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The Argentine Great Depression 1975-1990 [1]

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Abstract

In the period 1974-1990 Argentina's income per capita fell by 25%. A Solow growth decomposition shows that at most one quarter of this fall can be explained by a reduction in the capital/labor ratio. A study of labor reallocation shows that between 1973 and 1993 employment expanded the most in sectors with a declining output per worker and this reallocation of labor explains 44% of the fall in output per worker.

We argue that policies that increase the cost of capital may explain these observations. Consider a two sector model where capital/labor substitution is low in the tradable goods sector and high in the non-traded goods one. If the steady state capital stocks falls, labor flows from the tradable goods sector to the non-traded goods one, leading to a reduction in income per capita, productivity and wages. Thus, policies that increase the cost of capital have a direct effect on output through the fall in the capital stock and an indirect effect that operates through a reallocation of labor induced by the fall in investment.

KEYWORDS: Argentina, Growth Great Depressions, Irreversible Investment

JEL CLASSIFICATION CODES : E32, F43, N16, O4, O54

1. Introduction

In 1975 the Argentine economy enters in a deep depression that lasts for the following fifteen years. This episode followed 25 years of balanced growth, where per capita income expanded at and annual rate of 1.77% , with a stable sectorial distribution of employment. By 1990 income per capita was 23% below its 1975 value and output 40% below the 1935-1975 linear trend. Compared to the rest of Latin America and the United States, income per capita fell by 50%. In contrast to the previous period, the structure of employment changed considerably, as all net employment creation was concentrated in the service sector. In consequence, the share of employment in services increased by 20% of the labor force at the expense of employment in tradable goods. In the 1990's growth was restored.

Explaining the Argentine Great Depression of the late 70's and 80's is the focus of this paper. Due to its magnitude and persistence, the economic contraction experienced by the Argentine economy during the 1980's qualifies as one of the great depressions of the twentieth century (Kehoe and Prescott, 2002). Kydland and Zarazaga (2002) attempt an explanation 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 in the model. The exercise does pretty well in explaining the behavior of aggregate variables during the 1980's. A problem with this approach is that since everything is explained by total factor productivity that is exogenous in the model, we learn very little about the factors that led to the dismal economic performance of Argentina.

In this paper we revisit the evidence on growth in Argentina looking at aggregate data and also at sectorial national income data. At the aggregate level we expand Kydland and Zarazaga's growth accounting exercise, incorporating a new series for human capital that we

construct from household survey data. Qualitatively, results do not change much as we also find that most of the fall in output in the 1974-1990 period is accounted for by a fall in the Solow residual. The fall in capital per worker accounts for only 25% of the fall in output.

When we look at sectorial data we find that in the 1974-1990 period the composition of employment changed the most. The employment share in the service sector increased from 57% of the labor force in 1970 to 77% in 1993, while the employment share in manufacturing fell from 25.4% to 16.7% of the labor force and in agriculture from 17.5% to 6.7%. Although this type of resource reallocation towards the service sector (wholesale and retail trade and personal, community and social services) also took place in many developed economies, the one observed in Argentina was quite different: while in the developed economies the reallocation was associated with a rising relative price of services, the price was falling in Argentina. Moreover, output per worker in the service sector fell while employment increased. The employment reallocation in Argentina accounts for 44% of the decline in per capita output between 1973 and 1993, as shown in a shift-share decomposition of employment and output growth carried out in this paper .

The main hypothesis of this paper is that government policies in effect in the 1975-1990 period increased the cost of capital, that this increase in capital costs reduced capital per worker, and this in turn induced the labor reallocation. In order to obtain this last effect we assume that the elasticity of substitution between capital and labor is higher in the service industry. As a result, new entrants into 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 the cost of capital in the period we consider. Following a default on international debt, the 80's were a period of high interest

rates. Indeed, during the period 1983-90 the average interest rate on Argentine government liabilities was 22%, more than twice the rate for the 1991-97 period.[2] Capital costs were also high in Argentina as a result of tariffs and other trade barriers. Argentina's trade policy between 1950 and 2000 was very volatile and relied on several instruments: tariffs, quotas, export taxes, credit subsidies, etc. The paper provides an index of trade policy distortions that is a summary statistic for trade policy and data on the composition of imports and exports. This gives a proxy for the role of tariffs and quotas on the relative price of capital. Diaz Alejandro (1970) calculates a similar index of trade policy and argues that the distortive effect of protection on investment contributed to the slow relative growth of Argentina after the 1930's.

In addition to the direct distortionary effect of tariffs, we argue that uncertainty about future protection had a detrimental force on investment. To make this point, we present a model where 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 (non-traded 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 non-traded 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.

[2] These high rates may be also linked to macro instability and the strong fiscal deficits of the period.

2. Aggregate Growth Accounting.

In this section we present a standard Solow growth decomposition of the growth of output per worker in Argentina. Our main contribution relative to previous work is the introduction of a new series for human capital.

As it is standard we assume a constant returns to scale production function of the form

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

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

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

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 using Argentina's permanent household survey with the methodology described in section 8. The rest of the data used in the growth accounting exercise is from Kydland and Zarazaga (2000), who provide their own time series for the capital stock in Argentina and use data on the number of employed workers based on 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 previous section are depicted in the following table. The data on the growth of h in the 49-70 period is not available. In the period 1970-1974, h grew at an

average rate of 2.91% per year.

Table 1. Annual % Growth Rates

	Y/L	K/L	h	L
1949-74	1.77	3.26	-	1.69
1975-90	-1.09	-0.70	1.43	1.15
1991-97	4.35	2.12	0.63	1.85

The table shows that in the quarter century between 1949 and 1974 income per worker in Argentina grew at a rate of 1.77% per year, while there was substantial capital deepening. In the fifteen years following 1975 output and capital per worker fell significantly, and recovered in the 1990's.

A growth accounting exercise is performed in the next table. It uses the data reported in the previous 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%		

The growth accounting exercise indicates that the contribution of capital to the growth of output per worker explains 74% of growth in the first period with the remaining 26% attributed to the Solow residual (without human capital). If we assume that the growth

rate of H for the 1970-1974 is a good description of the accumulation of H since 1949, the estimate of the growth rate of total factor productivity for this period is -1.29% per year. In the second period output per worker fell at an average of 1.09% per year for 15 years. The depletion of the capital stock accounts for 26% of the decline. After controlling for the growth of the average level of human capital aggregate total factor productivity during this period fell at an average annual rate of 1.67%, 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% between 1975 and 1990. In the 1990's growth is restored with 19% of growth accounted for by the contribution of capital, 9% by the contribution of human capital, and the remaining 72% by the Solow residual.

