THE EFFICIENCY COST OF UNCERTAINTY IN ARGENTINA
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Abstract

Based on econometric estimates, we analyze the relationship between fiscal deficit, macroeconomic uncertainty and growth between 1915 and 2006, and include an estimate of the efficiency cost of uncertainty for the period 1875-2006. We arrive at two conclusions: a) the fiscal deficit, through the uncertainty it generates, is a significant restriction on per-capita income growth in Argentina; b) the welfare cost of the Argentine risk has been extraordinary: for example, in the period 1976-2006 it was around 26% of GDP, several times larger than the cost of any conventional distortion.

JEL classification codes: O11, O23, O54, D61
Key words: Macroeconomic uncertainty, fiscal deficit, volatility, growth, efficiency cost of country-risk

Some of the ideas on the efficiency cost of country risk go back to Avila (1989). An earlier version of this paper corresponds to chapter 2 of Avila (2000). I am grateful for the comments made on substance and style by M. Conte Grand, M. Gallacher, R. Pantazis and J. Streb, and for the English assistance of V. Dowding.

The spirit of a people, its cultural level, its social structure, the deeds its policy may prepare, all this and more is written in its fiscal history, stripped of all phrases. He who knows how to listen to its messages here discerns the thunder of world history more clearly than anywhere else.
Joseph Schumpeter (1954)

Introduction

According to a commonly-held argument, the fundamental cause of Argentina's economic decline has been a mixture of excesses: industrial protectionism, state monopolies, public spending, rapid monetary growth, etc. In our view, however, the Argentine disease consists of an exceptional dose of uncertainty, in particular since the 70s. Specifically, our thesis is that the persistence of high fiscal deficits, financed in pendulous way by means of inflation tax and foreign debt, generated a sequence of violent adjustments in relative prices that made it impossible to make any reliable evaluation of investment projects; this fact led to a reduction in capital stock per worker, hindered the incorporation of technical progress and ended by reducing per capita income. In this paper we advance three hypotheses: the fiscal deficit is the main source of uncertainty; uncertainty is the source of Argentine economic decline, and causality runs from deficit to growth, and not the other way around.

Several works provide rather traditional explanations for the Argentine decline in the 20th century. Cortés Conde (1997) heads in the right direction in trying to explain the late 19th century miracle, but he goes astray in trying to explain the decline since 1930. Regarding the miracle, he argues that the end of the civil wars provided the political and legal stability the country badly needed to assert property rights and cut transaction costs, and that this achievement was the key reason behind the huge inflows of capital and labor that built modern Argentina. In explaining the decline, however, he points to mistakes in the import substitution policy, shortages of foreign exchange, and lack of domestic savings. Sturzenegger (1984) and Cavallo (1984) provide a suggestive explanation for the 20th century decline, although they do not provide one for the 19th century miracle. Having had a mixed economy, Sturzenegger argues that the capitalist sector of Argentina did not have real markets while the socialist sector did not have central planning; that policy-induced distortions worsened conditions for competition, appropriability and certainty upon which the workings of markets is founded, while political instability worsened conditions for planning where markets fail. Cavallo emphasizes the impact on the rate of growth of some static distortions (taxes, regulations, and trade barriers), and he may be right in some sense: even when a static distortion yields a once-and-for-all reduction in the level of national income, a crescendo of static distortions may yield a long-run sequence of national income reductions that looks like a reduction in the rate of economic growth. Sturzenegger's work broadens this thesis until explicitly including the impact of dynamic distortions, which we think are the key explanation of investment and growth.

It is well established in the literature that growth comes from investment in physical and human capital and basic research, from improved organization of production and trade, from prompt and precise information. The act of investment involves taking low-risk liquid funds, freezing them in permanent shapes, and betting that they will be recovered with profit or that at least their opportunity cost will be compensated for. Therefore, the depth of

the horizon is critical. The collapse of fiscal accounts and the consequent uncertainty on the path of key relative prices distorted the intertemporal margins that determine investment. On the contrary, restrictions on foreign trade, lack of competition in large sectors of the economy and public spending beyond the social optimum level do not have a first degree impact on the rate of growth of per-capita income, as they affect static margins and only provoke one-time falls in national income.

The structure of this paper is the following. Section I presents the empirical evidence. Historical comparison and international comparison have given rise to a double correlation: 1) the higher the fiscal deficit, the higher the volatility in relative prices, and the lower the deficit, the lower the volatility; 2) the higher the volatility in relative prices, the lower the growth in per capita income, and the lower the volatility, the higher the growth rate. Section II presents an interpretation of these phenomena. The swinging between inflation and fund inflows from abroad as sources of public sector financing boosts large variations in the real exchange rate and the real interest rate, among other important prices; these variations in key relative prices let the country's economy adjust to budget innovations. But since risk aversion is a predominant trait in capital markets, such volatility creates a wedge in capital market that hinders the process of accumulation. The size of the gap between the demand price for capital and the supply price of savings is positively linked to the variance in key relative prices and the degree of risk aversion.[1] Section III provides an estimate of the efficiency cost of uncertainty or country risk. Section IV provides concluding remarks.

I. Empirical Evidence

The purpose of this section is to explore statistically the thesis of the paper. To do so we have to define uncertainty and measure it. We are going to link uncertainty to the concept of volatility of a couple of important prices in real terms: the rate of exchange and the rate of interest. We will then measure volatility using simple statistics such as the variance or the standard deviation for the respective time series. We will finally claim that a country undergoes a period of uncertainty when the variance in relative prices is high in comparison to other stages in its history, or with other countries in the same period. Our purpose is to explain economic growth focusing attention on the behavior of individual investors and their restrictions. In this regard, a variance in prices tending to zero would inform that the flow of future income generated by an investment project could be valued at relative prices very similar to those prevailing at the time the decision is taken; on the other hand, an exceptionally high variance will remove any usefulness as a reference from present relative prices. Hence, we will say that a country is economically "predictable" or "safe" when its volatility index is low in a relative sense.

