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EXPLAINING ARGENTINA'S GREAT DEPRESSION OF 1975-1990

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Preface

This paper is part of the project "Explaining Economic Growth Performance" launched by the Global Development Network (GDN). The purpose of this project is to explain economic growth performances across seven regions - East Asia, South Asia, Latin America, Eastern Europe, Former Soviet Union, Middle East and North Africa, and Sub-Saharan Africa. Project support was provided by the GDN. Eduardo Fernández-Arias coordinated the preparation of the country papers for the Latin American region on behalf of the Latin American and Caribbean Economic Association (LACEA).

Introduction

In 1975 the Argentine economy entered a deep depression that lasted for 15 years. This followed 25 years of balanced growth in which per capita income expanded annually by 1.77 percent, with a stable sectoral distribution of employment. By 1990, per capita income was 23 percent below its 1975 value, and output was 40 percent below its 1935–75 trend line. Compared to the rest of Latin America and the United States, income per capita fell by 50 percent. The employment structure also changed considerably. Net job creation was concentrated entirely in the service sector, which increased its share of the labor force by 20 percent, at the expense of tradable goods employment. In the 1990s growth was restored.

Due to its magnitude and persistence, the economic contraction experienced by Argentina through the 1980s qualifies as one of the great depressions of the twentieth century (Kehoe and Prescott, 2002). Kydland and Zarazaga (2002) attempt to explain what happened through the lens of a neoclassical growth model, estimating Solow residuals from the Argentine data and feeding the estimated series as the exogenous total factor productivity (TFP) in the model. The exercise performs fairly well in explaining the behavior of aggregate variables during the 1980s. Yet by using exogenous TFP to explain everything, the model sheds little light about the internal factors behind Argentina's dismal economic performance.

This paper revisits the evidence on growth in Argentina, looking at aggregate data as well as national income data by sector. At the aggregate level our analysis expands Kydland and Zarazaga's growth accounting exercise, incorporating a new series for human capital constructed from household survey data. Qualitatively, results do not change much as we also find that most of the fall in output in 1974–90 is accounted for by a decline in the Solow residual. The decline in capital per worker accounts for only 25 percent of the fall in output.

Sectoral data for 1974–90 shows the greatest change occurring in the composition of employment. Employment in the service sector increased from 57 percent of the labor force in 1970 to 77 percent in 1993, while manufacturing employment fell from 25.4 percent to 16.7 percent, and agricultural employment fell from 17.5 percent to 6.7 percent respectively. Although resource reallocation toward the service sector (wholesale and retail trade and personal, community, and social services) also occurred in many developed economies, Argentina's shift was quite different. While reallocation was associated with a rising relative price of services in the developed countries, in Argentina the price was falling. Moreover service sector output per worker fell as employment rose. Employment reallocation in Argentina accounts for 44 percent of the decline in per capita output between 1973 and 1993, as a shift-share decomposition of employment and output growth will show later in this paper.

Our primary hypothesis is that government policies during 1975–90 increased capital costs, reducing the capital per worker and thereby inducing a labor reallocation. Our analysis assumes that the elasticity of substitution between capital and labor is higher in the service industry, so that new entrants to the labor force were allocated to the service sector where it was easier to substitute labor for capital.

Several factors contributed to the increase in capital costs during this period. Following a default on international debt, the 1980s were plagued by high interest rates. Indeed during 1983–90, the average interest rate on Argentine government debt was 22 percent, more than twice the rate for 1991–97.[1] Tariffs and other trade barriers also played a role. Argentina's trade policy between 1950 and 2000 was very volatile and relied on several instruments, including tariffs, quotas, export taxes, credit subsidies, etc. An index of trade policy distortions — that is, a summary statistic for trade policy and data on the composition of imports and exports — is used to create a proxy for the role of tariffs and quotas on the relative price of capital.[2]

In addition to the direct distortionary effect of tariffs, we argue that uncertainty about future protection was detrimental to investment. A model is presented to illustrate this in which uncertainty about future protection drives up the cost of capital in a multisector economy with irreversible investment. The two sectors in the model are a sector where capital/labor substitution is low (tradable goods) and another one where it is high (nontraded goods). An increase in the cost of capital that reduces investment also induces labor to flow from the tradable goods sector (with low capital/labor substitution) to the nontraded sector (with high capital/labor substitution). The reallocation of labor induced by the fall in the capital stock reduces income per worker, labor productivity, and wages, as observed in the data.

Aggregate Growth Accounting

This section features a standard Solow decomposition of the growth of output per worker in Argentina. Its main contribution to previous work is the introduction of a new series for human capital.

As is standard, we assume a constant returns-to-scale production function of the following form:

$$\frac{Y}{L} = A\left(\frac{K}{L}\right)^{\alpha} h^{1-\alpha} \tag{1}$$

where Y denotes output, K is the capital stock, L is the number of workers, h is the average level of human capital, and $0 < \alpha < 1$. The growth rate of output per worker then is

$$\hat{y} = \hat{A} + \alpha\hat{k} + (1-\alpha)\hat{h} \tag{2}$$

where $\hat{x}$ denotes the percentage change in x and y and k are per worker variables.

The series for the average level of human capital is new and was computed with Argentina's permanent household survey, using the methodology described in the Appendix to this paper. The remaining data for the growth accounting exercise comes

[1] The high rates also may be linked to the period's macro instability and massive fiscal deficits.

[2] Díaz Alejandro (1970) calculated a similar index of trade policy and argued that the distortional effect of protection on investment contributed to the slow relative growth of Argentina after the 1930s.

from Kydland and Zarazaga (2000), who provide their own time series for Argentine capital stock and derive data on the number of employed workers from Elias (1992) and Meloni (2000). The growth rates of output and capital per worker, our measure of *h*, and the growth rate of *L* for the three periods identified in the introduction are depicted in Table 1. Data on the growth of *h* in the full period 1949–70 is unavailable, although in 1970-1974, *h* grew at an average rate of 2.91 percent annually.

Table 1. Annual Growth of Output, Capital per Worker, Human Capital, and the Workforce (%)

	Y/L	*K/L*	*h*	*L*
1949–74	1.77	3.26	n.a.*	1.69
1975–90	–1.09	–0.7	1.43	1.15
1991–97	4.35	2.12	0.63	1.85

* Results for the partial period 1970–74 show a rate of 2.91 percent.

The table shows that in the quarter century between 1949 and 1974 income per worker in Argentina grew at a rate of 1.77 percent annually, while there was substantial capital deepening. In the 15 years following 1975, output and capital per worker fell significantly before recovering in the 1990s.

Table 2 shows the results of a growth accounting exercise using the data from Table 1 and a labor share of 0.6 from Maia-Nicholson (2000).

Table 2. Aggregate Growth Accounting

	Contribution *K/L*	Contribution *h*	TFP
	Average annual % growth rates (% of growth of *y*)		
1949–74	1.30 (74%)	—	—
1975–90	–0.28 (26%)	0.86 (–79%)	–1.67 (153%)
1991–97	0.85 (19%)	0.38 (9%)	3.13 (72%)

Note: Labor share = 60% (Maia-Nicholson, 2000).

The growth accounting exercise indicates that the contribution of capital to the growth of output per worker accounts for nearly three-quarters of growth in 1949–74, with the remaining 26 percent attributable to the Solow residual (without human capital). Assuming that the growth rate of *h* for 1970–74 reported earlier is a good description of the accumulation of human capital since 1949, the estimate of the growth rate of TFP for the entire period is –1.29 percent yearly. In 1975–90, output per worker fell at an average of 1.09 percent yearly for 15 years. Capital stock depletion accounts for 26 percent of the decline. After controlling for growth of the average level of human capital, aggregate TFP during this period fell at an annual average of 1.67 percent, accounting in excess for the fall in output per worker. Ignoring the growth of *h*, the Solow residual grew at a rate of –0.81 percent between 1975 and 1990. In the 1990s growth was restored, with 19 percent of growth accounted for by the contribution of capital, 9 percent by the contribution of human capital, and the remaining 72 percent by the Solow residual.