A. Labor Reallocation and Output per Worker

The extent of sectorial reallocation of labor in the time period considered is substantial. The next table 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 seventies and eighties. According to Table I, 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 seventies and eighties.

Table 3. Employment Structure

	Agriculture 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 2 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.

To measure the extent of sectorial reallocation, we construct the following index:

$$R_{t,t+1} = \frac{1}{2} \sum_i |l_{it} - l_{it+1}| \,,$$

where l_{it} is sector i's share of total employment in period t. The reallocation index takes values between zero and one, where the extremes correspond, respectively, to no reallocation and to the case where all employment moves to a non pre-existing sector. An examination of the following table shows that the highest degree of reallocation occurred in the 70's and

80's, where growth rates were at the lowest.

Table 4. Reallocation Index

50-60	60-70	70-80	80-87	87-93	93-97
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.

$$y_t = \sum_i l_{it}\ y_{it},$$

where the subindex i represents each of the goods or groups of goods produced in the economy, $l_{it} = L_{it}/L_t$, $y_{it} = p_{i0}Y_{it}/L_{it}$, and p_{i0} represents the prices of a base year. The shift-share decomposition of this expression links the annual average rate of growth of output per worker between t and $t+n$ to changes in output per worker and in employment shares as shown below.

$$(2) \quad \frac{1}{n}\ln\frac{y_{t+n}}{y_t} = \frac{1}{n}\ln\frac{\sum_i l_{it}\ y_{it+n}}{\sum_i l_{it}\ y_{it}} + \frac{1}{n}\ln\frac{\sum_i l_{it+n} y_{it}}{\sum_i l_{it}\ y_{it}} + \frac{1}{n}\ln\frac{\frac{\sum_i l_{it+n} y_{it+n}}{\sum_i l_{it+n} y_{it}}}{\frac{\sum_i l_{i,t} y_{i,t+n}}{\sum_i l_{i,t} y_{i,t}}}$$

The first term on the right hand side measures the within change or shift component, which is a weighted average of the increase in total factor productivity, capital per worker and average

human capital in each sector as shown by

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

If there is balanced growth the within component should account for 100% of the change in output per worker. The second term in (2) 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 output per worker in each sector constant. If labor flows from sectors with low output per worker to sectors with a high output per worker this term is positive, and viceversa. The third term in (2) is an interaction effect, which is negative if there is a transfer of labor to sectors with relatively low rates of growth of output 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 1970's and in the 1980's.

[Insert table 5]

Table 5 shows the raw data used in the shift share analysis. The table shows the interaction between changes in the employment structure and changes in output per worker. The employment share of agriculture fell by 11% of the labor force while productivity showed significant gains. In manufacturing, employment fell by 8% of the labor force while productivity was roughly constant. The largest gains in employment shares occurred in wholesale and retail trade and in personal, community and social services, where output per worker experienced significant drops. Observe that in 1970 output per worker in the trade sector

was higher than in agriculture and manufacturing and this was no longer the case in 1980. It is also worth noticing that the personal, social, and community service sector grew considerably despite being the least productive in the economy. This sector includes government employment. The financial sector is small in terms of employment, but is important because it experienced dramatic falls in productivity.

Table 6. Shift Share Analysis

	Output per worker	Within Change	Between Change	Interaction
50-70	2.14%	2.11% (93%)	0.08% (4%)	-0.05% (-2%)
73-80	-2.50%	-1.40% (56%)	0.36% (-15%)	-1.46% (59%)
80-93	-0.59%	-0.33% (56%)	0.32% (-54%)	-0.57% (97%)
93-97	2.44%	1.07% (44%)	-1.84% (-75%)	3.21% (131%)

Note: Average annualized rates of growth (% of total change)

The table above gives the shift-share decomposition of productivity growth described in (2). The qualitative changes in output per worker mimic the pattern of changes in total factor productivity given in section 2, with positive growth until 1973, followed by negative growth in the late 1970's and in the 1980's, and again positive growth in the nineties.

The remarkable thing about the 1950-1970 period is that most of the change in output per worker is explained by the within component. Argentina during this period seems to have been in a balanced growth path. Capital deepening and growth in productivity accounts for most of the growth of the Argentine economy in this period.

In the twenty years following 1973 the growth of output per worker was negative and reallocation played an important role in reaching this result. Reallocation explains 44% of the fall in output per worker in 1973-1980 and 1980-1993 sub-samples. The combined effect

of reallocation induced an average annual fall in output per worker of 1.1% per year in the period 1973-1980. For the 1980-1993 period output per worker fell at an average annual rate of -0.59%, of which -0.26% (or 44% of the total change) is due to reallocation effects. Thus, for the period 1973-1993, 44% of the change in output is accounted for by reallocation effects. This number is significantly larger than the 25% attributed to capital in the aggregate growth accounting exercise.

Most of the within decrease of output per worker in the late seventies and eighties is explained by a fall of 2/3 in the retail trade sector productivity and a fall of 1/3 in the productivity of community, social and personal services. These sectors increased their share of employment from, respectively, 11% and 24% of the labor force in 1970 to 20% and 32% in 1987. The large negative value of the interaction term is capturing the fact that the service sector absorbed a large fraction of the labor force while output per worker in that sector fell.

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

In order to gain an international perspective on the shift-share ana;ysis and compare the Argentine case with other countries, table 7 presents data for Chile, Mexico, Canada, Finland, Italy, Norway and the United States. These sample contains all the OECD and Latin American countries for which we could obtain the data. The international comparison, especially with OECD countries is interesting because in these countries also experienced significants changes in the composition of the labor force with about 20% of the labor force moving to the service sector. The table, however, shows that the Argentine case is quite

different.