The thesis of the paper highlights a firm correlation between fiscal deficit, volatility in relative prices and long-term growth of per-capita income. As a first step to assess such correlations, Table 1 shows Argentine macroeconomic performance in seven periods that cover the last 90 years and Figure 1 shows the paths of the fiscal deficit, the real-exchange rate volatility index and the growth rate as five-year moving averages for the period 1915-2006.

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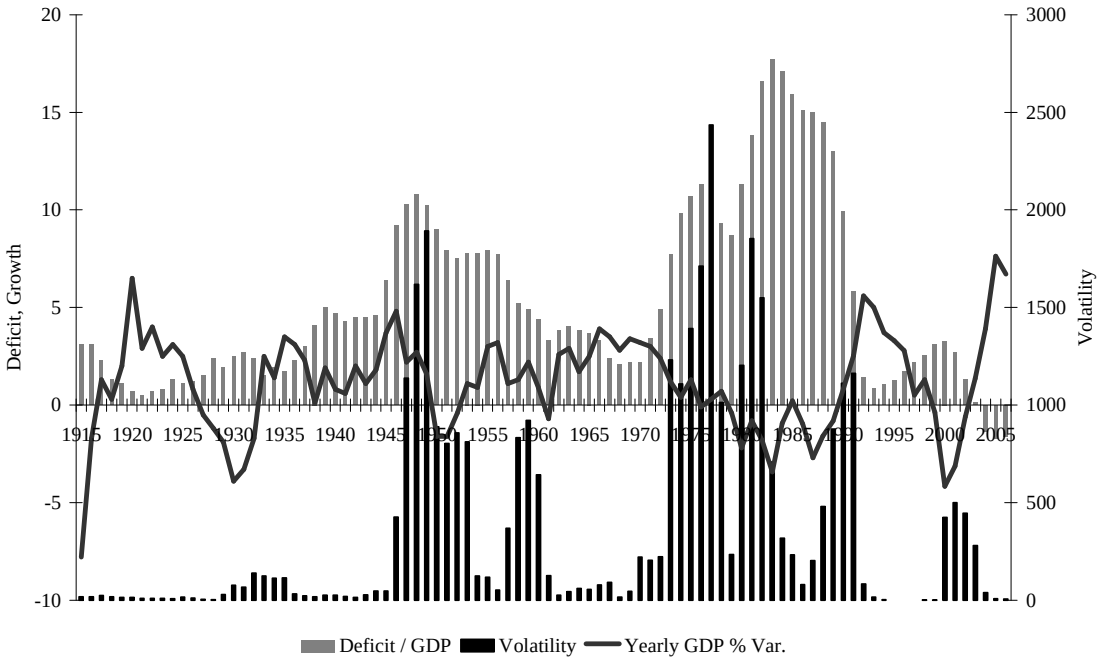
[1] Our thesis deepens that in Lucas (1981). For Lucas, volatile-price countries like Argentina tend to exhibit vertical Phillips curves. For him a volatile-price country means a high and volatile inflation country; this is the kind of environment that generates the volatility in relative prices we refer to.

Table 1: Argentina, 1915-2006			
	Consolidated Fiscal Deficit % of GDP	Volatility Real Rate of Exchange	Income per Capita Cumul. annual %
1915-28	1.4	0.4	1.5
1933-45	3.3	2.0	0.5
1946-58	8.7	8.1	1.4
1959-72	3.0	1.8	2.3
1973-90	13.3	13.1	-0.8
1991-01	2.0	0.3	1.3
2002-06	-1.3	0.6	6.0

Notes
a) Fiscal deficit: simple annual average of the imbalance in the consolidated public sector.
b) Volatility: The volatility coefficient is equal to the variance in the series for the real rate of exchange divided by the statistical mean for the period. The real rate of exchange is equal to the US wholesale price index times the free rate of exchange (pesos per dollar) divided by the Argentine consumer price index.
c) Growth in per capita income: to moderate the impact of the peaks and troughs of the economic cycle, we have calculated the cumulative growth rate between triennial per capita income averages which correspond to the initial and end year in each stage.
Source: Calculations based until 1979 on data from IEERAL (1986); from then on calculations are based on Argentina National Income Accounts. Fiscal deficits for the periods 1991-2001 and 2002-06 have been taken from Espert & Associates. Per capita income data up to 1990 has been taken from chap. 3 of Avila (2000) and since then from recent calculations based on various issues of the IMF International Financial Statistics Yearbook.

Figure 1: Argentina: Fiscal Deficit, Volatility and Growth, 1915-2006



On the base of such annual data we have run three regressions to study in greater depth the type of relation and the existing causality between the fiscal deficit, volatility and per-capita income growth, whose results are summarized in Table 2:

Table 2: Results of the regressions

1) $VOL = -32.36 + 72.95DEF + 0.31VOL(-1) - 0.23VOL(-2) + 0.63AR(1)$
(-0.3) (3.6) (2.0) (-2.2) (4.2)

R2: 71% Prob. F-stat: 0.0000 D-W: 1.96

2) $GRO = 1.06 - 0.0005VOL(-3) + 0.0007VOL(-4) + 0.74AR(1)$
(1.5) (-1.0) (1.3) (9.8)

R2: 54% Prob. F-stat: 0.0000 D-W: 1.72

3) $GRO = 2.44 - 0.24DEF + 0.69AR(1)$
(3.5) (-2.7) (8.6)

R2: 56% Prob. F-stat: 0.0000 D-W: 1.86

VOL is the five-year moving variance of the real exchange rate. GRO is the five-year moving average of the rate of growth of per capita income. DEF is the five-year moving average of the fiscal deficit as a percentage of GDP.

