier is slightly above one only for the first year.

Finally, we argued that not adding a measure of debt into the model was equivalent to assuming that debt as percentage of GDP is not changing following a deficit financed fiscal shock, which is in direct contraction to the implications of the optimal fiscal policy models and also to the finding that the dynamic response of debt to government spending shock is significantly different from zero.

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APPENDIX

Overview of Argentina's Public Debt in the 20th century.

Argentina's public debt throughout the 20th century was very volatile. The governments in power during this time implemented different policies that affected government spending and public accounts accordingly.

By the beginning of the century, Argentina was one of the world's richest countries, thanks to its exports of primary goods. In addition, important levels of direct foreign investment had a huge impact on the economy, helping the country reduce its level of debt until the First World War, when debt levels soared.

World War I had a negative impact on the Argentine economy, reducing capital flows and labor and capital inputs brought from Europe. Exports were reduced, even though the beef cattle industry was not affected, as demand from fighting troops increased. Yet the trends recovered from 1914 –the end of the war- to 1930. The oil industry also developed during this time, with both national and foreign investment, mainly from the U.S.

By the 1930s Argentina was a leading grain exporter. In 1931, tariffs were introduced, as well as exchange rate controls, affecting foreign investment. Companies were severely hit, as trade volumes decreased and losses were generated. Then in World War II, agricultural exports were reduced as European markets were closed due to temporary German hegemony.

The government of Domingo Peron (1946-1955) implemented policies of high impact on public expenditure, with stimulus on national industry, import substitutions, and nationalization of foreign-owned companies. Government expenditure grew through public investment in health and education, and the Central Bank became heavily indebted to the Bank of England.

Between 1956 and 1966, investment in energy and industry led to sporadic inflation. The opposite was seen in terms of economic policy, with austerity measures such as wage freeze, subsidy cuts, credit controls and currency devaluation, all in attempt to end public deficit.

Public expenditure increased again between 1966 and 1973, and from 1973 to 1976, inflation took over the economy. Under the military government (1976-1983), the import substitution model was dismantled, orienting Argentina towards free trade, open capital markets and privatization of businesses; trying to reduce the size of the public sector and public deficit.

However, public expenditure was not reduced as military expenditure rose with the military government and the Malvinas War. Argentina became heavily indebted in this period, the private sector borrowed heavily from foreign markets, and foreign debt rose. In 1982, this debt was overtaken by the government, affecting public balance sheets even more.

Debt was monetized and the country suffered from hyperinflation levels between 1983 and 1989. This unfortunate situation came to a halt once the new government took power, taking extreme measures in 1991 to end up with the ever-increasing rise in prices. These measures were a fixed exchange rate with equal parity to the U.S. Dollar, backed with major privatizations, tariff reductions and market deregulations.

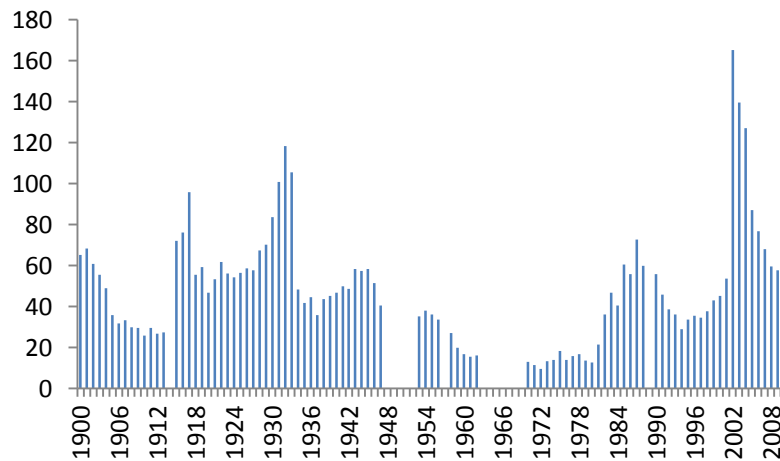
Historical Exchange Rate Arrangements

Extracting from Ilzetzki et al (2008), after the 1980s debt crisis, Argentina's foreign debt kept on growing as it was constantly re-negotiated. Thus, the capability of the government to pay became ever harder. Balance of Payments deficits appeared and the IMF suggested devaluation to reach external equilibrium.