Labor Reallocation and Output per Worker

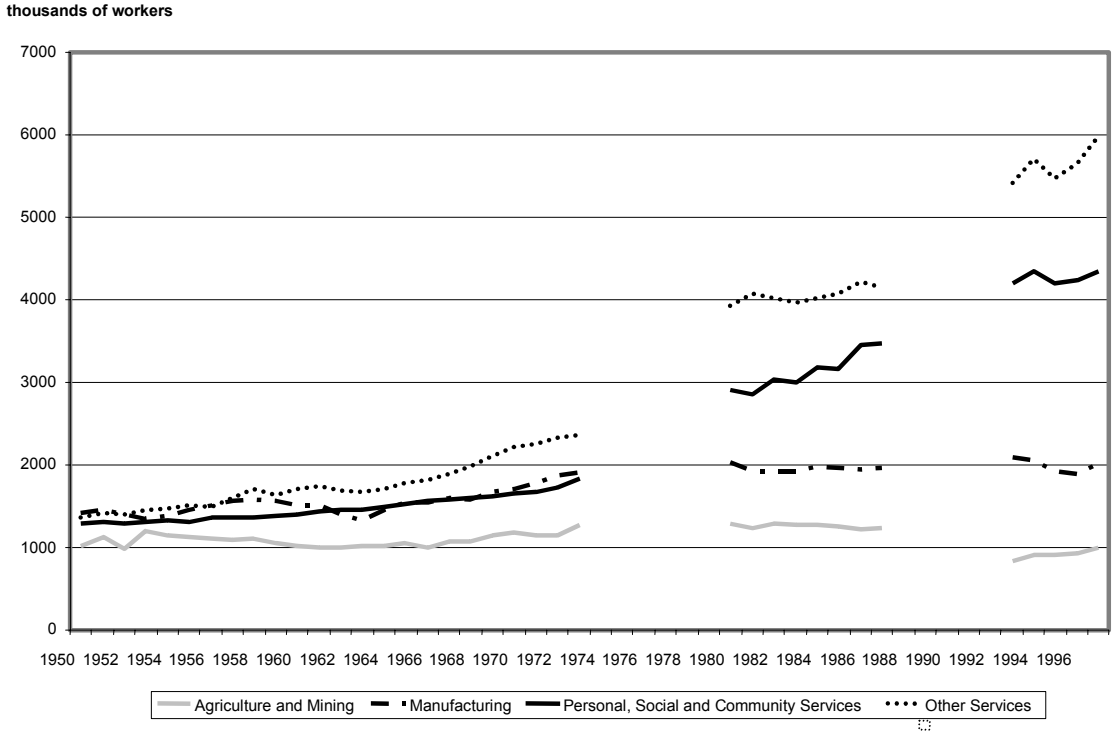
The extent of sectoral reallocation of labor was substantial. Table 3 indicates the progressive transition of employment from primary (agriculture and mining) and secondary (manufacturing) sectors to services. The largest increases in services occurred in the 1970s and 1980s. According to Table 5 these changes were concentrated in trade (wholesale and retail), and community, social, and personal services. These sectors account for most of the increase in services (20.4 percentage points). All of this increase occurred in the 1970s and 1980s.

Table 3. Sectoral Structure of Employment (%)

	Agr. and mining	Manufacturing	Services
1950	19.9	27.9	52.1
1960	18.2	26.7	55.1
1970	17.5	25.4	57.1
1980	12.7	20.0	67.4
1987	11.4	18.2	70.5
1993	6.7	16.7	76.6
1997	7.5	15.1	77.4

Figure 1 depicts the evolution of employment in agriculture and mining; manufacturing; personal, community, and social services; and other services. It shows that behind the changes in employment shown in the previous table there is a steady employment in the tradable-goods sector and growth of employment in services: all net entry to the labor force was absorbed by the service sector.

Figure 1. Employment by Sector



To measure the extent of sectoral reallocation, the following index was constructed:

$$R_{t,t+1} = \frac{1}{2}\sum_{i}\left|l_{it} - l_{it+1}\right| \tag{3}$$

where l_{it} is the share of total employment of sector i in period t. The reallocation index takes values between zero and one, where the extremes correspond, respectively, to no reallocation and to the case in which all employment moves to a nonpreexisting sector. Table 4 shows that the greatest reallocation occurred in the 1970s and 1980s, when growth rates were lowest.

Table 4. Reallocation Index

1950–60	1960–70	1970–80	1980–87	1987–93	1993–97
0.035	0.04	0.135	0.07	0.065	0.025

We explore the relationship between the observed changes in the allocation of labor and output per worker through a shift-share analysis. Output per worker can be written as the sum of output per worker in each sector of the economy times the share of employment in that sector, i.e.,

$$y_t = \sum_i l_{it} y_{it} \tag{4}$$

where the subindex i represents each of the goods or groups of goods produced in the economy,

$$l_{it} = L_{it}/L_t,\ y_{it} = p_{i0} Y_{it}/L_{it}, \tag{5}$$

and p_{i0} represents the prices of a base year. The shift-share decomposition of this expression links the annual average growth rate of output per worker between t and $t + n$ to changes in output per worker and in employment shares as shown below:

$$\frac{1}{n}\ln\frac{y_{t+n}}{y_t} = \frac{1}{n}\ln\frac{\sum_i l_{it} y_{it+n}}{\sum_i l_{it} y_{it}} + \frac{1}{n}\ln\frac{\sum_i l_{it+n} y_{it}}{\sum_i l_{it} y_{it}} + \frac{1}{n}\ln\frac{\dfrac{\sum_i l_{it+n} y_{it+n}}{\sum_i l_{it+n} y_{it}}}{\dfrac{\sum_i l_{i,t} y_{i,t+n}}{\sum_i l_{i,t} y_{i,t}}}. \tag{6}$$

The first term on the right hand side measures the within change, or shift component, which is a weighted average of the increase in TFP, capital per worker, and average human capital in each sector as shown by

$$\frac{\sum_i l_{it} y_{it+n}}{\sum_i l_{it} y_{it}} = \sum_i \frac{p_{it} Y_{it}}{Y_t}(1 + \hat{A}_i + \alpha_i \hat{k}_i + (1-\alpha_i)\hat{h}_i). \tag{7}$$

If there is balanced growth, the within component should account for 100 percent of the change in output per worker. The second term in (6) corresponds to the between change, or share component, and it captures how much of the growth in y is due to pure reallocations of labor across sectors, with constant output per worker in each sector. If labor flows from sectors with low output per worker to sectors with high output per worker, this term is positive, and vice versa. The third term in (6) is an interaction effect, which is negative if there is a transfer of labor to sectors with relatively low rates of output growth per worker. The interaction can be important and negative if labor flows from sectors in which output per worker rises, to sectors in which it falls. This was the dominant effect in Argentina in the late 1970s and in the 1980s.

Table 5 contains the raw data used in the shift-share analysis, showing the interaction between changes in the employment structure and changes in output per worker. Between 1970 and 1993, the employment share of agriculture fell by 11 percent of the labor force, while productivity showed significant gains. Manufacturing employment fell by 8 percent of the labor force, while the sector's productivity remained roughly constant. The largest gains in employment shares occurred in wholesale and retail trade and in personal, community, and social services, sectors in which output per worker experienced significant drops. Observe that output per worker in the trade sector was higher than in agriculture and manufacturing in 1970, and that this was no so in

1980. It is also worth noting that the personal, social, and community service sector grew considerably despite being the least productive in the economy. This sector includes government employment. Although the financial sector is small in terms of employment, it is important because of its dramatic declines in productivity.