The results of regression (1) tell us that the fiscal deficit is an important variable in explaining volatility. An increase in the mean deficit by one point of GDP increases mean volatility by 73 points (18%). Regression (2) tells us that our measurement of volatility has little or no influence on per-capita income growth. On the other hand, the outcome of regression (3) highlights that the fiscal deficit certainly does have an impact on growth; when the mean deficit increases by one point of GDP the mean rate of annual growth falls by 0.24 percentage point. Regarding the causality between the fiscal deficit and growth, we would point out that the Granger test throws up results that are definitely favorable to the hypothesis that the deficit is the cause of growth and not the other way around, for lags of 1, 2, 3, 4, 5 and 6 periods.

As a last step in the analyses of data, Table 3 provides a comparison of the Argentine performance with that of a group of countries for the period 1974-85 (see next page).

The empirical evidence allows us to conclude that:

- There is a seemingly positive correlation between the fiscal deficit and the volatility of key macroeconomic prices, such as the real exchange rate and the real interest rate. The correlation appears closer in the historical series for Argentina than in the international comparison; the difference may be due to the fact that in Table 1 we use a more uniform measurement of the deficit covering the public sector imbalance than in Table 3.

- There is a negative correlation between volatility and economic growth. Exceptions to the rule include the 1946-58 period in Argentina, when in spite of a large increase in the fiscal deficit and volatility, growth rose instead of falling. The cause of this unexpected performance was probably the sharp improvement in the terms of trade in 1948 and the world-wide post-war boom.

Table 3: International Comparison, 1974-85

	Fiscal Deficit % of GDP	Volatility		Income per Capita Cumul. annual %
		Real Rate of Exchange	Real Rate of Interest	
Argentina	6.5 (3.2)	19.9	23.3	-1.3
Chile	0.1 (3.2)	5.1	11.3	0.6
Uruguay	2.9 (2.6)	7.6	10.3	0.6
USA	3.4 (1.6)	0.1	3.4	1.5
West Germany	2.0 (0.7)	3.6	2.2	2.1
Japan	6.1 (1.7)	1.0	3.6	3.2
Paraguay	0.1 (1.0)	2.4	7.6	2.9
Singapore	-1.4 (1.3)	0.3	2.9	5.9
South Korea	1.9 (0.8)	0.5	4.2	6.2

Notes
a) Fiscal deficit: simple annual average at Central Administration level. Respective standard deviation is shown in brackets.
b) Volatility: measured in the same way as for Table 1.
c) Growth in income per capita: idem.
Source: Calculations based on IMF data (1987).

- Countries or historical stages with good public finances are noted for low volatility in relative prices and high growth in per-capita income. This was the scenario in the comparatively stable periods in Argentina (1915-28; 1933-45; 1959-72; 1991-2001), and in countries such as the USA, West Germany and Japan, and even more clearly in Paraguay, Singapore and South Korea in the period 1974-85. On the contrary, scenarios dominated by a high (or unstable) deficit are noted for a significantly greater volatility. The period 1946-58 and especially that of 1973-90 fall into this category: unusually high volatility and a fall in per-capita income without precedent. This context repeated itself, with less intensity, in Chile and Uruguay; both countries experienced a higher volatility than that observed in the other countries in the sample and very low growth.
- The measure for the fiscal deficit employed in Table 3 is the only one available at international level, but it is not the most appropriate since it only covers the imbalance of the Central Administration. The problem becomes evident when comparing Argentina with Japan. While in Argentina the Central Administration deficit in the period 1974-85 was approximately half the consolidated total, in Japan the strong deficit of the Central Administration was neutralized by the surplus in the provinces and the social security system, so that the consolidated deficit became insignificant. The Chilean case is interesting; here the coexistence of budget equilibrium and high volatility contradicts our thesis. In this case, volatility is due to the instability of the

deficit; the standard deviation of the Chilean deficit is similar to that for Argentina; in the period analyzed Chile frequently swung from large deficits to surpluses and vice-versa, forcing adjustments in relative prices that shortened the investor's horizon. The Uruguayan case is similar to that of Chile, although more moderate.

- In short, to extend the investor's horizon and foster growth not only is the mean size of the fiscal deficit important but also its stability. This assertion carries with it an implicit causality judgement: the deficit causes volatility and the volatility causes low growth. Though it is possible to speculate on the existence of a hidden variable the fluctuations of which dominate the relationship between deficit and growth (such as the terms of trade), we should remember that the deficit is unequivocally the cause of growth in the Argentine time series, according to the Granger causality test.

II. An Interpretation

The Australian model, popular in the literature on open macroeconomics in the 70s and 80s, is a good representation of the scenario we have in mind. In a nutshell, the model is described as follows: the economy of the country is small and open, and therefore takes as given the prices of exportable and importable goods, as well as the risk-free interest rate; the country is populated by individuals who produce and consume goods that are traded with the rest of the world (exportable and importable) and goods that are not traded (domestic or services); individuals save a fraction of their income, part of which is placed in local currency and external risk-free assets and the rest is converted into fixed domestic investment; the fiscal deficit is financed by foreign borrowing or inflation tax; individuals are risk averse, a fact that explains why they spread their wealth among those three assets; individuals have rational expectations and incomplete information on the future course of economic policy (the deficit size and the way of financing it).

A. Deficit and Volatility

Assume the fiscal deficit starts to be financed by foreign debt. How does the economy adjust to such innovation? Foreign debt leads to an increase in aggregate spending and an appreciation of the domestic good to ration its supply, which is rather inelastic. And so the budget innovation leads to a fall in the real exchange rate.[2] However, when the horizon for external financing gets short and the public forecast the return of the inflation tax, the country undergoes a higher real rate of interest and currency overvaluation. A couple of factors may explain the emergence of the exchange risk in this situation: a) expectations regarding an increase in the rate of devaluation of the currency;[3] b) the perception that when external credit is replaced by the inflation tax the nominal rate of exchange will rise faster that the price level, so that the real exchange rate will recover the level it had before the budget innovation. The opposite scenario prevails when the deficit starts to be financed with the inflation tax proceeds. This budget cycle explains to a large extent the successive inflation and current-account adjustments that Argentina experienced in the second half of

[2] Evidence seems to indicate that the private sector behaves as if it does not discount the future tax liabilities.

