# THE EFFICIENCY COST OF UNCERTAINTY IN ARGENTINA
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**Abstract**

We analyze the relationship between fiscal deficit, macroeconomic uncertainty and growth for the period 1915-2006, and estimate the efficiency cost of macroeconomic 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 huge: for instance, 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 the paper was published as chapter II 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

It is a commonly-held argument that the cause of Argentina's economic decline has been a mixture of excesses: industrial protectionism, state-run monopolies, public spending, rapid monetary growth. In our view, however, the Argentine disease consists of an exceptional dose of uncertainty, in particular since the 70s. More specifically, our thesis is that the persistence of high fiscal deficits, financed alternatively by means of the inflation tax and foreign debt, generated a sequence of adjustments in relative prices that made it impossible to make reliable evaluations of investment projects. This fact led to a reduction in the capital stock per worker, hindered technical progress and lowered per capita income. We advance three hypotheses: a) the fiscal deficit is an important source of macroeconomic uncertainty; b) uncertainty is an important cause of the Argentine economic decline, and c) causality runs from the 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 19th century miracle, but 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 and shortages of foreign exchange and domestic savings. Sturzenegger (1984) and Cavallo (1984) provide a suggestive explanation for the 20th century decline, yet they do not provide one for the 19th century miracle. Since the Argentine economy has been a mixed economy for most of the last century, Sturzenegger argues that its capitalist sector did not have real markets while the socialist sector did not have central planning; that policy-induced distortions worsened conditions such as competition, appropriability and certainty that markets required to work, while political instability worsened conditions for planning where markets fail. Cavallo stresses 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.

Following the growth literature, a long-run increase in per capita income comes from investment in physical and human capital and basic research, from improved organization of production and trade, from prompt and precise information. Most investments involves taking low-risk liquid funds, sinking them within a country's jurisdiction, and betting that they will be recovered with at least some profit above their opportunity cost. So the depth

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

Section I presents the empirical evidence. Historical and international comparisons let's identify two correlations: 1) a positive correlation between the fiscal deficit and volatility in relative prices; 2) a negative correlation between volatility in relative prices and per capita income growth. Section II develops a rationale for these correlations. The change in fiscal deficit financing from inflation tax to foreign debt, and from the latter back to the former, boosts large changes mainly in the real exchange rate and the real interest rate; the relative price changes are needed for the country's economy to adjust to budget innovations. Since risk aversion is a predominant trait in capital markets, such volatility creates a wedge in the capital market that hinders the process of accumulation. The gap between the demand price and the supply price of capital is positively linked to the variance in key relative prices.[1] Section III provides an estimate of the efficiency cost of uncertainty (also known as country risk). In Section IV we summarize our findings.

## I. Empirical Evidence

The purpose of this section is to explore statistically the thesis of the paper. To that end, we have to define uncertainty and measure it. We will link uncertainty to the volatility of two important prices in real terms: the exchange rate and the interest rate. We will then measure volatility using simple statistics (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. We want to explain economic growth as the outcome of the behavior of investors in response to volatility constraints. In this regard, a relative price variance approaching zero will tell them 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, a high variance will make present relative prices useless as a reference point. Thus we will say that a country is economically "predictable" or "safe" when its volatility index is low in a relative sense.