Table 3.5. Labor Allocations and Output Per Worker: Argentina 1950-1997

Years	Agriculture		Mining		Manufacturing		Electricity, Gas, Water		Construction	
	Labor Share (%)	Output per worker	Labor Share (%)	Output per worker	Labor Share (%)	Output per worker	Labor Share (%)	Output per worker	Labor Share (%)	Output per worker
1950	19%	93	1%	97	28%	100	1%	93	6%	77
1960	17%	115	1%	190	27%	140	1%	124	7%	70
1970	17%	112	1%	347	25%	213	1%	305	10%	79
1970	17%	119	1%	443	25%	169	1%	308	10%	95
1980	12%	137	1%	537	20%	163	1%	455	11%	91
1980	12%	74	1%	490	20%	181	1%	189	11%	98
1987	11%	82	0%	543	18%	179	1%	220	7%	115
1993	6%	137	0%	980	17%	183	1%	344	7%	93
1993	6%	95	0%	585	17%	130	1%	323	7%	92
1997	7%	89	0%	807	15%	153	1%	476	8%	96

Years	Wholesale and Retail Trade, Restaurants, and Hotels		Transport, Storage and Communications		Banking, Insurance and Real Estate		Community, Social and Personal Services		Output per worker
	Labor Share (%)	Output per worker	Labor Share (%)	Output per worker	Labor Share (%)	Output per worker	Labor Share (%)	Output per worker	
1950	10%	186	8%	110	1%	289	25%	63	100
1960	12%	192	8%	113	2%	263	25%	74	121
1970	11%	247	8%	142	2%	241	24%	85	154
1970	11%	209	8%	216	2%	520	24%	91	154
1980	17%	104	5%	267	4%	253	29%	65	129
1980	17%	133	5%	99	4%	405	29%	77	129
1987	20%	97	5%	108	5%	353	32%	70	120
1993	22%	87	6%	104	7%	262	33%	64	119
1993	22%	88	6%	141	7%	320	33%	69	119
1997	24%	93	6%	170	7%	372	33%	72	131

Table 6 shows the shift-share decomposition of productivity growth described in (6). The qualitative changes in output per worker mimic the pattern of changes in total factor productivity given earlier in the paper, with positive growth until 1973 followed by negative growth in the late 1970s and in the 1980s before returning to positive growth in the 1990s.

Table 6. Shift-Share Analysis

	Output per Worker	Within Change	Between Change	Interaction
1950–70	2.14	2.11 (93)	0.08 (4)	–0.05 (–2)
1973–-80	–2.50	–1.40 (56)	0.36 (–15)	–1.46 (59)
1980–93	–0.59	–0.33 (56)	0.32 (–54)	–0.06 (97)
1993–97	2.44	1.07 (44)	–1.84 (–75)	3.21 (131)

Notes: Figures represent average annual rates of growth in %, figures in parentheses represent % of total change.

The remarkable thing about the 1950–70 period is that most of the change in output per worker is explained by the within component. Argentina during this period seems to have followed a balanced growth path. Deepening capital and rising productivity account for most of the economic growth.

For 20 years post 1973 the growth of output per worker was negative. Reallocation was a major factor, explaining 44 percent of the fall in output per worker in the 1973–80 and 1980–93 subsamples. The combined effects of reallocation induced an average annual decrease in output per worker of 2.5 percent in 1973–80, while in 1980–93 output per worker fell an average of –0.59 percent annually, of which -0.26 percent (or 44 percent of the total change) was due to reallocation. Forty-four percent of the change in output for 1973–93 can be explained by reallocation effects, significantly more than the 25 percent attributed to capital in the aggregate growth accounting exercise.

Most of the within decrease of output per worker in the late 1970s and the 1980s is explained by a two-thirds fall in productivity in the retail trade sector and a one-third fall in productivity of community, social, and personal services. These two sectors increased their share of employment from 11 percent and 24 percent of the labor force in 1970 to 20 percent and 32 percent in 1987, respectively. The large negative value of the interaction term captures the fact that the service sector absorbed a large fraction of the labor force while experiencing a declining output per worker.

In the 1990s growth and investment rebound, but the reallocation effects are still important. The overall reallocation effect induced an increase in aggregate output per worker of 1.37 percent yearly, which account for 56 percent of the total change. The within change was 1.07 percent yearly, and accounts for the remaining 44 percent of total change.

To put the shift-share analysis for Argentina in perspective, Table 7 presents data for Chile, Mexico, Canada, Finland, Italy, Norway, and the United States. The sample contains all OECD and Latin American countries for which data could be obtained. The results are interesting, especially for the OECD countries, because they also experienced significant changes in the composition of their labor forces, with about 20 percent of the workforce moving to the service sector. The table, however, shows that the Argentine case is quite different.

Table 7. Shift-Share Analysis for Six Countries (%)

	Chile		Canada	
	Output per worker	Within change	Output per worker	Within change
1970–75	–1.34	–1.34 (100)	0.92	0.56 (61)
1975–80	3.38	3.63 (107)	0.60	0.42 (71)
1980–86	–0.99	–0.57 (58)	1.42	1.43 (101)
1986–90	2.27	1.57 (69)	0.21	0.10 (49)
1990–95	4.85	4.45 (92)	1.34	1.41 (105)
	Finland		Italy	
	Output per worker	Within change	Output per worker	Within change
1970–75	3.64	2.38 (66)	2.53	1.43 (57)
1975–80	2.66	2.13 (80)	2.82	1.89 (67)
1980–85	2.51	2.12 (84)	1.49	0.16 (11)
1985–90	3.10	2.62 (85)	1.97	1.16 (59)
1990–95	3.33	3.33 (100)	1.84	1.55 (85)
	Mexico		Norway	
	Output per worker	Within change	Output per worker	Within change
1970–75	2.60	2.34 (90)	3.16	2.16 (69)
1975–80	1.24	1.47 (118)	2.06	1.71 (83)
1980–85	0.37	0.17 (47)	2.23	1.69 (76)
1985–90	0.18	0.16 (88)	1.87	2.16 (115)
1990–95	--	--	2.72	2.80 (103)
	United Sates			
	Output per worker	Within change		
1970–75	0.85	0.66 (78)		
1975–80	0.19	-0.26 (-136)		
1980–85	1.34	1.07 (80)		
1985–90	0.77	0.67 (87)		
1990–95	1.03	1.10 (107)		

Note: Figures in parentheses represent the percent of total change.

The table shows that the only cases in which the reallocation component of the shift-share analysis is important are Chile 1980–86 and the United States 1975–80. The Chilean case resembles Argentina's since it encompassed a deep recession in which output and capital per worker were falling. The reallocation effect accounts for 42 percent of the 1 percent yearly decline in output per worker. In the case of the United States, output per worker grew at an annual rate of 0.19 percent, the within change was negative

(productivity slowdown), and the reallocation effect was 0.45 percent annually. Thus the reallocation effect in the late 1970s was positive.

Another key difference separates the reallocation of labor in Argentina from that of developed countries. In Argentina the relative price of services fell while employment in the sector was growing; in the developed countries the price increased.

Price Performance

To understand the economic forces underlying the movements in quantities described above, it is useful to look at the behavior of some key relative prices.