[3] Since international reserves are finite, there exists a relationship between the inflation tax rate and the devaluation rate. Many authors have written on this matter; see Arriazu (1983).

the 20th century. The bulk of financing swung from one source to another; the phenomenon got stronger in the 70s and 80s as the deficit literally exploded.[4] We think this is the origin of the volatility in relative prices, a phenomenon that reached very high levels in the 1946-58 period, and overwhelmingly so in the period 1974-85.

B. Volatility and investment

The intuition of the link between volatility in relative prices and economic uncertainty seems obvious. The standard assumption that the marginal utility of income decreases when income increases reflects risk aversion. The classic example of risk aversion consists in a lottery with 50% probability of winning $100 and 50% of losing $100, so that the expected value of the lottery is zero. As the utility of income is declining, the utility expected from participating in the game is negative; in other words, the dis-utility of losing $100 is greater than the utility of winning $100. The difference between the utility of not intervening in the lottery and the expected utility of participating represents the loss of welfare experienced by a risk-averse individual who decides to abandon a safe position to embark on a project with an uncertain outcome. Such difference measures the maximum price the individual is prepared to pay in order to make sure that his original wealth will remain unaltered; it is the maximum premium that he would pay to an insurance company for such a service.[5]

The peculiar way through which the volatility in relative prices filters into the process of capital formation is now evident. A project for sinking capital into Argentina would be subject to a turbulence of relative prices 30 times greater than the turbulence that the same project would undergo in South Korea, never mind Singapore. Therefore the risk premium for investing in Argentina will have to be several times higher than the international level. In weighing the possibility of investing physically in Argentina, informed investors sitting in New York or Buenos Aires will behave in identical fashion. With a 10 year-US Treasury bond yielding 4% per year, a project with a return of 12%, excellent in the environment of security and predictability of the European Union, Canada or Korea, in Argentina would be promptly discarded as loss. Think of the fate of a project for non-traditional exports during the incredible revaluation in real terms of the peso in 1979-80, or the fate of a construction-oriented project in the middle of the strong real depreciation of the 80s. Consider further the fortune of any such firms when they have to go month after month in the context of an anti-inflation program with real rates of interest at 4% per month. The instability of key relative prices is too high in Argentina for the average investor to be attracted by a return of 12% per year. During the 80s investors required a 22% average return per year on projects to be carried out in Argentina under Argentine law, or a quick recovery of the capital invested. In the absence of markets offering insurance against macroeconomic instability, investors self-insured, demanding from their projects the international opportunity cost of the funds to be sunk (the interest yield on a long US Treasury bond) plus a risk premium that in the case of Argentina has been in the order of 15% per year. Hence, lots of projects that would have contributed greatly to national wealth were discarded until the horizon improves.

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[4] On the relative importance of each source (money creation, domestic debt bonds and foreign loans) see Cavallo and Peña (1983). A budget vision of the Argentine economy progress and reversals can be found in FIEL (1989).

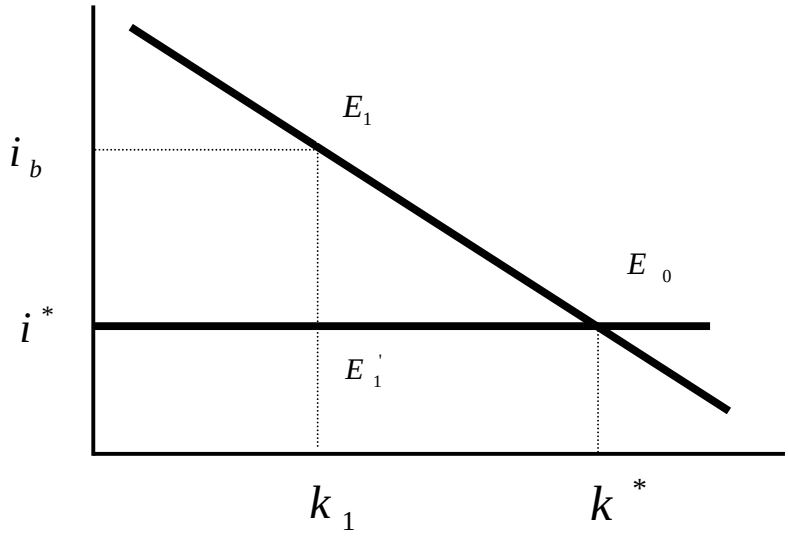
[5] Notice that the premium increases with the values at stake, with a less favorable distribution of probabilities, with a higher risk aversion, or with the combinations of these three elements.

III. An Estimate of the Cost

So far we have explained the low growth rates of the Argentine economy during the 20th century. While the leading group of countries kept growing normally, macroeconomic uncertainty led to the international decline of Argentina. What is the welfare loss of the Argentine-risk tax?

Investment is a gamble the outcome of which only becomes evident as time goes by. Therefore, the intertemporal market of the economy is the appropriate place to notice the effect of uncertainty. Figure 2 shows the impact of the country-risk premium on the capital market of a country that is open to international capital flows. On the vertical axis of the graph we measure the marginal yield on capital and on the horizontal axis, the stock of per-worker capital sunk in the country. In a certain environment, capital market equilibrium takes place at E_0. At this point, the domestic rate of interest is the same as the international rate and the stock of capital per local worker, k, is equal to the stock of capital per worker in the group of leading countries, k^*. Since investment in the country is not penalized by uncertainty a social optimum obtains. We speak of a social optimum because the Argentine risk does not come mainly from foreign but from domestic sources; the relevant uncertainty has been self-inflicted, its causes having been sudden, frequent and violent changes in economic policy. In an uncertain environment, a country-risk premium shows up. It filters into the capital market and opens a wedge between the marginal yield on capital i_b, which is the relevant rate for local borrower of funds, and the marginal compensation for savers i^*, which is equal to the international interest rate. From a social point of view, the optimum is reflected in the condition: $k = k^*$; from the private point of view, it implies a different condition: $k = k_1 < k^*$. For investors, the country-risk premium, $\rho = i_b - i^*$, is a provision against imponderables.