Table 7. Shift Share Analysis. International Comparisons

	Chile			Canada		
	Output per Worker	Within Change		Output per Worker	Within Change	
70-75	-1.34%	-1.34%	(100%)	0.92%	0.56%	(61%)
75-80	3.38%	3.63%	(107%)	0.60%	0.42%	(71%)
80-86	-0.99%	-0.57%	(58%)	1.42%	1.43%	(101%)
86-90	2.27%	1.57%	(69%)	0.21%	0.10%	(49%)
90-95	4.85%	4.45%	(92%)	1.34%	1.41%	(105%)
	Finland			Italy		
	Output per Worker	Within Change		Output per Worker	Within Change	
70-75	3.64%	2.38%	(66%)	2.53%	1.43%	(57%)
75-80	2.66%	2.13%	(80%)	2.82%	1.89%	(67%)
80-85	2.51%	2.12%	(84%)	1.49%	0.16%	(11%)
85-90	3.10%	2.62%	(85%)	1.97%	1.16%	(59%)
90-95	3.33%	3.33%	(100%)	1.84%	1.55%	(85%)
	Mexico			Norway		
	Output per Worker	Within Change		Output per Worker	Within Change	
70-75	2.60%	2.34%	(90%)	3.16%	2.16%	(69%)
75-80	1.24%	1.47%	(118%)	2.06%	1.71%	(83%)
80-85	0.37%	0.17%	(47%)	2.23%	1.69%	(76%)

The table shows that the only cases in which the reallocation component of the shift-share analysis is important are Chile 80-86 and the United States 75-80. The Chilean case was similar to Argentina's since it was a period of a deep recession in which output and capital per worker were falling. The reallocation effect accounts for 42% of the 1% per year decline in output per worker. In the case of the United States 75-80 output per worker grew at an annual rate of 0.19%, the within change was negative (productivity slowdown) and the reallocation effect was of 0.45% per year. Thus, the reallocation effect in the late 70's had a positive effect.

Another key difference between the reallocation of labor in Argentina and in developed countries is that while in Argentina the relative price of services fell while labor in services was growing, in the developed countries it increased.

3. The behavior of prices

In order 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.

A. The real exchange rate

In figure 3 we plot the real exchange rate measured as $e = \left(CPI^{\mathrm{ARG}}/CPI^{\mathrm{US}}\right)\ E$, where CPI^{i} denotes de consumer price index in Argentina and in the United States and E denotes de nominal exchange rate. This definition of the real exchange rate is a proxy for the relative price on non-traded goods. For the purpose of studying the real exchange rate we will break the sample into the sub-periods 1959-1974, 1982-1988 and 1991-2001. We observe that the real exchange rate fell almost 20% in the 1980's with respect to its value in the 60's and early 70's, and that it rose by 56% in the 90's. In the sub-periods 75-81 and 89-90 the

real exchange rate was extremely volatile due to a temporary opening of the economy in the late 70's and an hyperinflation at the end of the 80's.

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 = $(CPI^{\text{ARG}}/CPI^{\text{US}}$ Exchange Rate

B. Interest rates

Throughout the second half of the twentieth century the Argentine economy experienced repeated violations of creditor's property rights. In the period up to 1977, ceilings on interest rates 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 where part of the import-substitution industrialization policy. In 1977 financial markets were liberalized with the resulting increase in real interest rates. Real interest rates further increased 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 a tricky business. For the period 1983-1997 we use the measure of interest rates in

Alvarez-Neumeyer (2000), which was successfully used to explain Argentine business cycles in Neumeyer-Perri (1999). The average interest rate for the period 83-90 was 22% per year, and for the period 91-97 it was 10%.

C. The relative price of imports and exports: Trade Policy

The protectionist policies of last century relied on a complicated battery of instruments. The next two sections provide a summary measure of protection through a trade policy index that captures the joint effect of these policies on the relative price of imported goods, and an evaluation of the impact of these trade policies effect on the cost of capital and on investment.

Argentine Trade Policy: 1950-2000

During the period extending from 1950 to 1976 Argentina's development strategy was import substitution industrialization. This development strategy started in the 1930's and was reenforced in 1943. Economic policy served this development strategy through the use of commercial policy, exchange rate controls, the tax structure and credit subsidies. In the first stage these policies stimulated the creation of industries that substituted imports of final goods, and in later stages they protected intermediate inputs and capital goods, including cars, steel, and petrochemicals. In the period 1976-1981 there was a brief trade liberalization followed by protectionist policies in 1981-1991. The dismantling of the protectionist regime of the 1980's started in 1988 and consolidated in the 1990's. 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.

Import substitution policies included a battery instruments to induce resources to

flow to import competing industries. These policies included export taxes, price ceilings on exportable goods, import tariffs, quantitative restrictions on imports, export subsidies for non-traditional exports, multiple exchange rates with higher rates for imports and "non-traditional" exports and lower rates for exportable goods, credit subsidies that favored import competing industries.

The following table on the composition of exports shows that Argentina exports mainly agricultural goods. The share of agriculture in total exports was 93% in 1963, 85% in 1970 and 71% in 1980. Moreover, after over 40 years of import substitution only 23% of exports involved manufactured goods in 1980.

Table 9. Composition of Exports

	Agric 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 the distortive policy interven-

tions will be summarized by the trade policy index (TPI)

$$\begin{aligned} \text{trade policy index} &= \frac{\frac{\text{Domestic Price of Imported Goods}}{\text{Domestic Price of Agricultural Goods}}}{\frac{\text{International Unit Price of Imports}}{\text{International Unit Price of Exports}}} \\ &= \frac{E_m\left(1+\tau_m\right)}{E_x\left(1+\tau_x\right)}, \end{aligned}$$

where E_m/E_x is the ratio of the exchange rate applicable to producers of goods m and x, when there are multiple exchange rates. This is our preferred strategy for measuring trade policies, which looks directly at relative prices.

The blue line in figure 4 on trade policy and relative prices shows the value of this index for the period 1956-1999. The index shows that despite the apparent volatility of trade policies during the 1950's and 1960's the trade policy index remained fairly stable. This changed on the 1974-76 period due to the imposition of quantitative restrictions, export taxes and multiple exchange rates in 1974-1976. Figure 4 also shows the short lived trade liberalization experiment of 1977-1980, the strongly protectionist policies of the 1982-1989 period, and the trade liberalization of the 1990's. According to the trade policy index the level of protection of the 1990's is similar to that of the 1950's and 1960's. This is at odds with the data in table on the composition of imports that shows a significant rise in the imports of consumption goods and with the data on legal tariffs in the table on Legal Tariffs. A possible explanation is that since in the 1990's the share of agricultural goods in exports fell to 52% due to the increase in the exports of oil and manufactured goods, the index is measuring the price of exports with error.

The pink 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.

Summary of facts

In the period 1950-1975 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 in the growth process. Prices during this period were relatively stable as shown by the real exchange rate and the trade policy index.