Argentina's convertibility system was implemented from 1991 to 2001. The convertibility of the Argentine Peso to the Dollar set the proper conditions for foreign investment but implied strong fiscal unbalances. Under the fixed exchange rate regime, foreign goods became artificially cheaper, and as imports took over exports, the current account went into deficit.

During the Mexican devaluation of 1994, capital outflow was contained with public aid. Current account deficit was compensated with capital account surpluses because of privatization of public companies and foreign investment, yet not sufficiently, leading Argentina once more towards debt.

Argentina went after external financing, making public foreign debt equal to \$us 85 billion and total foreign debt equal to \$us 140 billion in 1999. Interest's debt was itself equal to \$us 11 billion. By 2001, the situation was unsustainable, and the Peso was devaluated, capital flows had to be restricted and Argentina defaulted on its debt.



The graph above shows public debt in Argentina as a percentage of GDP. Public debt has always represented an important part of the Argentine economy. In 1900 its level was well above 60% of GDP, with a downward trend until it came back up with World War I.

With the Great Depression of the 1930s, debt level became unsustainable after going way above 100% of the GDP. The period between 1940 and 1980 was one of relative stability in this matter, but the military government that came after got highly indebted and affected the public accounts tremendously.

As the following governments were not able to pay back the debt, but only to re-negotiate it, interest rates went even higher, making debt levels historically high and unsustainable, ultimately reaching more than 160% of GDP in 2002.

The Data

We have used two main sources of data for the purposes of this paper. One of them is for the public debt time series, which comes from a historical base of the IMF (<http://www.imf.org/external/pubs/ft/wp/2010/data/wp10245.zip>) based on Abbas et al. (2010), targeting gross general government debt. For the pre-1980 period, however, data is mostly based on central government data. This was then reported as a percentage of GDP.

The other variables were obtained from the Montevideo-Oxford Latin American Economic History Database, which covers a wide range of economic and social indicators for the region used in Thorpe (1998) from 1900 to 2000. These variables are population, central government revenue and expenditure, gross domestic product, and implicit GDP deflator. The detailed definitions and sources are given below.

Central Government Expenditure: Consolidated Central Government Expenditures (million current LCU): Figures for 1900-1984 are from Mitchell (1993), budgetary central government expenditure exclusive of debt repayment to 1975, consolidated central government expenditure thereafter. Figure for 1957 is for ten months ended 31 October; figure for 1958/59 is for years ended 31 October. Figures for 1985-1998 are from IMF GFSY (1993, 2000, 2001), consolidated central government total expenditure (current and capital) excluding lending minus repayments, years ending 31 December. Figures are expressed in GP from 1900-1933, PMN from 1934-1969, PA from 1970-1982, OPA from 1983-1984, A from 1985-1991, NPA from 1992 onwards.

Central Government Revenue (million current LCU): Figures for 1900-1984 are from Mitchell (1993); current (tax and nontax) revenue excluding capital revenue and grants. Figures for 1985-2000 are from IMF GFSY (1993, 2000, 2001), current (tax and nontax) revenue excluding capital revenue and grants, years ending 31 December. Figures are expressed in GP from 1900-1933, PMN from 1934-1969, PA from 1970-1982, OPA from 1983-1984, A from 1985-1991, NPA from 1992 onwards.

GDP (local currency): Figures for 1900-1969 are from Mitchell (1993), possible break in continuity of series 1950/1 due to later revisions not being carried back further. Figures for 1970-1988 are from IMF YIFS (1999). Figures for 1989-2000 are from IMF IFS (2002b). Figures are expressed in GP from 1900-1933, PMN from 1934-1969, PA from 1970-1982, OPA from 1983-1984, A from 1985-1991, NPA from 1992 onwards.

Implicit GDP Deflator: Calculated from real and nominal GDP. Real GDP: Figures for 1900-1976 are from ECLAC CE (1978), GDP at factor cost. Figures for 1977-2000 are calculated with the rate of growth of GDP in constant prices from Hoffman (2000) for 1977-1994 and ECLAC SYLA (1997, 2002) for 1995-2000, GDP at market prices. Nominal GDP: Constructed by applying the rate of growth of GDP at current prices from Mitchell (1993) for 1900-1969, IMF YIFS (1999) for 1971-1988, IMF IFS (2002b) for 1989-2000 to the value of GDP in 1970 at 1970 prices from ECLAC CE (1978). Levels are not directly comparable.

Population: Figures for 1900-2000 are from Wilkie (2002).