Figure 2: The Country-Risk Tax



The country-risk premium works in a similar fashion to a conventional tax. On the one hand, it creates a distortion with a welfare cost that takes the shape of triangle $E_0E_1E_1^{'}$ on figure 2. As the premium rises, the triangle grows and a real-income loss is accumulated as the productivity of capital increasingly exceeds the opportunity cost of the resource, i^*. On the other, it determines the rectangle $i_bE_1E_1^{'}i^*$, similar to that representing the revenue of a conventional tax; however, this time it symbolizes the economic cost of risk aversion and the partial insurance that investors are required to suffer and bear when there exists country risk. Unlike a conventional tax, the revenues of which are transferred to the Treasury, the country-risk rectangle is a social cost because it represents a drain on resources that benefits no-one. The sum of the triangle and the rectangle measures the wage increase that labor fails to receive because of the existence of country risk.

Switching to a one-sector model for the sake of simplicity, placing the problem in the context of the principle of convergence, and assuming a logarithmic production function with constant returns to scale, we calculate the welfare cost of uncertainty (WCU) with this equation:

$$WCU = \int_{k_1}^{k^*} \left[i_b(k) - i^* \right] \cdot dk + \left[i_b(k_1) - i^* \right] \cdot k_1 \qquad (4)$$

The right-hand side of this equation has two terms: the first measures the social cost of the triangle and the second measures that of the rectangle. The cost of the triangle is equal to the integral of the country-risk premium over the gap in capital per worker that separates the lagging country from the leading group. The cost of the rectangle is equal to the country-risk premium on the capital per worker sunk into the country.[6]

As shown in figure 3, WCU has been extraordinary in Argentina. In the period 1895-1905 it was nill; in the period 1915-40 it averaged 5% of per-capita income; in the period 1940-75 it seldom fell below 10%, while for the period 1976-2006 it fluctuated largely with a mean value of 26%.[7] To put our estimate into perspective, some estimates of social costs of conventional distortions should be considered. Harberger (1974) estimated the efficiency loss due to the monopolizing of the U.S. manufacturing sector at 0.1% of GDP. Krueger (1984) reports that the efficiency loss caused by tariff and non-tariff protection in Latin American countries has fluctuated between 0.3% and 0.8% of GDP; she also points out that this loss rises to an exceptional level of 7% in Brazil after taking into account the losses in X-efficiency and the monopolization of markets induced by the same protection. Fernández and Rodríguez (1980) estimated that the Argentine state telephone monopoly generated in 1980 a welfare loss close to 1.5% of GDP.

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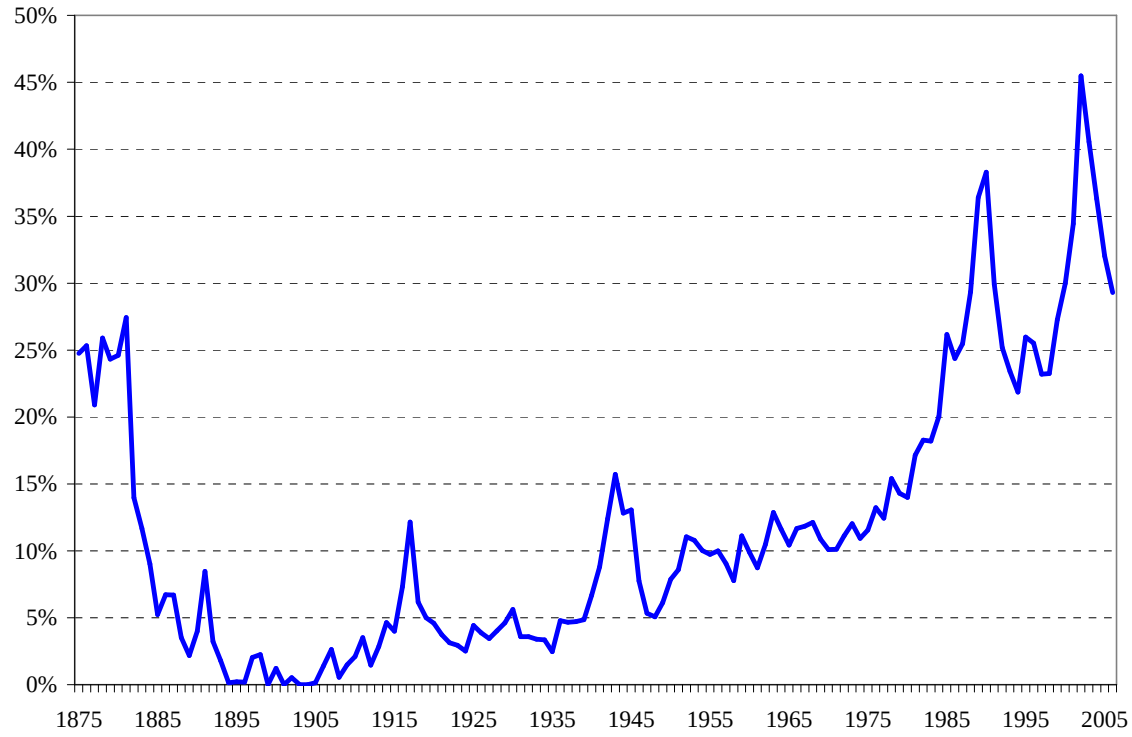
[6] For a development of the WCU equation, see Appendix II. For the data needed to calculate the WCU, see Appendix III.