In the period 1975-1990, output per worker falls at an annual average rate of 1.09% per year.Argentine income per capita fell 50% relative to the United States and the rest of Latin America. This growth implosion was driven by a fall in capital per worker of 0.7% per year and by a puzzling fall in total factor productivity of 1.67% per yearon average. Human capital during this period was 1.43% per year. The analysis of labor reallocation shows that there was a considerable reallocation of labor during this period, from sectors with growing output per worker to sector in which output per worker as falling. These movements in the labor force account for 44% of the fall in output per worker in this period. During this period, the cost of capital, measured through interest rates and through the relative price of investment goods was higher then in the other two periods. The relative price of services on the other hand was lower and more volatile than in the preceeding and following periods. Our measure of protection, the trade policy index, was higher and much more volatile than

in the other periods.

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

4. Capital Stagnation and Reallocation

The previous section shows that during the Argentine great depression the capital stock fell, all the new entrants into the labor force were employed in the service sector and the relative price of services fell. In this section we provide a simple model to interpret these facts.

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

The easiest way to illustrate this point is to consider an economy with two goods: $T$and N, preferences described by $U = \mu \ln T + (1-\mu) \ln N$ and technology is described by

the functions:

$$
\begin{aligned}
(3) \quad Y_T &= \phi \min\left(a_T K_T, L_T\right) \\
Y_N &= A_N \; K_N^{\alpha_N} L_N^{1-\alpha_N},
\end{aligned}
$$

where $T$and N denote the production and consumption of goods $T$and N, K_i denotes capital employed in sector i, L_i 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

$$
\begin{aligned}
L_T &= a_T K_T \\
L_N &= L - a_T K_T,
\end{aligned}
$$

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

$$
\begin{aligned}
\frac{p_N}{p_T} &= \frac{1-\mu}{\mu} \frac{\phi a_T K_T}{A_N \; K_N^{\alpha_N} \left(L - a_T K_T\right)^{1-\alpha_N}} \\
\frac{w}{p_T} &= \left(1-\alpha_N\right) \frac{1-\mu}{\mu} \frac{\phi a_T K_T}{L - a_T K_T} \\
r &= \alpha_n \frac{1-\mu}{\mu} \frac{\phi a_T K_T}{K_N}.
\end{aligned}
$$

Observe that, for a given capital stock, an increase in the labor force results in a fall 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

$$\begin{aligned}\frac{d\log\left(p_N/p_T\right)}{d\log L} &= -\left(1-\alpha_N\right)\frac{L}{L_N}\\ \frac{d\log\left(w/p_T\right)}{d\log L} &= -\frac{L}{L_N}.\end{aligned}$$

This simple equations show that in an economy with the technology (3), if the capital stock is fixed, an increase in the labor force will induce a fall 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

$$\begin{aligned}\frac{\Delta y}{y} = &\underbrace{\left(\frac{p_T\ Y_T}{Y}\frac{\Delta y_T}{y_T}+\frac{p_N\ Y_N}{Y}\ \frac{\Delta y_N}{y_N}\right)}_{\text{within}}\\ &+\underbrace{\left(\frac{\Delta l_T}{l_T}\ \frac{p_T\ Y_T}{Y}+\frac{\Delta l_N}{l_N}\ \frac{p_N\ Y_N}{Y}\right)}_{\text{between}}\\ &+\underbrace{\left(\frac{p_T\ Y_T}{Y}\ \ \frac{\Delta l_T}{l_T}\ \frac{\Delta y_T}{y_T}+\frac{p_N\ Y_N}{Y}\ \frac{\Delta l_N}{l_N}\frac{\Delta y_N}{y_N}\right)}_{\text{interaction}}.\end{aligned}$$

An increase in the labor force with a given capital stock will result in a negative within term equal to $-\frac{p_N\ Y_N}{Y}\ \alpha_N\ L/L_N\ \hat{L}$. The between term will be equal to $\left(\frac{p_N\ Y_N}{Y}-\frac{p_T\ Y_T}{Y}\right)\left(1-L_N/L\right)\ \hat{L}$, which is positive as the service sector of the economy is larger than the tradable one. The interaction term will be $-\frac{p_N\ Y_N}{Y}\ \alpha_N\ L/L_N\left(L/L_N-1\right)\ \hat{L}$. Using 1970 data $p_N\ Y_N/Y = L_N/L \simeq$

0.57 and $\alpha_N = 0.7$ 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% of the change in output per worker, are qualitatively consistent with the data in table (shift-share), where the within term accounts for 56% 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].

5. Why did the stock of capital per worker fall?

In previous sections we documented the rise in interest rates and the increased protection experienced during the 1975-1990 period. Here, we evaluate their impact on the stock of capital per worker using the framework of the standard Neoclassical growth model.

A. The rise in interest rates

The effect of changes in the relative price of investment goods and in the interest rates is calculated with the methodology described in Hopenhayn and Neumeyer (2000). The expression for the equilibrium capital stock implies that the elasticity of the capital stock with respect to the interest rate is

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

[3] $\frac{\Delta Y}{Y} = (1-\alpha)\frac{1-\mu}{L_N/L}\hat{L}$ and $\frac{wL}{Y} = (1-\alpha)\frac{1-\mu}{L_N/L}$

The average interest rate for the period 83-90 was 22% per year, and for the period 91-97 it was 10%. As this is also the interest rate that Kydland and Zarazaga calibrated for Argentina's steady state, we assume that before 1974 Argentina's rate was also 10%. Following Kydland and Zarazaga we set the depreciation rate at 9%. Using these parameter values the elasticity of the capital labor ratio with respect to the interest rate in the mid seventies was 0.17. This implies that an increase in the interest rate of 100% should result in a fall of the capital stock of 17%. As the index of the capital labor ratio in 1991 was 34% lower than the average value for the 1962-1984 period (39% lower than its 1981 value) we conclude that interest rates explain up to 50% of the decline in Argentina's capital labor ratio. The value of the elasticity in the 1980's when interest rates where around 20% is -0.3, and hence the effect of a fall in the interest rate of 50% would induce a rise in the capital labor ratio of 15%, which is actually very close to the 13% 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

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

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 1974-1990 period were twice the ones in the 1960-1974 period. This is inferred from the doubling of protection implied by the trade policy index in figure 4, which can also be seen in the following table.

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% in 1973 to 20% 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 and the estimated fall induced in the capital labor ratio in these sectors by the increase in tariffs is 15%. As services and primary products account for about 2/3 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%.