The Real Exchange Rate

In Figure 3.2 we plot the real exchange rate:

$$e \equiv (CPI^{A} / CPI^{US}) \cdot E \tag{8}$$

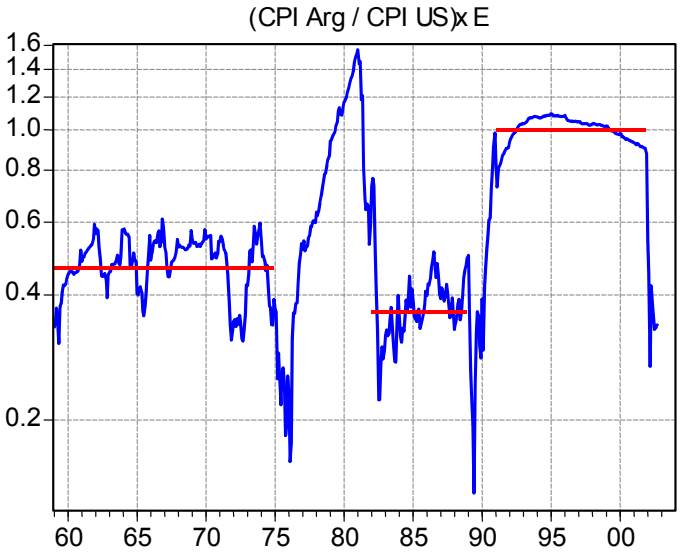
where CPI^{i} denotes the consumer price index in Argentina and in the United States and E denotes the nominal exchange rate. This definition of the real exchange rate is a proxy for the relative price on nontraded goods. For the purpose of studying the real exchange rate, the sample is broken into the subperiods 1959–74, 1982–88, and 1991–2001. We observe that the real exchange rate fell almost 20 percent in the 1980s from its value in the 1960s and early 1970s, and rose by 56 percent in the 1990s. In the subperiod 1975–81 the real exchange rate was extremely volatile due to a temporary opening of the economy in the late 70s, and volatility also spiked in 1989–90 because of hyperinflation.

Table 8. The Real Exchange Rate (1959–2001)

Period	Mean	St. Dev	Min	Max
1959:01–1974:12	0.48	0.07	0.30	0.61
1975:01–1981:12	0.74	0.39	0.15	1.50
1982:01–1988:12	0.39	0.09	0.22	0.76
1989:01–1990:12	0.45	0.23	0.13	0.98
1991:01–2001:12	1.00	0.07	0.72	1.09

Note: Real Exchange Rate = (CPI^{ARG}/CPI^{US}) Exchange Rate; subperiods begin in January of the first year and end in December of the latter year.

Figure 2 Relative Price of Services



Interest Rates

Throughout the second half of the 20th century the Argentine economy experienced repeated violations of creditor's property rights. Up to 1977, interest rate ceilings were standard, and nominal financial contracts were eroded by inflation. Credit at negative real interest rates was allocated by the government that transferred resources from depositors to privileged debtors. These credit subsidies were part of the import-substitution industrialization policy. In 1977 financial markets were liberalized and real interest rates rose. Rates increased further after Argentina defaulted on its public debt in the early 1980s. Our analysis focuses on this period.

Real interest rates in Argentina are hard to measure since regulations make local interest rates hard to interpret and the volatility of inflation makes measuring expected inflation tricky. For the period 1983–97 we use the measure of interest rates in Alvarez-Neumeyer (1999) which was successfully used to explain Argentine business cycles in Neumeyer and Perri (1999). The average annual interest rate for 1983–90 and for 1991–97 was 22 percent and 10 percent, respectively.

Relative Price of Imports and Exports: Trade Policy 1950–2000

The protectionist policies of the last century relied on a complicated battery of instruments. Our analysis turns to providing a summary measure of protection by using a trade policy index to capture how these policies affected the relative price of imported goods as well as how they affected the cost of capital and investment.

From 1950 to 1976 Argentina continued to pursue the development strategy of import-substitution industrialization that had begun in the 1930's and been reinforced in 1943. This strategy was supported through commercial policy, exchange rate controls, the tax structure, and credit subsidies. In the first stage one stimulated creation of industries that replaced imports of final goods; in later stages one protected intermediate inputs and

capital goods, including cars, steel, and petrochemicals. A window of trade liberalization cracked open in 1976–81, only to be closed again in the 1981–91 period. Actual dismantling of the protectionist regime started in 1988 and was consolidated in the 1990s. This section describes Argentina's trade and exchange rate policies and constructs an index that is used as a summary statistic of Argentina's trade policy stance.

A battery of instruments was used to channel resource flows to industries replacing imports. Such policies included export taxes; price ceilings on exportable goods; import tariffs; quantitative restrictions on imports; export subsidies for nontraditional exports; multiple exchange rates, with higher rates for imports and "nontraditional" exports and lower rates for exportable goods; and credit subsidies favoring import-competitive industries.

Table 9 shows that Argentina mainly exports agricultural goods. Agriculture's share of total exports was 93 percent in 1963, 85 percent in 1970, and 71 percent in 1980. Moreover in 1980, after over 40 years of import substitution, only 23 percent of exports involved manufactured goods.

Table 9. Composition of Exports (%)

	Agro Raw Material	Food	Fuel	Ore and Metals	Total Agriculture	Manufactures
1963	20	72	1	1	93	6
1970	11	74	0	0	85	14
1980	6	65	3	2	71	23
1990	4	56	8	2	61	29
1997	3	49	12	2	52	34

Source: World Development Indicators (1999).

Given the composition of exports, the combination of all distortionary policy interventions will be summarized by the trade policy index (TPI):

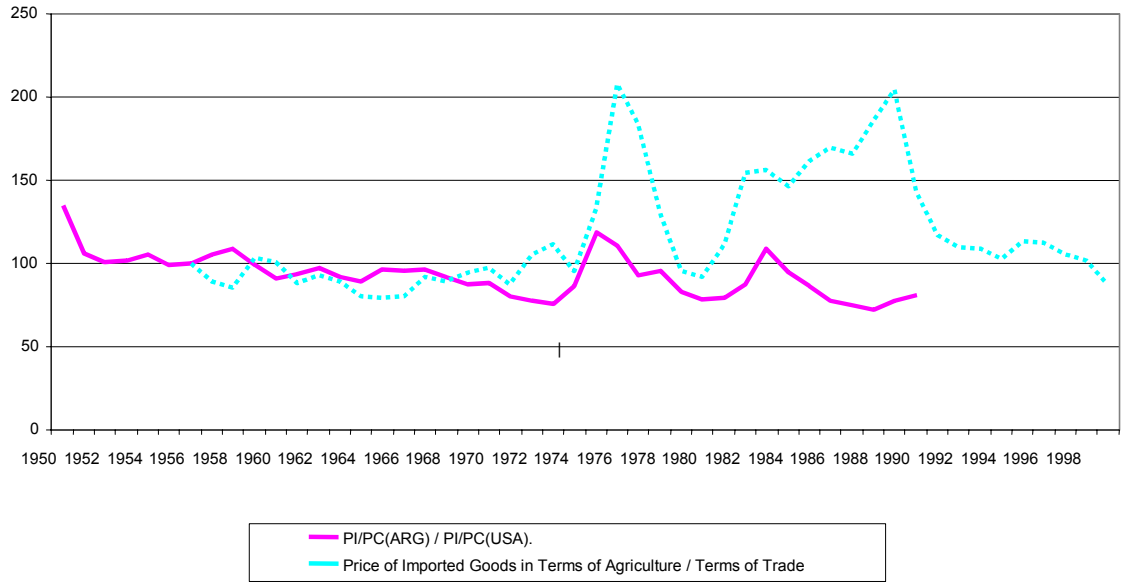
$$\text{TPI} = \frac{\dfrac{\textit{Domestic Price of Imported Goods}}{\textit{Domestic Price of Agricultural Goods}}}{\dfrac{\textit{International Unit Price of Imports}}{\textit{International Unit Price of Exports}}} = \frac{E_m(1+\tau_m)}{E_x(1+\tau_x)} \tag{9}$$

where E_m/E_x is the ratio of the exchange rate applicable to producers of goods m and x, respectively, when there are multiple exchange rates. Our preferred strategy for measuring trade policies, then, is pegged to relative prices.