[7] Our estimates assume a perfectly elastic supply of capital. Thus the triangle of the efficiency cost of country-risk is explained 100% by a workers' earnings loss (recall that we have assumed a constant returns to scale production function and just two factors of production: capital and labor). Had we assumed an inelastic supply of domestic savings, savers would also suffer a loss of surplus and the area of the triangle would increase.

Figure 3: Argentina: The Welfare Cost of Uncertainty, 1875-2006
As a percentage of GDP per capita



IV. Concluding Remarks

Few feel to such a high degree the risks posed by a country, the eventual instability of its basic political and economic institutions, as do investors who appraise the possibility of sinking capital within the country's frontiers for a lengthy period. The fiscal deficit appears as a likely first cause of macroeconomic uncertainty. The efficiency cost of the Argentine-risk premium, or the market price of macroeconomic uncertainty assigned by Wall Street to the country, seems large, much larger than the cost of commercial tariff and monopolies estimated in well-known studies. That's why we think the first condition for Argentina to overcome its stagnation consists in achieving a long-run reduction in her country-risk premium to the level prevailing in the group of leading countries.

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Appendix I

GDP Growth Rate, Real Exchange Rate, Volatility Index of RER, Fiscal Déficit, period: 1915-2006.

	Growth rate	Real Exch. Rate	Volatility Index	Fiscal Deficit
1915	-7,8	39,7	17,6	3,1
1916	-1,7	45,0	17,0	3,1
1917	1,3	51,0	23,7	2,3
1918	0,3	44,4	17,6	1,3
1919	2,0	51,2	13,9	1,1
1920	6,5	53,9	13,3	0,7
1921	2,9	47,2	9,6	0,5
1922	4,0	49,2	9,8	0,7
1923	2,5	54,6	9,0	0,8
1924	3,1	52,3	8,1	1,3
1925	2,5	48,4	16,2	1,1
1926	0,8	47,9	11,1	1,2
1927	-0,5	44,2	4,3	1,5
1928	-1,2	44,3	2,4	2,4
1929	-1,9	44,6	29,1	1,9
1930	-3,9	45,9	75,6	2,5
1931	-3,3	56,8	67,1	2,7
1932	-1,7	63,6	138,6	2,4
1933	2,5	47,5	123,7	1,5
1934	1,4	74,3	112,1	1,9
1935	3,5	72,3	114,1	1,7
1936	3,1	63,6	31,8	2,3
1937	2,3	61,2	21,7	3,0
1938	0,1	66,0	17,9	4,1
1939	1,9	70,5	26,5	5,0
1940	0,8	70,8	25,3	4,7
1941	0,6	74,5	19,0	4,3
1942	2,0	79,4	14,5	4,5
1943	1,1	79,3	27,4	4,5
1944	1,8	78,8	47,0	4,6
1945	3,7	67,2	46,6	6,4
1946	4,8	66,2	425,4	9,2
1947	2,2	79,2	1137,6	10,3
1948	2,7	116,9	1618,6	10,8
1949	1,6	142,2	1892,3	10,2
1950	-1,6	160,7	888,3	9,0
1951	-1,6	194,0	802,4	7,9
1952	-0,4	131,4	857,3	7,5
1953	1,1	122,6	810,9	7,8
1954	0,9	132,8	123,8	7,8
1955	3,0	142,4	117,5	7,9

1956	3,2	151,6	52,3	7,7
1957	1,1	139,4	367,9	6,4
1958	1,3	135,9	832,5	5,2
1959	2,2	101,5	921,5	4,9
1960	0,9	82,8	642,3	4,4
1961	-0,7	72,5	125,2	3,3
1962	2,6	80,7	25,6	3,8
1963	2,9	76,3	44,1	4,0
1964	1,7	71,1	59,9	3,8
1965	2,5	87,4	55,6	3,7
1966	3,9	68,0	78,2	3,3
1967	3,5	73,8	90,8	2,4
1968	2,8	64,4	15,0	2,1
1969	3,4	65,1	45,9	2,2
1970	3,2	65,4	221,1	2,2
1971	3,0	79,6	204,5	3,4
1972	2,4	98,7	222,3	4,9
1973	1,2	68,2	1231,6	7,7
1974	0,4	93,9	1107,6	9,8
1975	1,3	158,8	1391,3	10,7
1976	-0,1	109,1	1711,8	11,3
1977	0,3	68,8	2435,4	11,3
1978	0,7	51,4	1013,7	9,3
1979	-0,4	36,8	234,8	8,7
1980	-2,2	29,0	1204,1	11,3
1981	-0,8	51,2	1852,7	13,8
1982	-1,8	116,7	1550,4	16,6
1983	-3,4	115,8	708,1	17,7
1984	-0,9	92,2	317,2	17,1
1985	0,2	96,3	231,8	15,9
1986	-1,0	74,1	79,3	15,1
1987	-2,7	86,8	201,9	15,0
1988	-1,6	80,6	480,6	14,5
1989	-0,8	110,4	877,4	13,0
1990	0,8	49,7	1112,0	9,9
1991	2,5	36,7	1161,7	5,8
1992	5,6	30,9	83,5	1,4
1993	5,0	28,5	15,4	0,8
1994	3,7	27,5	2,2	1,1
1995	3,3	27,2	0,2	1,3
1996	2,8	27,8	0,1	1,7
1997	0,5	27,8	0,2	2,2
1998	1,3	27,3	0,7	2,5
1999	-0,4	28,1	1,6	3,1
2000	-4,2	29,5	423,9	3,3
2001	-3,1	30,4	500,4	2,7
2002	-0,6	74,8	445,4	1,3

2003	1,4	64,4	280,3	0,1
2004	3,9	63,6	39,4	-1,3
2005	7,6	60,3	7,3	-1,7
2006	6,7	58,7	6,3	-1,6

Sources: 1) Calculations based until 1979 on data from IEERAL (1986); from then on based on Argentina National Income Accounts data. Fiscal deficits for periods 1991-2001 and 2002-06 have been taken from Espert & Associates. Per capita income data has been taken from chapter 3 of Avila (2000) up to 1997; from then on, it has been estimated according to the same sources and method as in this book. 2) The growth rate and the fiscal deficit are five-year moving averages centered on the year under consideration. The volatility index is a five-year moving variance of the real-exchange rate centered on the year under consideration. The real exchange rate is equal to the nominal exchange rate times the US WPI divided by the Argentine CPI.