There is still a 10% fall in the capital stock that needs to be explained. Potential candidates to explain this are higher export taxes (small because 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.

6. Uncertain Protection, Growth and Resource Allocation.

In this section we sketch a model that tries to capture what we think are essential features of the Argentine economy that will help us to understand the *Great Depression* of the 80's. We need to explain the fall in aggregate output per worker, why capital per worker fell and why the share of employment in sectors with falling productivity increased and why it declined in sectors with rising productivity. This is the model that we will use 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. The model we use departs from the neoclassical model in several dimensions: (i) it assumes that investment is irreversible, (ii) it assumes that protectionist policies may become unsustainable, so agents expect that a trade liberalization will occur[4], and (iii) it assumes that there is less substitutability between factors of production in the tradable sector than in the non-tradable one.

The irreversibility of investment combined with the expectation of a trade reform imply that the cost of investment should also include an option value of waiting that captures the expected capital loss of installed capital arising from a trade liberalization. In the protected sectors a move towards 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

[4]In particular, we consider the effect of increasing the probability of a drastic change in trade policy that would bring and end to protection. It is interesting to note that the 90's were indeed a period where protection was substantially decreased in many Latin American economies. Moreover, Argentina had already experienced in the mid-seventies a period of substantial tariff reductions and currency appreciation that lowered considerably the price of imports.

if freely imported after the reform. We show that the effects of these two assumptions can be significant.

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

$$\begin{aligned} x &= \min\left(a_x\ K_x, l_x\right) \\ m &= \phi_m \min\left(a_m\ K_m, l_m\right) \\ i &= \phi_i \min\left(a_i K_i, l_i\right) \\ n &= A_n\ K_n^{\alpha}\ l_n^{1-\alpha}. \end{aligned}$$

Tradable goods are produced with a Leontieff technology while services are produced with a Cobb-Douglas one. The idea is that in the non tradable sector -mainly services- there is more scope of substituting labor for capital. As a result, if the desired capital stock falls in the tradable sectors, labor will flow from these sectors to the non traded sector. As the marginal product of labor is decreasing in labor and capital in this sector falls, output per worker in the non-traded sector falls. Therefore, this flow of resources shows up as a negative interaction term in the shift-share decomposition presented in (2).

The capital accumulation technology is

$$(4) \quad \dot{K}_j(s_t) = i_j(s_t) - \delta K_j(s_t) \quad \text{for all } j = x, m, n, i$$

$$(5) \quad i_j(s_t) \geq 0 \quad \text{for } j = x, m, n, i$$

where K_j is the stock of capital in sector j and δ is the instantaneous rate of depreciation. The non-negativity of investment is capturing the irreversible nature of investment mentioned above.

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 to restrict the technological parameters to satisfy

$$\begin{aligned} \phi_m &< 1 + \left(\frac{1}{a_m} - \frac{1}{a_x}\right)(r + \delta) \\ \phi_i &< 1 + \left(\frac{1}{a_i} - \frac{1}{a_x}\right)(r + \delta) \end{aligned}$$

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 will assume that tariffs are prohibitive. The domestic price of imported goods is

$$1 \leq p_m \leq 1 + \tau_m \text{ and } 1 \leq p_i \leq 1 + \tau_i.$$

The expectation of a trade reform under protection implies that the protectionist policy is uncertain since tariffs may be removed. Denote the state of the economy by s, with

$$s = \begin{cases} P \text{ if there is protectionism} \\ F \text{ is there is free trade} \end{cases}$$

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

$$E\left[\int_0^{\infty} u\left(x\left(s_t\right), m\left(s_t\right), n\left(s_t\right)\right) e^{-r\,t} dt\right]. \tag{6}$$

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

The private sector's problem is to maximize (6) subject to the capital accumulation (4) and irreversibility (5) constraints, the household's budget constraint

$$\begin{aligned} \dot{b}\left(s_t\right) &= r\left(s_t\right) b\left(s_t\right) + a_x K_x\left(s_t\right) + p_m\ \phi_m a_m K_m\left(s_t\right) + p_n\left(s_t\right)\ f\left(K_n\left(s_t\right), l_n\left(s_t\right)\right) \\ &\quad + p_k\left(s_t\right)\ \left[\phi_i a_i K_i(s_t) - \left(i_x\left(s_t\right) + i_m\left(s_t\right) + i_n\left(s_t\right)\right)\right] + \tau \\ &\quad - \left[x\left(s_t\right) + p_m\left(s_t\right) m\left(s_t\right) + p_n\left(s_t\right) n\left(s_t\right)\right] \end{aligned} \tag{7}$$

and the labor constraint

$$0 = l - a_x K_x\left(s_t\right) - a_m K_m\left(s_t\right) - a_i K_i\left(s_t\right) - l_n. \tag{8}$$

The first constraint (7) is the household's budget constraint. 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, $l_x = a_x k_x(s_t)$, $l_m = a_m k_m(s_t)$ and $l_i = a_i K_i(s_t)$.

The government budget constraint is

$$\tau = \tau_m \max\left[\left(m - \phi_m a_m k_m(s_t)\right), 0\right] + \tau_i \max\left[\left(i - \phi_l l_i\right), 0\right]$$

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 non-traded goods sector aggregate consistency requires

$$n(s_t) = f\left(K_n(s_t), l_n(s_t)\right).$$

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]

$$\begin{aligned} r + \delta &= a_j \left(\phi_j \ - w^F \right) \text{ under free trade and} \\ (r + \delta)\, p_i^P &= a_j \left(p_j^P \ \phi_j \ - w^P \right) + \lambda \left(\frac{u_x^F}{u_x^P} - p_i^P \right) \text{ under protection.} \end{aligned}$$

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

$$\begin{aligned} r + \delta &= p_n^F \, \frac{\alpha A_n}{k^{1-\alpha}} \text{ under free trade and} \\ (r + \delta)\, p_i^P &= p_n^P \, \frac{\alpha A_n}{k^{1-\alpha}} + \lambda \left(\frac{u_x^F}{u_x^P} - (1 + \tau_i) \right) \text{ under protection,} \end{aligned}$$

[5] Outside of steady state the foc are

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

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 is

$$p_n^s\,(1-\alpha)\,A_n\;k_n = w^s.$$

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

We solve the model for a steady state with positive investment.

Results.