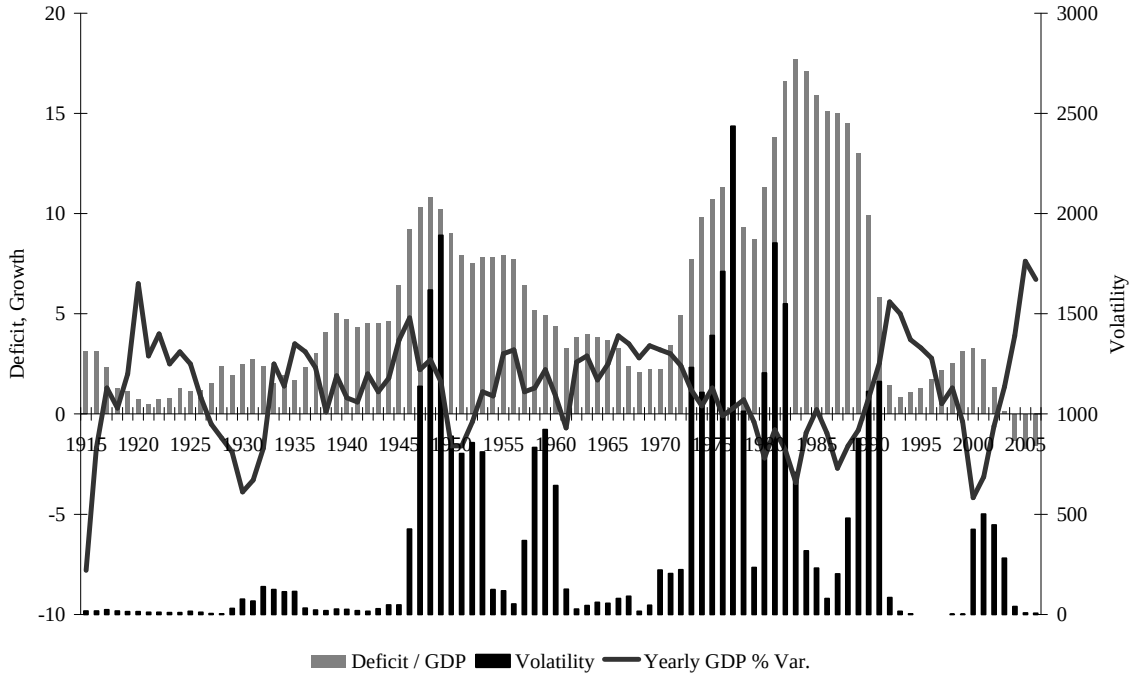
Our thesis highlights correlations between fiscal deficit, volatility in relative prices and long-term growth of per-capita income. As a first step to assess such correlations, Table 1 shows Argentine macroeconomic performance in seven periods that cover the last 90 years and Figure 1 shows the paths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

[1] For Lucas (1981), volatile-price countries like Argentina tend to exhibit vertical Phillips curves. A volatile-price country means for him a high and volatile inflation country. This kind of environment 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 (Appendix I) 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 public sector deficit 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 large increases 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 | | | | |
|---|---|---|---|---|
| | | Volatility | | |
| | Fiscal Deficit % of GDP | Real Rate of Exchange | Real Rate of Interest | Income per Capita Cumul. annual % |
| 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 periods with good public finances are noted for low volatility in relative prices and high growth in per-capita income. This is the case for Argentina in periods of relative stability (1915-28; 1933-45; 1959-72; 1991-2001), and for countries such as USA, West Germany and Japan, and even more clearly for Paraguay, Singapore and South Korea in the period 1974-85. Countries or historical periods characterized by a high (or unstable) deficit are noted for a significantly greater volatility. Argentina falls into this category in the period 1946-58 and especially that of 1973-90: 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 fiscal deficit measure used in Table 3 is the only one available for international comparisons, yet 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: budget equilibrium coexists with high volatility; this observation contradicts our thesis. In this case, however, volatility is a consequence of an unstable 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 both variables are important: the mean size of the fiscal deficit and its degree of 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 seems to be the cause of growth in the Argentine time series (according to the Granger causality test).

## II. A Rationale

The Australian model, quite popular in the literature on open-economy macroeconomics in the 70s and 80s, represents fairly well the setting we have in mind. According to the model, the country's economy is a) small and open, and takes as given the prices of exportable and importable goods as well as the risk-free interest rate; b) 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); c) they save a fraction of their income, part of which is allocated to local currency and external risk-free assets and the rest to fixed domestic investment; d) the fiscal deficit is financed by foreign borrowing or inflation tax; e) individuals' risk aversion explains why they spread their wealth among those three assets; f) 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 demand and an appreciation of the domestic good to ration its supply, which is rather inelastic. In this way, the budget innovation leads to a fall in the real exchange rate.[2] As the horizon for external financing gets short and economic agents forecast the return of the inflation tax, the country experiences, besides currency overvaluation, a higher interest rate in real terms. The latter can be attributed to a change in expectations regarding the rate of currency devaluation. The economic agents expect that the substitution of the inflation tax for external credit will make the nominal rate of exchange rise faster than the price level, so that the real exchange rate will recover the level it had before the initial budget innovation. The opposite scenario (higher real exchange rate and lower real interest rate) prevails when the deficit starts to be financed through the inflation tax. This budget cycle helps to explain the history of inflation and current-account crisis (adjustments) that Argentina underwent in the second half of the 20$^{th}$ century. The bulk of financing swung from one source to another. This phenomenon

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

got stronger in the 70s and 80s as the deficit literally exploded.[3] We think this is the origin of the volatility in relative prices. The volatility index reached very high levels in the 1946-58 period, and overwhelmingly so in the period 1974-85.