Appendix II

Consider an economy characterized in the relevant segment by the following function of production:

1) $y = \alpha \ln k$,

where y is income per capita, α is a constant and k is the physical capital stock per worker (in the estimate we assume that $k = 3.y$);

2) $MPK = \frac{\alpha}{k} = i_b$,

where the marginal product of capital is equal to the domestic interest rate, gross of country risk;

3) $i^* = \frac{\alpha}{k^*} = 0.04$,

where the international interest rate, free of country risk, is equal to the marginal product of capital in the leading group and is equal, by hypothesis, to an annual 4%;

4) $i_b = \frac{\alpha}{k} = \frac{0.04.k^*}{k}$,

so that the domestic interest rate is a proportion of the ratio between capital per worker in the leading group and capital per worker in Argentina.

The final equation for the welfare cost of the country risk premium is:

5) $WCU = \int_{k_1}^{k^*} \left[0.04\left(\frac{k^*}{k} \right) - 0.04 \right].dk + \left[i_b(k_1) - i^* \right] k_1$,

from which the following expression arises after the resolution of the integral, application of Barro's rule and reordering the first term, and replacing with equations 2) and 3) in the second term:

6) $WCU = 0.04.k^* \left[\frac{k_1}{k^*} - \ln\left(\frac{k_1}{k^*} \right) - 1 \right] + 0.04.\left(k^* - k_1 \right)$.

From this equation come the annual estimates of the welfare cost of uncertainty, expressed in the corresponding graph as percentages of Argentine per capita income.

Appendix III

Per Capita Capital Stocks for Argentina and the Anglo-Saxon Group (USA, Great Britain, Australia and Canada); Triangle, Rectangle and Total Costs as fractions of per Capita GDP, period: 1875-2006.

	Argentina	**Anglo-Saxon Group**	**Triangle Cost**	**Rectangle Cost**	**Total Cost**
	Per capita capital stock		Fraction of per capita GDP		
1875	2816,4	6702,8	0,082	0,166	0,248
1876	2743,2	6596,8	0,085	0,169	0,253
1877	3006,8	6626,7	0,065	0,144	0,209
1878	2800,7	6807,9	0,087	0,172	0,259
1879	2928,7	6912,7	0,080	0,163	0,243
1880	3048,2	7235,3	0,081	0,165	0,246
1881	2973,3	7426,9	0,095	0,180	0,274
1882	3909,8	7293,7	0,036	0,104	0,140
1883	4334,1	7566,2	0,027	0,089	0,117
1884	4643,9	7430,5	0,018	0,072	0,090
1885	5414,8	7439,8	0,008	0,045	0,052
1886	5057,6	7412,6	0,011	0,056	0,067
1887	5281,0	7737,7	0,011	0,056	0,067
1888	6087,8	7678,3	0,004	0,031	0,035
1889	6881,5	8041,0	0,002	0,020	0,022
1890	6051,7	7825,4	0,005	0,035	0,040
1891	5097,8	7994,8	0,016	0,068	0,085
1892	6157,4	7646,3	0,003	0,029	0,032
1893	6369,5	7261,6	0,001	0,017	0,018
1894	7237,0	7324,9	0,000	0,001	0,001
1895	7292,5	7422,9	0,000	0,002	0,002
1896	7423,5	7541,3	0,000	0,002	0,002
1897	6521,4	7556,5	0,001	0,019	0,020
1898	6802,8	7980,5	0,002	0,021	0,022
1899	8552,6	8220,7	0,000	0,000	0,000
1900	7572,5	8315,6	0,001	0,012	0,012
1901	8491,2	8429,4	0,000	0,000	0,000
1902	8083,8	8436,3	0,000	0,005	0,005
1903	9401,4	8640,0	0,000	0,000	0,000
1904	10283,6	8680,6	0,002	0,000	0,000
1905	10836,1	10971,0	0,000	0,001	0,002
1906	10508,3	11669,6	0,001	0,013	0,014
1907	9800,0	11770,9	0,002	0,024	0,026
1908	10671,8	11161,3	0,000	0,006	0,006

1909	10606,5	11854,5	0,001	0,014	0,015
1910	10458,7	12168,2	0,002	0,020	0,021
1911	9763,2	12315,1	0,004	0,031	0,035
1912	11230,1	12537,3	0,001	0,014	0,015
1913	10531,4	12800,2	0,003	0,026	0,028
1914	8894,6	11880,9	0,006	0,040	0,046
1915	9348,9	12095,5	0,005	0,035	0,040
1916	8671,8	13018,2	0,013	0,060	0,073
1917	7355,7	13033,6	0,029	0,093	0,122
1918	9152,3	13106,2	0,010	0,052	0,062
1919	9116,5	12392,3	0,007	0,043	0,050
1920	9124,0	12165,6	0,006	0,040	0,046
1921	9203,0	11746,4	0,004	0,033	0,037
1922	9896,9	12238,9	0,003	0,028	0,032
1923	10511,2	12855,8	0,003	0,027	0,030
1924	11046,2	13165,6	0,002	0,023	0,025
1925	10271,3	13582,6	0,006	0,039	0,044
1926	10633,4	13665,9	0,004	0,034	0,039
1927	11149,2	14012,7	0,004	0,031	0,034
1928	10896,8	14119,2	0,005	0,035	0,040
1929	10709,6	14289,5	0,006	0,040	0,046
1930	9588,3	13407,8	0,008	0,048	0,056
1931	9617,6	12187,1	0,004	0,032	0,036
1932	9103,1	11533,3	0,004	0,032	0,036
1933	9154,6	11479,1	0,004	0,030	0,034
1934	9755,0	12196,2	0,003	0,030	0,034
1935	10793,0	12825,3	0,002	0,023	0,025
1936	10192,5	13705,1	0,006	0,041	0,048
1937	10744,6	14370,5	0,006	0,040	0,047
1938	10594,0	14204,8	0,006	0,041	0,047
1939	10822,8	14608,7	0,007	0,042	0,049
1940	10826,9	15840,2	0,011	0,056	0,067
1941	11209,1	17791,1	0,018	0,070	0,088
1942	11150,1	19895,9	0,030	0,094	0,124
1943	10895,5	21301,2	0,043	0,115	0,157
1944	11920,0	21531,9	0,031	0,097	0,128
1945	11342,4	20629,5	0,032	0,098	0,131
1946	12146,9	18548,5	0,014	0,063	0,078
1947	13265,0	18303,1	0,008	0,046	0,053
1948	13703,6	18677,9	0,007	0,044	0,051
1949	13197,8	18861,1	0,010	0,051	0,061