The dashed line in Figure 3 shows the value of this index for the period 1956–99. It shows that the trade policy index remained fairly stable despite the apparent volatility of policies during the 1950s and 1960s. This changed in the 1974–76 period due to the imposition of quantitative restrictions, export taxes, and multiple exchange rates. Figure 3 also shows the short-lived trade liberalization experiment of 1977–80, the strongly protectionist policies of the 1982–89 period, and the trade liberalization of the 1990s. According to the trade policy index the level of protection in the 1990s was similar to that of the 1950s and 1960s. This is at odds with data on the composition of imports that shows a rise in consumption goods and with data on legal tariffs. A possible explanation may lie in the fact that by the 1990s agricultural goods only comprised 52 percent of exports due to the increase in exported oil and manufactured goods, making the index measurement of export prices susceptible to error.

The solid line shows the ratio between the relative price of investment goods in terms of consumption goods in Argentina and the United States. Changes in this variable can be interpreted as changes in distortions to invest, such as import tariffs on capital goods. The graph shows that the relative price of investment goods in Argentina peaks in 1975 and 1983, and these peaks coincide with protectionists spurs.

Figure 3. Trade Policy Index and Relative Price of Investment Goods



Sources and Comments: The relative price of investment goods is from the Penn World Tables. An index value of 100 corresponds to a true value of 2. Domestic relative prices are from the wholesale price index and the terms of trade from Berlinski (2000)

Summary of Facts

In the period 1950–75 Argentina was on a balanced growth path. Income per capita was growing at approximately the same rates as in the United States and the rest of Latin America. The growth accounting exercise shows that most of this growth was capital

deepening, and the shift-share analysis shows that labor reallocation played a small role. Prices during this period were relatively stable as shown by the real exchange rate and the trade policy index.

In 1975–90, output per worker falls at an annual average rate of 1.09 percent. Argentine income per capita plunged 50 percent relative to the U.S. and the rest of Latin America. This growth implosion was driven by a fall in capital per worker of 0.7 percent yearly and by a puzzling average decrease in TFP of 1.67 percent yearly. Human capital during this period was 1.43 percent per year. Analysis shows a considerable reallocation of labor during this period from sectors with growing output per worker to a sector in which output per worker was falling. These movements in the labor force account for 44 percent of the decline in output per worker. During this period the cost of capital, as measured through interest rates and the relative price of investment goods, was higher than in the other two periods. The relative price of services on the other hand was lower and more volatile than in the previous and the following periods. Our measure of protection, the trade policy index, was higher and much more volatile than in the other periods.

In the 1990s growth was restored, with capital per worker and total factor productivity growing also. Labor reallocation was important, accounting for 56 percent of growth, and labor was flowing to sectors with rising output per worker. Real interest rates, as well the relative price of investment goods, fell relative to the 1980s, while the relative price of services was higher.

Capital Stagnation and Reallocation

The previous section shows that capital stock fell, all new entrants to the labor force were employed in the service sector, and the relative price of services decreased during the Argentine Great Depression. This section provides a simple model to interpret these facts.

Our main hypothesis is that a bad investment environment produced a stagnant capital stock, which in turn induced the labor reallocation observed in the data. The main underlying assumption is that it is harder to substitute labor for capital in the tradable sector of the economy (agriculture, mining, and manufacturing) than in the nontradable one (services). In the extreme case, in which tradable goods are produced with a Leontieff technique and services are produced with a Cobb-Douglas one, a labor force increase is fully absorbed by the Cobb-Douglas sector and results in a declining relative price for goods in this sector, declining wages, and an increasing return to capital

The easiest way to illustrate this point is to consider an economy with two goods: T and N. Preferences are described by

$$U = \mu \ln T + (1 - \mu) \ln N, \tag{10}$$

and technology is described by the following functions:

$$Y_T = \phi \min (\alpha_T K_T, L_T), \text{ and} \tag{11a}$$

$$Y_N = A_N K_N^{\alpha_N} L_N^{1-\alpha_N} \tag{11b}$$

where T and N denote the production and consumption of goods T and N; K_i denotes capital employed in sector i; L_i is the labor employed in sector i; and ϕ, α_N, A_N, and μ are parameters.

Given K_T, K_N, an equilibrium consists of the prices p_N, r_n, w and the quantities L_N, N, and T for which consumers optimize and markets clear. Using the optimal labor demand in the T sector, market clearing in the labor market, $L_N + L_T = L$, is equivalent to

$$L_T = a_T K_T \,,\; L_N = L - a_T K_T \tag{12}$$

where L is the labor force.

The relative prices in this economy, derived from the market-clearing conditions in labor and output markets, and in the optimization conditions, are

$$\frac{p_N}{p_T} = \frac{1-\mu}{\mu} \frac{\phi a_T K_T}{A_N K_N^{\alpha_N} \left(L - a_T K_T\right)^{1-\alpha_N}} \,, \tag{13a}$$

$$\frac{w}{p_T} = \left(1-\alpha_N\right) \frac{1-\mu}{\mu} \frac{\phi a_T K_T}{L - a_T K_T} \text{ , and} \tag{13b}$$

$$r = \alpha_n \frac{1-\mu}{\mu} \frac{\phi a_T K_T}{K_N} \,. \tag{13c}$$

Observe that, for a given capital stock, an increase in the labor force results in a decrease in the relative price of the N good and a fall in real wages. The elasticities of the relative price of N and of real wages with respect to L are

$$\frac{d \log(p_N / p_T)}{d \log L} = -(1-\alpha_N) \frac{L}{L_N} \,, \tag{14a}$$

$$\frac{d \log(w / p_T)}{d \log L} = -\frac{L}{L_N} \,. \tag{14b}$$

These simple equations show that in an economy with the technology (11a/b), if the capital stock is fixed, an increase in the labor force will induce a drop in the relative price of services and of real wages. Using the share of employment in services in 1970 and a labor share of 0.7 for the service sector, the elasticity of the relative price of services with respect to the labor force is –1.2 and the elasticity of real wages is 1.75.

In this simple example it is also easy to see that for a given capital stock a shift-share analysis, with base year prices, would result in the following decomposition of output per worker:

$$\frac{\Delta y}{y} = \underbrace{\left(\frac{p_T Y_T}{Y} \frac{\Delta y_T}{y_T} + \frac{p_N Y_N}{Y} \frac{\Delta y_N}{y_N} \right)}_{within} \tag{15}$$

$$+ \underbrace{\left(\frac{\Delta l_T}{l_T} \frac{p_T Y_T}{Y} + \frac{\Delta l_N}{L_N} \frac{p_N Y_N}{Y} \right)}_{between}$$

$$+ \underbrace{\left(\frac{p_T Y_T}{Y} \frac{\Delta l_T}{l_T} \frac{\Delta y_T}{y_T} + \frac{p_N Y_N}{Y} \frac{\Delta l_N}{l_N} \frac{\Delta y_N}{y_N} \right)}_{\text{int}eraction}.$$

An increase in the labor force with a given capital stock will result in a negative within term equal to

$$-\frac{p_N Y_N}{Y} \alpha_N L / L_N \hat{L}. \tag{16}$$

The between term will be equal to

$$\left(\frac{p_N Y_N}{Y} - \frac{p_T Y_T}{Y} \right)\left(1 - L_N / L\right)\hat{L}, \tag{17}$$

which is positive since the service sector of the economy is larger than the tradable one.