B. Volatility and Investment

Risk aversion is a key factor in capital markets. It is a consequence of the hypothesis of decreasing marginal utility of income. According to this hypothesis, the expected value of a lottery with 50% chance of winning $100 and 50% chance of losing $100 is zero, while its expected utility is negative because the disutility 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 intervening is the welfare loss borne by the investor who leaves a safe position to embark on a project with an uncertain outcome. It accounts for the maximum premium he would pay to keep his wealth unchanged.

The peculiar way through which the volatility in relative prices filters into the process of capital accumulation should be now evident. A project for sinking capital into Argentina would bear a turbulence of relative prices thirty times greater than that for same project in South Korea. Therefore, the risk premium for investing in Argentina will have to be several times higher than the South Korean risk-premium. In weighing the possibility of investing physically in Argentina, investors who live in New York or Buenos Aires will behave in identical fashion. Given a 10 year-US Treasury bond that yields 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 great revaluation in real terms of the peso in 1979-80, or the fate of a non-tradable project in the middle of the great real depreciation of the 80s. Consider further the fortune of any such firms when they have to go month after month through 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. Without an insurance against macroeconomic instability, investors self-insure 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 which for Argentina at that time was about 15% per year. Thus, lots of projects that would have contributed greatly to the national wealth were discarded until the horizon improves.

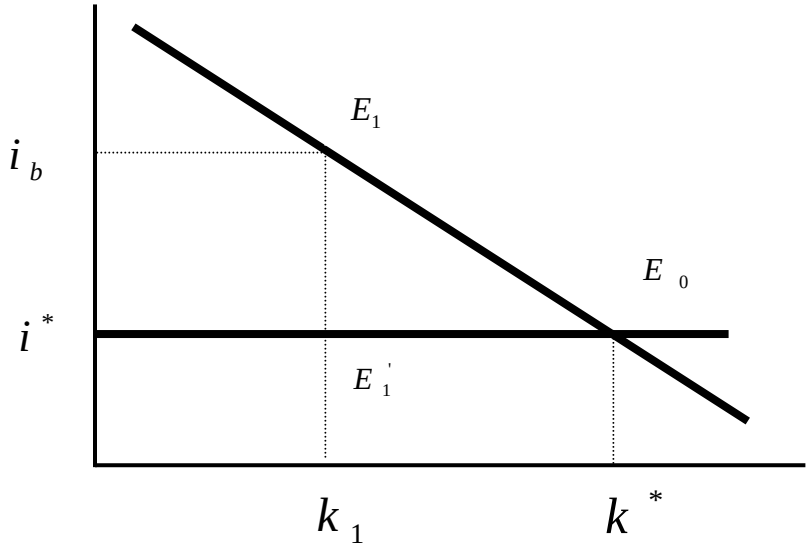
## III. An Estimate of the Cost

So far we have explained the low rates of economic growth of Argentina for most of the 20th century. While the leading group of countries kept growing normally, macroeconomic

[3] 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).

uncertainty led to the international decline of Argentina. What is the welfare loss of the Argentine-risk tax?

Figure 2: The Country-Risk Tax




Investment is a gamble whose outcome only becomes evident as time goes by. That's why 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. With certainty, 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 is self-inflicted, its causes are sudden, frequent and important changes in economic policy. Without certainty, the country-risk premium filters into the capital market and open a wedge between the marginal yield on capital $i_b$ (the relevant rate for local borrower of funds) and the marginal compensation for savers $i^*$. From a social standpoint, the optimum requires $k = k^*$; from the private standpoint, it requires $k = k_1 < k^*$. The country-risk premium $\rho = i_b - i^*$ can be seen as a provision against imponderables.