1950	12884,4	19756,6	0,015	0,064	0,079
1951	13104,7	20643,4	0,017	0,069	0,086
1952	12195,3	20880,8	0,025	0,085	0,110
1953	12592,3	21374,6	0,024	0,084	0,108
1954	12865,1	21315,4	0,022	0,079	0,100
1955	13520,5	22178,3	0,021	0,077	0,097
1956	13648,2	22578,0	0,021	0,079	0,100
1957	14107,0	22594,5	0,018	0,072	0,091
1958	14716,6	22497,4	0,014	0,063	0,078
1959	13538,7	23244,5	0,025	0,086	0,111
1960	14367,6	23704,2	0,021	0,078	0,099
1961	15141,9	23980,2	0,017	0,070	0,087
1962	14669,0	24663,3	0,023	0,082	0,105
1963	14101,0	25510,8	0,032	0,097	0,129
1964	15316,8	26703,3	0,027	0,089	0,116
1965	16470,1	27651,1	0,023	0,081	0,104
1966	16335,4	28522,7	0,027	0,090	0,117
1967	16532,6	29018,2	0,028	0,091	0,118
1968	17000,2	30080,6	0,029	0,092	0,121
1969	18186,3	30980,9	0,024	0,084	0,109
1970	18874,3	31327,0	0,022	0,079	0,101
1971	19270,8	32018,2	0,022	0,079	0,101
1972	19345,2	33202,4	0,025	0,086	0,111
1973	19730,4	34820,7	0,029	0,092	0,120
1974	20445,9	34876,7	0,025	0,085	0,109
1975	19988,3	34780,4	0,027	0,089	0,116
1976	19663,1	35943,0	0,033	0,099	0,132
1977	20582,8	36776,1	0,030	0,094	0,124
1978	19603,4	38005,3	0,041	0,113	0,154
1979	20629,1	38841,3	0,037	0,106	0,143
1980	20626,1	38523,1	0,036	0,104	0,140
1981	19198,8	38884,8	0,048	0,123	0,172
1982	18295,4	38043,3	0,053	0,130	0,183
1983	18746,2	38935,2	0,053	0,129	0,182
1984	18823,6	40736,2	0,061	0,140	0,200
1985	17246,7	42121,9	0,089	0,173	0,262
1986	18201,3	43002,9	0,080	0,164	0,244
1987	18385,4	44329,7	0,085	0,169	0,255
1988	17763,6	45828,0	0,104	0,190	0,293
1989	16283,0	46794,1	0,139	0,225	0,364
1990	15830,8	46688,3	0,149	0,234	0,383

1991	17319,2	45111,8	0,107	0,193	0,299
1992	18914,7	45377,7	0,084	0,168	0,252
1993	19898,2	46150,3	0,076	0,158	0,234
1994	21281,5	47853,4	0,069	0,150	0,219
1995	20056,1	48805,4	0,088	0,172	0,260
1996	20652,3	49857,9	0,086	0,170	0,255
1997	22123,7	51101,6	0,075	0,157	0,232
1998	22714,5	52512,8	0,075	0,157	0,232
1999	21701,2	54045,5	0,094	0,179	0,273
2000	21300,4	55555,0	0,107	0,193	0,300
2001	20159,2	56312,7	0,129	0,215	0,344
2002	17767,4	57421,8	0,187	0,268	0,455
2003	19158,1	58242,4	0,161	0,245	0,406
2004	20691,9	59393,1	0,139	0,224	0,363
2005	22385,5	60298,4	0,117	0,203	0,320
2006	23830,6	61433,5	0,104	0,189	0,293

Notes: 1) Per capita capital stock of a country equals 3 times its per capita income. 2) The per capita capital stock for the Anglo-Saxon group is the simple average of the per capita capital stocks of the four involved countries. 3) Triangle and Rectangle efficiency costs are calculated according to Eq. 6 in Appendix II. 4) The k* variable represents the per capita capital stock for the Anglo-Saxon group; the k_1 variable represents the per capita capital stock for Argentina. 5) To put into 1985 US dollars the Argentine per capita income, we generated time series for the four comparison years suggested by Cortés Conde op. cit., and averaged them.

Sources: 1) As informed in Avila (2000 III, 68), GDP times series for Argentina were taken from Cortés Conde (1997), period 1875-1935; Fundación Mediterránea, period 1936-1961; BCRA, period 1962-1997. Population time series for Argentina were taken from Cortés Conde (1997), period 1875-1912; Fundación Mediterránea, period 1913-1990. From then on, GDP and population series were taken from Espert & Associates. 2) GDP and population series for the Anglo-Saxon group were taken from Maddison (1991) and updated until 2006 on data taken from the IMF International Financial Satistics Yearbook, various issues.