The interaction term will be

$$-\frac{p_N Y_N}{Y} \alpha_N L / \left(L / L_N - 1\right)\hat{L}. \tag{18}$$

Using 1970 data,

$$p_N Y_N / Y = L_N / L \cong 0.57 \text{ and } \alpha_N = 0.7, \tag{19}$$

implying that the within term is -0.7 $\hat{L}$, the between term is \$0.06 $\hat{L}$ and the interaction term is –0.52 $\hat{L}$. Since all the new labor goes to the *N* sector, the reallocation effects become smaller over time as L_N converges to *L*. These back-of-the-envelope calculations, in which the within term accounts for 60 percent of the change in output per worker, are qualitatively consistent with the data in Table 6 where the within term accounts for 56 percent of the fall in output per worker.

Observe that a Solow-type growth accounting exercise here will correctly decompose the fall in output per capita, implying that the reallocation of labor does not explain the fall in total factor productivity.[3]

Accounting for the Fall in Capital Stock per Worker

Previous sections documented the rise in interest rates and the increased protection experienced during 1975–90. Here we evaluate their impact on the stock of capital per worker, using the framework of the standard neoclassical growth model.

Rising Interest Rates

The expression for the equilibrium capital stock implies that the elasticity of the capital stock with respect to the interest rate is

$$\frac{\partial k_i}{\partial r}\frac{r}{k_i} = -\frac{1}{1-\alpha_i}\frac{r}{r+\delta}. \tag{20}$$

The average annual interest rates for 1983–90 and 1991–97 were 22 percent and 10 percent, respectively. As this is also the interest rate that Kydland and Zarazaga (2002) calibrated for Argentina's steady state, we assume that Argentina's rate before 1974 was also 10 percent. Following Kydland and Zarazaga we set the depreciation rate at 9 percent. Using these parameter values, the elasticity of the capital-labor ratio with respect to the interest rate in the mid-1970s was 0.17. This implies that a 100 percent increase in the interest rate should result in a fall in capital stock of 17%. As the index of the capital-labor ratio in 1991 was 34% lower than the average value for the 1962–84 period (39 percent lower than its 1981 value), we conclude that interest rates explain up to half of the decline in Argentina's capital-labor ratio. The value of the elasticity in the 1980s, when interest rates were around 20 percent, is –0.3; hence the effect of a 50 percent drop in the interest rate would induce a rise in the capital-labor ratio of \$15%, which is actually very close to the 13 percent increase observed between 1991 and 1997.

The direct impact of trade policies on investment

In order to evaluate the effects of trade policies on the steady-state equilibrium capital stock with respect to tariffs, it is necessary to distinguish between tariffs on capital goods, *I*, which reduce investment, and tariffs on final goods that increase investment. The expression for the equilibrium capital stock in each sector implies that the elasticities of the capital stock in each sector with respect to tariffs on investment goods (τ_I) and with respect to protective tariffs (τ_i) are

[3] $\left(\frac{\Delta Y}{Y}\right) = (1-\alpha)\frac{1-\mu}{L_{N/L}}\hat{L}$ and $\frac{\omega L}{Y} = (1-\alpha)\frac{1-\mu}{L_{N/L}}$.

$$\frac{\partial k_i}{\partial \tau_I}\frac{\tau_I}{k_i} = -\frac{1}{1-\alpha_i}\frac{\tau_I}{1+\tau_I} \text{ and } \frac{\partial k_i}{\partial \tau_i k_i} = \frac{1}{1-\alpha_i}\frac{\tau_i}{1+\tau_i}. \quad (21)$$

Assuming investment goods are imported, the direct effect of tariffs on the producers of imported goods is nil since the negative effect of the tariff is offset by increased protection. For the other two sectors, our evidence suggests that tariffs on capital goods in the 1974–90 period were twice those in 1960–74. This is inferred from the doubling of protection implied by the trade policy index in Figure 3, which can also be seen in Table 10.

Table 10. Trade Policy Index

1960–1965	72.47	1981–1985	149.12	1960–1974	75.32
1966–1970	77.21	1986–1990	176.29	1975–1990	149.50
1971–1975	88.07	1991–1995	126.84	1991–2000	117.52
1976–1980	126.69	1996–2000	108.21		

The implicit tariff rate in the tariff revenue to total imports ratio increased from 10 percent in 1973 to 20 percent in 1980 and 1986. Given that our measure of the elasticity of the capital-labor ratio with respect to tariffs on capital goods is 0.15, the estimated fall induced in the capital-labor ratio in these sectors by the increase in tariffs is 15 percent. Since services and primary products account for about two-thirds of output, assuming the share of the capital stock in these sectors equals the share in output, the fall in the aggregate capital-labor ratio stemming from the tariff on investment goods is 10 percent.

There is still a 10 percent decline in capital stock that needs to be explained. Potential reasons include higher export taxes (little likelihood since primary products account for a small share of GDP), removal of credit subsidies in import-competing sectors, and expectation of policy reversals, especially in the protected import-competing sector.

A Model for Uncertain Protection, Growth, and Resource Allocation

This section sketches a model that tries to capture features of the Argentine economy essential to understanding the Great Depression of the 1980s. We need to explain the fall in aggregate output per worker, why capital per worker dropped, and why the employment share increased in sectors with declining productivity and decreased in sectors with rising productivity. The model will then be used to quantify the effects of expected policy reversals.

In a standard neoclassical growth model, policies and distortions can explain only the change in capital per worker but not the changes in employment shares underlying the decline in total factor productivity. Hence departures from the standard one-sector growth model are necessary. Thus our model assumes (1) that investment is irreversible, (2) that protectionist policies may become unsustainable enough for agents to expect that trade

liberalization will occur,[4] and (3) that there is less substitutability between factors of production in the tradable than the nontradable sector.

The irreversibility of investment, combined with the expectation of a trade reform, imply that the investment cost should also include an option value for waiting that captures the expected capital loss of installed capital arising from trade liberalization. In the protected sectors a move toward free trade devalues installed capital by reducing the present value of future profits; in the competitive sectors free trade lowers the value of imported capital that is freely imported after the reform. We show that the effects of these two assumptions can be significant.

The assumption about factor substitutability implies that when government policies reduce the equilibrium capital-labor ratio, labor will flow from the more rigid to the more flexible sectors. To be precise, we consider an economy that produces two tradable consumption goods (x and m), a tradable investment good (i), and a nontraded consumption good (n). The technology to produce each of the goods is described by the following production functions:

$$x = \min(a_x K_x,\ l_x) \tag{22a}$$

$$m = \phi_m \min(a_m K_m l_m) \tag{22b}$$

$$i = \phi_i \min(a_i K_i l_i) \tag{22c}$$

$$n = A_n K_n^{\alpha} l_n^{1-\alpha}. \tag{22d}$$

Tradable goods are produced with a Leontieff technology while services are produced with a Cobb-Douglas one. The idea is that in the nontradable sector — mainly services — there is more scope in substituting labor for capital. Consequently if the desired capital stock falls in the tradable sectors, labor will flow from them to the nontraded sector. As the marginal product of labor is decreasing in labor and capital in this sector falls, output per worker in the nontraded sector falls. Therefore this flow of resources shows up as a negative interaction term in the shift-share decomposition presented in (6).