We have performed some preliminary experiments with this model to check its potential to shed light on the Argentine experience. The experiment we perform is to compare the steady state of the economy with protection and no probability of a trade reform, to the steady state of an economy with a probability of 5% of a trade reform and with an economy with free trade. The emergence of uncertainty about the stability of the protectionist regime is one way of introducing a higher cost of capital. The probability of 5% of a trdae reform implies that the expected time for the trade reform to ocur is tenty years.

We calibrate the model so that the risk free interest rate is 5%, the capital share in the production of the exported good is 0.65%, which accords with the labor share of agriculture in Argentina. For the import competeing consumption good 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 an excess cost in the m sector of 50% and an excess cost in the i sector of 45%. The labor share in the n sector is set to 2/3 and $A_n = 1/2$. The utility function is set to $u = 0.3\log x + 0.2\log m + 0.5\log n$.

Table 11a. Simulation Results: Aggregate Variables			
	Certain Protection	Uncertain Protection	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

The first table shows how aggregate variables react to the higher cost of capital created by the uncertainty about the survival of the protecionis 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% chance of a trade liberalization. The last column corresponds to the allocation under free trade.

The effect of the expectation of a policy reversal in this example is large and consistent with the Argentine 1975-1990 experience. When λ increases to 5% the capital stock declines in all sectors, with the aggregate capital stock falling by 24%. This confirms the intuition that expectations of policy reversals can generate large changes in relative prices that significantly reduce the demand for capital when investment is irreversible.

The table shows that GDP, measured at market prices, drops by 24% when a 5% chance of a trade reform is introduced. The gains of 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%. The difference between the two measure of GDP is due to the fact that we are using exports as the numeraire and the relative price of non-traded 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. The implications of these aggregate experiments for growth accounting are that, at prices of the certain protection regime, output falls by 12% and the fall in the capital per worker implies an 11% drop in output. Thus, this model does well in explaining the fall in capital per worker but does not account for the fall in TFP observed in the data. The distortion introduced by the fact that the marginal product of capital is different accross sectors is not quantitatively important[6].

The model does better in terms of accounting for the changes in the allocation of labor and in relative prices. As in the simple model in section 5, the interaction between the assumptions on technology and the fall in the capital stock per worker induces a labor

[6] The simulated capital stock confirms this as the increase in λ induces a fall in the capital stock that is, roughly, proportional across sectors.

Steady State Capital Stock			
	Certain Protection	Uncertain Protection	Free Trade
K_x	38	30	216
K_m	20	16	0
K_i	13	10	0
K_n	29	20	35
K	100	76	252

reallocation similar to that observed in the data. In this simple experiment, the increase in the cost of capital caused by the increase in λinduces 12% of the labor force to move to the non-traded sector.

Table 11b. Simulation Results: 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 is accounts for -56% of the drop in output. The between effect and the interaction effects are both negative and account for the remainder 44% of the fall in output per worker.

The price effects are summarized in the next table. As a result of the introduction of uncertainty, which reduces the capital per worker and deviates resorces to the non-traded sector, the price of this good falls 25% and real wages fall by 37%. The trade reform, on the other hand, induces a rise of 50% in the relative price of good n and a rise in real wages of 117%. These price movements are consistent with the Argentine experience of the 1980's when labor and non-traded goods were cheap and with the 90's when their value increased.

Table 11c. Simulation Results: Price Effects

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

To conclude, 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 towards the service sector.

7. Final Remarks

This paper has examined Argentina's Great Depression of the 80's in some detail. A standard Solow growth-decomposition shows the factor accumulation explains only one fourth of the lack of growth during this period. The rest remains unexplained. During the 1975-1990 period there also was a tremendous reallocation of labor shifting 20% of the labor force from agriculture and manufacturing towards service sectors. We believe that a large increase in the cost of capital during this period caused the observed fall in investment and contributed to the reallocation of labor.

The big puzzle is to to explain why total factor productivity fell at an average rate of 1.67% per year for fifteen yeras. Our view on this matter is that the tremendous reallocation that took place during this period may be related to the fall in productivity and, therefore,

hide the role played by low capital investment. We showed in an example that, in the absence of other distortions, the change in the structure of employment observed in the data cannot account for the fall in total factor productivity. Exploring the connection between these two phenomena remains a question for future research.

What caused the large increase in the cost of capital during this period? As shown by our analysis, it can be explained to a large extent by an increase in tariffs and non-tariff barriers and high interest rates that followed the default in the early 80's. But even if one believes international lending came to an end during this period, high local interest rates are still to be explained. One possible explanation could come from expectations of bank runs or the confiscation of deposits, which occurred twice during the 1980's. An alternative cause which we explore in the paper, is lead by expectations of future capital losses. In the model presented, such capital losses are associated to a reversal in trade protection policy and the resulting fall in the relative price of imports.

Our simulations suggest that if investment is irreversible (putty-clay), small changes in expectations can give rise to a large increase in capital costs. This could lead to a collapse in investment or at least a significant fall in capital/labor ratios and a large reallocation to more labor intensive sectors, as observed in the data. Moreover, our model predicts a substantial fall in wages which partly compensates the rise in capital costs, which is necessary to encourage investment. During the 80's, real wages did not fall as predicted by the model but investment collapsed. At the same time, government employment increased. If such employment creation served to contain the fall in wages, then it may be partly responsible for the investment collapse.

The model we have considered is overly simplistic and obviously misses many impor-

tant ingredients. But it provides a plausible alternative story to Kydland and Zarazaga's (2002) one sector neoclassical growth model. Further work is needed to evaluate the quantitative merit of this story.

8. Appendix A. Estimates of human capital growth

The following procedure was used to construct the human capital series. Letting X_{it} denote a vector of characteristics of worker i at time t, let $H_{it} = \beta X_{it}$ 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 is currently held twice a year (may and October.) Only the October surveys were available for the years 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 onwards. Sample selection was controlled by jointly estimating a participation equation, as in Heckman (1979). Consistent standard errors were obtained using the method in Greene (1981),

The following covariates were used in both, participation and wage equations: age, dummies for sex and 5 schooling levels esc1-esc5 (completed elementary , incomplete high school, completed high school, incomplete college, complete college) and dummies for each of the surveys.