The country-risk premium works like a 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 gets bigger; a real income loss builds up as the productivity of capital increasingly exceeds $i^*$ (the opportunity cost of the resource). On the other, it generates the rectangle $i_bE_1E_1'i^*$, similar to that representing the revenue of a conventional tax. Though this time it represents the economic cost of that anxiety and partial insurance the investor finds hard to

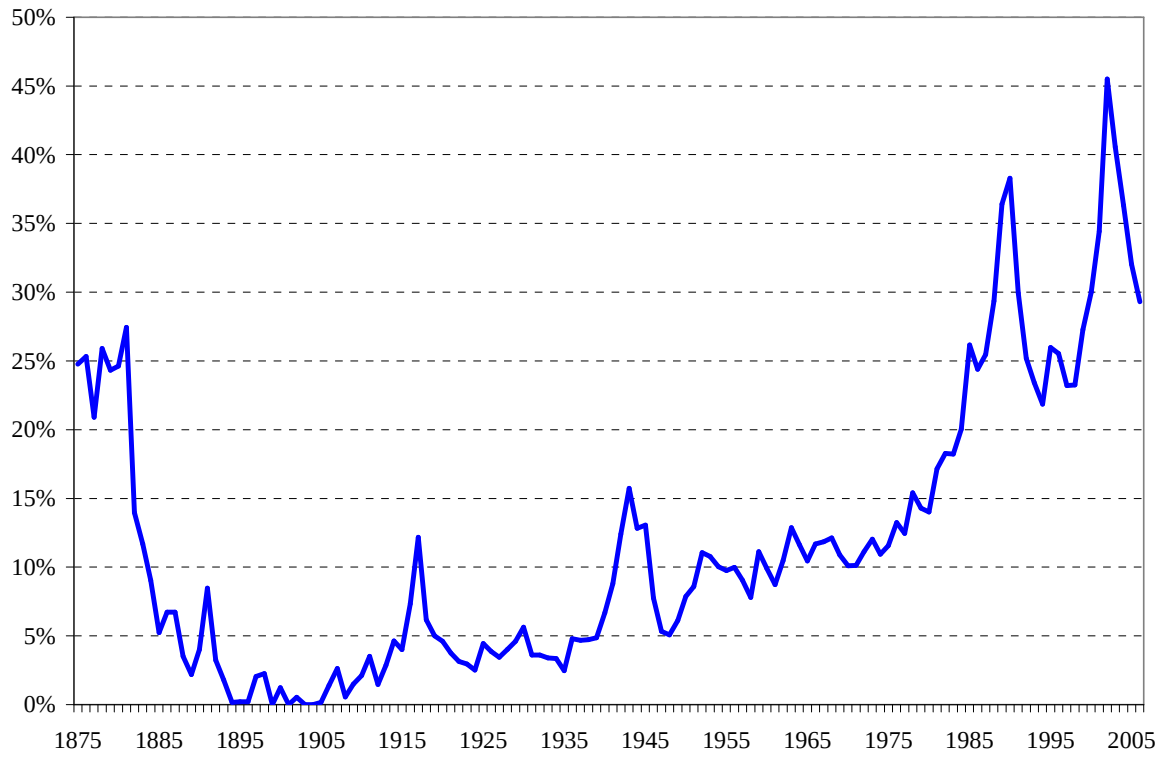
avoid in the face of country risk. Unlike a conventional tax, whose revenues go straight to the Treasury, the country-risk rectangle stands for a social cost because it represents a drain on resources that benefits no-one. The sum of triangle and rectangle measures the wage increase that labor fails to receive because of the existence of country risk.

Switching to a one-sector model for the sake of simplicity, and assuming a logarithmic production function with constant returns to scale, we calculate now 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 the equation has two terms: the first measures the triangle and the second, 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 that has been sunk into the country. (For a development of the WCU equation, see Appendix II; for the data needed to calculate the WCU, see Appendix III.)

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




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%.[4] 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 protection itself. Fernández and Rodríguez (1980) estimated that the Argentine state telephone monopoly generated in 1980 a welfare loss close to 1.5% of GDP.

## 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 that a key condition for Argentina to overcome its stagnation consists in achieving a long-run fall in her country-risk premium to the level prevailing in the group of leading countries.

[4] 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.

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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, $\alpha$ 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.