The capital accumulation technology is

$$\dot{K}_j(s_t) = i_j(s_t) - \delta K_j(s_t) \ \text{ for all } j = x,\ m,\ n,\ i \ \text{ and} \tag{23}$$

$$i_j(s_t) \geq 0 \quad \text{for } j = x,\ m,\ n,\ i \tag{24}$$

[4] In particular, we consider the effect of increasing the probability of a drastic change in trade policy that would end protection. Indeed during the 1990s protection *was* substantially curtailed in many Latin American economies. Moreover Argentina had already experienced in the mid-1970s a period of substantial tariff reductions and currency appreciation that lowered import prices considerably.

where K_j is the stock of capital in sector j and is the instantaneous rate of depreciation. The nonnegativity of investment is capturing the irreversible nature of investment mentioned previously.

The international prices of the tradable goods are normalized to be

$$p_x^* = p_m^* = p_i^* = 1,$$

and the international risk-free interest rate is assumed to be r. Under these assumptions there is complete specialization in production, and we assume that under free trade it is inefficient to produce goods m and i. This requires restricting the technological parameters to satisfy

$$\phi_m < 1 + \left(\frac{1}{a_m} - \frac{1}{a_x}\right)(r + \delta) \tag{25}$$

$$\phi_i < 1 + \left(\frac{1}{a_m} - \frac{1}{a_x}\right)(r + \delta). \tag{26}$$

Under a protectionist regime, tariffs τ_m and τ_i are levied on goods m and i so that it becomes profitable for domestic firms to produce these goods at home. For simplicity we assume that tariffs are prohibitive. The domestic price of imported goods then is

$$1 \le p_m \le 1 + \tau_m \text{ and } 1 \le p_i \le 1 + \tau_i. \tag{27}$$

The expectation of a trade reform under protection implies that the protectionist policy is uncertain since tariffs may be removed. The state of the economy (s) is equal to P if there is protectionism or F if there is free trade.
At any instant, the probability that the protectionist regime will end and there will be a switch to free trade is λ.

Household preferences are given by

$$\mathrm{E}\left[\int_0^\infty u(x(s_t), m(s_t), n(s_t))e^{-rt}dt\right] \tag{28}$$

where r is the household's discount rate, which is assumed to equal the international interest rate, and u is an additive logarithmic function.

The private sector's problem is to maximize (28) subject to the capital accumulation (23) and irreversibility (24) constraints; the household's budget constraint,

$$\begin{aligned}\dot{b}(s_{t)} &= r(s_t)b(s_t) + a_x K_x(s_t) + p_m\phi_m a_m K_m(s_t) + p_n(s_t)f(K_n(s_t), l_n(s_t)) \\ &+ p_k(s_t)\left[\phi_i a_i K_i(s_t) - (i_x(s_t) + i_m(s_t) + i_n(s_t))\right] + \tau \\ &- \left[x - (s_t) + p_m(s_t)m(s_t)n(s_t)\right];\end{aligned} \tag{29}$$

and the labor constraint,

$$0 = l - a_x K_x(s_t) - a_m K_m(s_t) - a_i K_i(s_t) - l_n. \tag{30}$$

The first constraint is the household's budget constraint (29). The private sector accumulates bonds denominated in the export good, which pay an interest rate $r(s_t)$ from the income of producing the four goods, interest income, and government transfers (τ) net of the expenditures in consumption and investment. The capital accumulation and irreversible investment constraints are standard. The constraint on labor uses the fact that if labor is optimally set,

$$l_x = a_x k_x(s_t),\ l_m = a_m k_m(s_t) \text{ and } l_i = a_i K_i(s_t). \tag{31}$$

The government budget constraint is

$$\tau = \tau_m \max\left[(m - \phi_m a_m k_m(s_t)),0\right] + \tau_i \max\left[(i - \phi_i l_i),o\right]. \tag{32}$$

For simplicity we assume that under protection the country has no access to loans from the rest of the world and under free trade it faces an inelastic supply of loans at the international interest rate. Therefore aggregate consistency in financial markets requires that under protection $\dot{b} \geq 0$ and under free trade $r^F = r$.

In the nontraded goods sector, aggregate consistency requires that

$$n(s_t) = f(K_n(s_t), l_n(s_t)). \tag{33}$$

For an interior solution, the first-order conditions for capital accumulation in sectors $j = x$, m, and i under free trade and protection satisfy[5]

$$r + \delta = a_j(\phi_j - w^F) \tag{34}$$

under free trade and

$$(r+\delta)p_i^P = a_j(p_j^P \phi_j - w^P) + \lambda\left(\frac{u_x^F}{u_x^P} - p_i^P\right) \tag{35}$$

under protection.

These first-order conditions state that the marginal cost of investing an extra unit of capital in sector j has to equal the marginal benefit. Under free trade, the investment good price is $p_i^F = 1$, so the cost of capital is $r + \delta$. With the Leontieff technology, the

[5] Outside of steady state the foci are:

$$(r+\delta)q_j^P = a_j(p_j^P\phi_j - w^P) + q_j^s\left(\frac{\dot{q}_m^P}{q_m^P} + \frac{\dot{u}_x^P}{u_x^P}\right) + \lambda\left(\frac{u_x^F}{u_x^P} - q_j^P\right)\quad q_j^s \leq p_i^s;\ i_j^s \geq 0;\quad (p_i^s - q_j^F)i_j^F = 0.$$

marginal gain of an additional unit of capital is the marginal product of capital, $\phi_j a_j$, net of the cost of hiring a_j additional units of labor. Under protection, the cost of capital is higher since its price is higher. The expected marginal profit of capital is smaller due to the expected capital loss that occurs if there is trade liberalization. The capital loss is equal to the difference between the value of a unit of capital if there is a trade reform in terms of the *x* good under protection u_x^F / u_x^P and the price of capital under protection, p_i^P. Observe that increases in the probability of a trade reform reduce the incentives to invest.

In the nontradable sector the analogous conditions under free trade are

$$r + \delta = p_n^F \frac{\alpha A_n}{k^{1-\alpha}} \tag{36}$$

and

$$(r+\delta)p_i^P = p_n^P \frac{\alpha A_n}{k^{1-\alpha}} + \lambda\left(\frac{u_x^F}{u_x^P} - (1-\tau_i)\right) \tag{37}$$

under protection, where the term $\alpha A_n / k^{1-\alpha}$ represents the marginal product of capital in the *n* sector. Finally, the first-order conditions for labor in the *n* sector are expressed by

$$p_n^s (1-\alpha) A_n k_n = w^s . \tag{38}$$

Observe that expectations of policy reversals, in this example increases in λ, reduce the incentives to invest.

Testing the Model

Some preliminary experiments were performed to check the model's potential to shed light on the Argentine experience. The steady state of an economy with protection and no probability of trade reform was compared with the steady state of an economy with a 5 percent probability of trade reform and with a free trade economy. The emergence of uncertainty about the stability of the protectionist regime is one way of introducing a higher cost for capital. The 5 percent probability of trade reform implies an expected timeframe for occurrence of 20 years.

The model was calibrated to set the risk free interest rate at 5 percent and the capital share in the production of the exported good at 0.65 percent, which accords with the agricultural labor share in Argentina. For the import-competing consumption goods and the capital goods sectors we assume $a_m = 2a_x$ and $a_i = 4a_m$. The parameters ϕ_m and ϕ_i are set to 0.45 and 0.3 respectively, and imply a 50 percent excess cost in the *m* sector and a 45 percent excess cost in the *i* sector. The labor share in the *n* sector is set to two-thirds, and A_n equals one-half. The utility function is set to

$$u = 0.3\log x + 0.2\log m + 0.5\log n. \tag{39}$$

Table 11a shows how aggregate variables react to the higher capital costs created by uncertainty about the survival of a protectionist regime. The first column reports the equilibrium allocation when there are prohibitive tariffs and no expectation of a policy reversal. In the second column, government policy is the same as under protection, but agents think that there is a 5 percent chance of trade liberalization. The last column corresponds to the allocation under free trade.