Estimates for the human capital parameters in the ln wage equation are given below:

Table 12. Estimates of Human Capital Parameters

Variable	DF	Estimate	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
Esc1	1	0.62498	0.05908	10.58	<.0001
Esc2	1	0.74869	0.05288	14.16	<.0001
Esc3	1	1.19538	0.07474	15.99	<.0001
Esc4	1	1.29406	0.07494	17.27	<.0001
Esc5	1	1.85703	0.09293	19.98	<.0001

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TABLE I: LABOR ALLOCATIONS AND OUTPUT PER WORKER: ARGENTINA 1950-1997

	Agriculture		Mining		Manufacturing		Electricity, Gas, Water		Construction	
	Share of Labor	Output per worker	Share of Labor	Output per worker	Share of Labor	Output per worker	Share of Labor	Output per worker	Share of Labor	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

	Wholesale and Retail Trade, Restaurants, and Hotels		Transport, Storage and Communications		Banking, Insurance and Real Estate		Community, Social and Personal Services		Output per worker
	Share of Labor	Output per worker	Share of Labor	Output per worker	Share of Labor	Output per worker	Share of Labor	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

Note: NIPA accounts at prices of 1960, 1970, 1986, and 1993.
There is no labor data by sectors for the periods 1974-1979 and 1988-1992.
The sum of value added per sector at 1993 prices is 94% of GDP.