Table 11a. Simulation Results for Aggregate Variables

	Certain Protection	Uncertain Protection[a]	Free Trade
GDP	100	76	173
TFP	100	86	115
K	100	76	251
K Share	0.452	0.549	0.446
GDP_0		88	181
TFP_0		99	93

[a] Five percent chance of trade reform.

The effect of the expectation of a policy reversal in this example is large and consistent with Argentina's 1975–90 experience. When λ increases to 5 percent, capital stock declines in all sectors, with aggregate capital stock falling by 24 percent. This confirms the intuition that expectations of policy reversals can generate large changes in relative prices that significantly reduce demand for capital when investment is irreversible.

The table shows that GDP, measured at market prices, drops by 24 percent when a 5 percent chance of trade reform is introduced. Gains from switching to a free trade regime are very large (due to the extreme assumptions on technology and international prices). If we fix relative prices at their certain protection levels, GDP falls by only 12 percent. The difference between the two measures of GDP is due to the fact that exports are used as the numeraire and the relative price of nontraded goods falls when the cost of capital increases. Total factor productivity is computed using an aggregate Cobb-Douglas technology with a capital share of 0.452, which is the capital share of the model economy under certain protection. The table shows that TFP at constant prices (as it is measured in the Argentine national income accounts) barely moves. These aggregate growth accounting experiments imply a 12 percent drop in output at prices of the certain protection regime, and the decline in capital per worker implies an 11 percent output drop. Thus the model performs well in explaining the decline in capital per worker but fails to account for the TFP fall observed in the data. The distortion introduced by the fact that the marginal product of capital is different across sectors is quantitatively unimportant. The simulated capital stock confirms this since the increase in λ induces a

fall in the capital stock that is roughly proportional across sectors. This exercise is available upon request from the authors.

The model does better in accounting for changes in labor allocation and relative prices. As in the basic growth model used earlier in the chapter, the interaction between the assumptions on technology and the declining capital stock per worker induces a labor reallocation similar to that observed in the data. In this simple experiment, the rise in capital costs caused by the increase in λ induces 12 percent of the workforce to move to the nontraded sector.

Table 11b. Simulation Results for Labor Allocation (%)

	Certain Protection	Uncertain Protection	Free Trade
l_x	11	9	62
l_m	12	9	0
l_i	30	2	0
l_n	47	59	38

Applying the shift-share analysis to the simulated data, we find that the within change induced by the increase in λ accounts for 56 percent of the output drop. The between effect and the interaction effects are both negative and account for the remaining 44 percent of decline in output per worker.

Price effects are summarized in Table 11c. As a result of introducing uncertainty, which reduces the capital per worker and detours resources to the nontraded sector, the product price falls 2 percent and real wages decline by 37 percent. Trade reform, on the other hand, induces a 50 percent rise in the relative price of good *n* and an increase in real wages of 117 percent. These price movements are consistent with the Argentine experience of the 1980s when labor and nontraded goods were cheap, and with the 1990s when their value increased.

Table 11c. Simulation Results for Price Effects

	Certain Protection	Uncertain Protection	Free Trade
p_n	85	65	100
w	26	16	35
p_i	114	101	100

Thus in this model uncertainty about government policies is responsible for all of the loss in output since nothing else changes. Expectations of policy reversals create a deleterious business environment that induces capital per worker to fall (since installed capital is hard to unbolt) and a labor reallocation toward the service sector.

Conclusion

This paper has examined Argentina's Great Depression of the mid-1970s and the 1980s in some detail. A standard Solow growth decomposition shows that factor accumulation explains only one-fourth of the lack of growth during this period. The rest remains unexplained. During 1975–90 there also was a tremendous reallocation of labor, with 20 percent of the labor force shifting from agriculture and manufacturing toward the service sector. We believe that a large jump in capital costs caused the observed drop in investment and contributed to the reallocation of labor.

The big puzzle is explaining why total factor productivity fell an average of 1.67 percent yearly for 15 years. In our view, the tremendous workforce reallocation that occurred may be related to the fall in productivity, thereby hiding the role played by low capital investment. We showed in an example that, absent other distortions, the change in employment structure observed in the data cannot account for the drop in TFP. Exploring the connection between these two phenomena remains a question for future research.

What caused the large rise in capital costs during this period? Our analysis shows that much of the jump can be explained by an increase in tariffs and nontariff barriers and the high interest rates that followed the default in the early 1980s. But even if one believes international lending ceased during this period, high local interest rates must still be explained. One reason could be the expectation of bank runs or the confiscation of deposits, which occurred twice during the 1980s. An alternative cause, which we explore in this chapter, is the anticipation of future capital losses. In this model capital losses are associated with a reversal in trade protection policy that triggers falling relative prices for imports.

Our simulations suggest that if investment is irreversible (putty-clay), small changes in expectations can prompt a large increase in capital costs. This could lead to a collapse in investment or at least to a significant drop in capital-labor ratios and a large reallocation to more labor intensive sectors, as observed in the data. Moreover our model predicts a substantial decrease in wages that partly compensates for the rise in capital costs, and is necessary to encourage investment. During the 1980s real wages did not fall as the model predicted, but investment collapsed. Meanwhile government employment rose. If the new employment helped brake falling wages, it may be partly responsible for the investment collapse.

The model we have considered is overly simplistic and obviously misses many important elements. Yet it provides a plausible alternative story to Kydland and Zarazaga's (2002) one-sector neoclassical growth model. Further work is needed to fill in the quantitative blanks and evaluate the story's merit.

APPENDIX

A. Estimates of Human Capital Growth

The following procedure was used to construct the human capital series. Using X_{it} to denote a vector of characteristics of worker i at time t, let

$$H_{it} = \beta X_{it} \qquad (A.1)$$

where β is a vector of weights estimated according to the procedure indicated below. H_{it} is a measure of the human capital of worker *i*. The population H_t is obtained by computing an average of the sample values H_{it}.

Data. All estimates were obtained using the household survey for the Federal District and Greater Buenos Aires area. The survey currently is held semiannually (in May and October). Only the October surveys were available for 1980–86. For the remaining years both surveys were used. An incomplete survey with no wage information was also available for 1974.

Estimates. The coefficients β were estimated through a wage regression, pooling all surveys available from 1980 onward. Sample selection was controlled by jointly estimating a participation equation (Heckman, 1979). Consistent standard errors were obtained using Greene (1981).

The following covariates were used in both participation and wage equations: age, dummies for sex and five schooling levels (Esc1–5: completed elementary, incomplete high school, completed high school, incomplete college, completed college), and dummies for each of the surveys.

Estimates for the human capital parameters in the ln wage equation are given in Table A.1.

Table A.1. Estimates of Human Capital Parameters

Variable	DF	Estimates	Standard Error	t Value	Pr > | t |
Intercept	1	4.51186	0.16029	28.15	< .0001
Age	1	0.01093	0.00021509	50.81	< .0001
Sex (male = 1)	1	0.68367	0.0341	20.05	< .0001
Esc 1	1	0.62498	0.05908	10.58	< .0001
Esc 2	1	0.74869	0.05288	14.16	< .0001
Esc 3	1	1.19538	0.07474	15.99	< .0001
Esc 4	1	1.29406	0.07494	17.27	< .0001
Esc 5	1	1.85703	0.09293	19.98	< .0001

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