Figure 1. The Argentine Economy 1950-2002

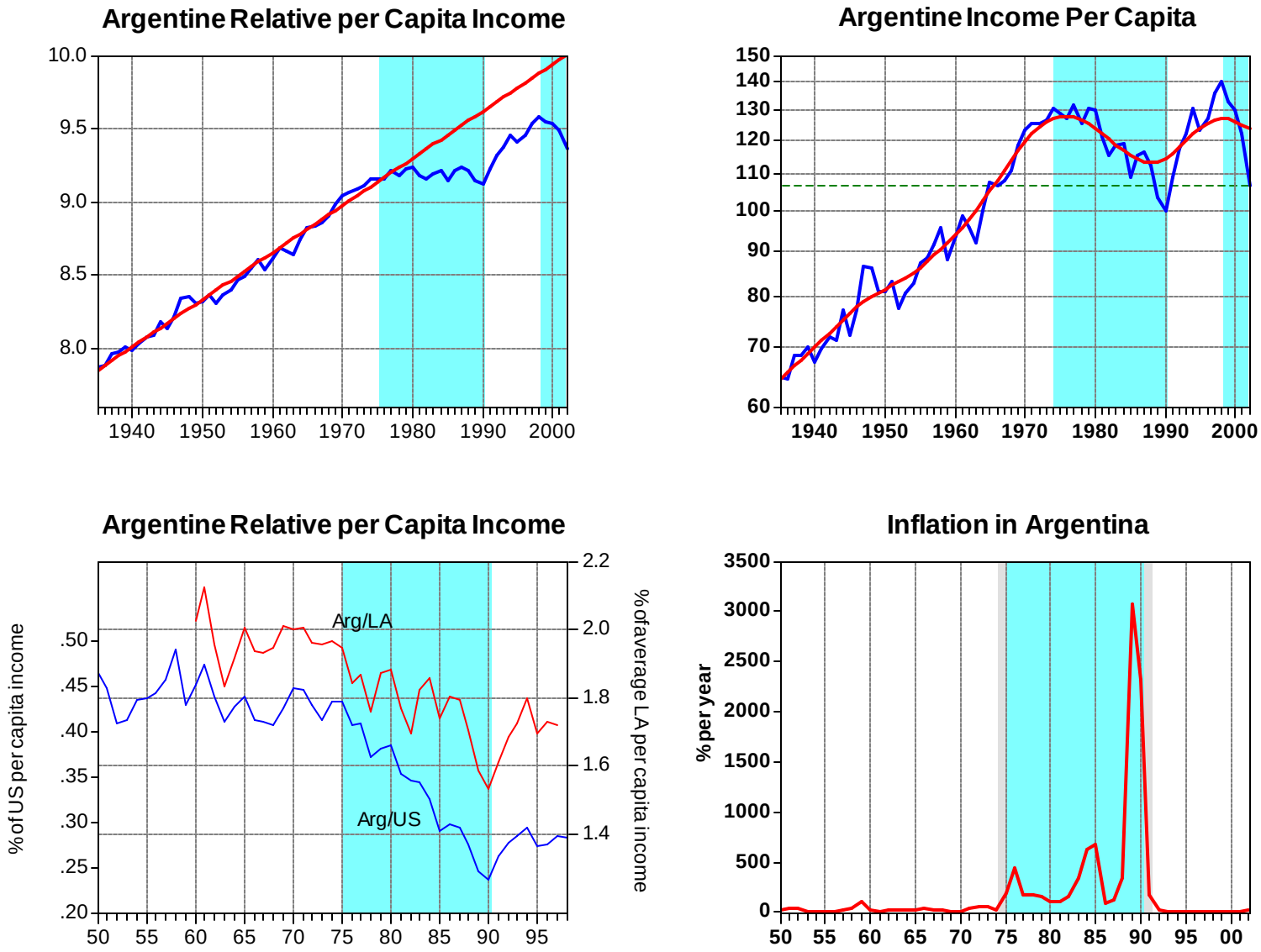


Figure 2. Employment by Sector

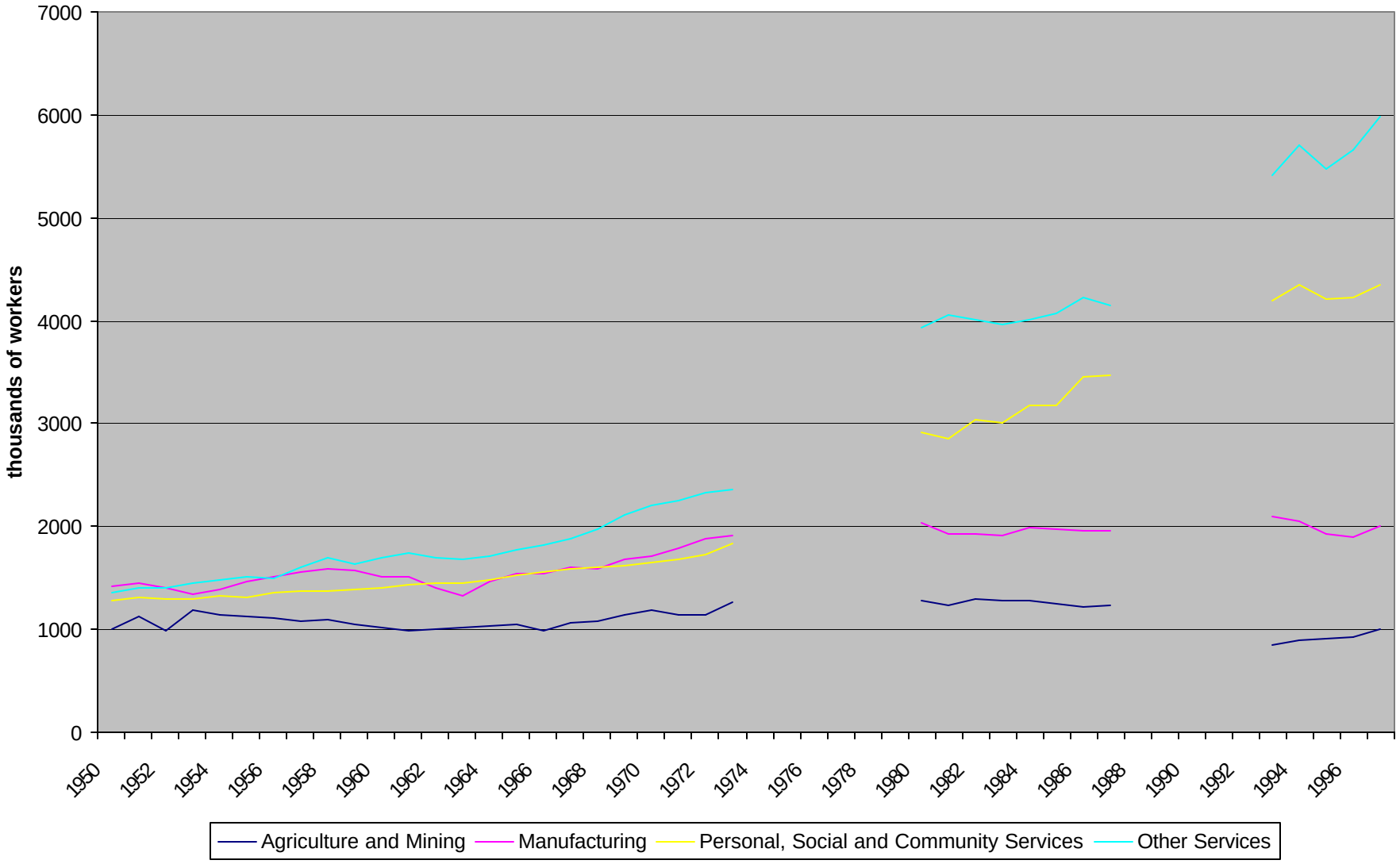


Figure 3. Relative Price of Services

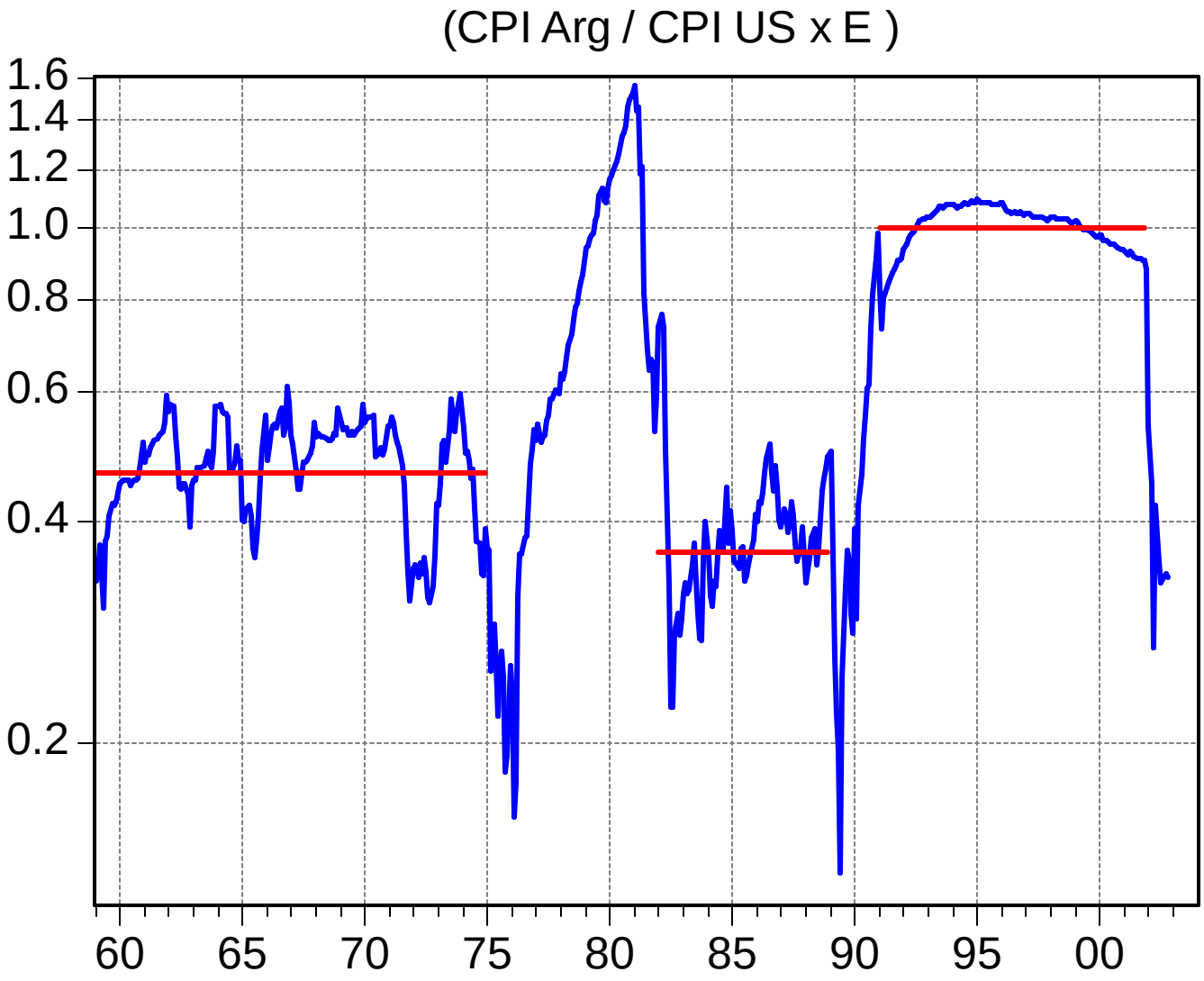
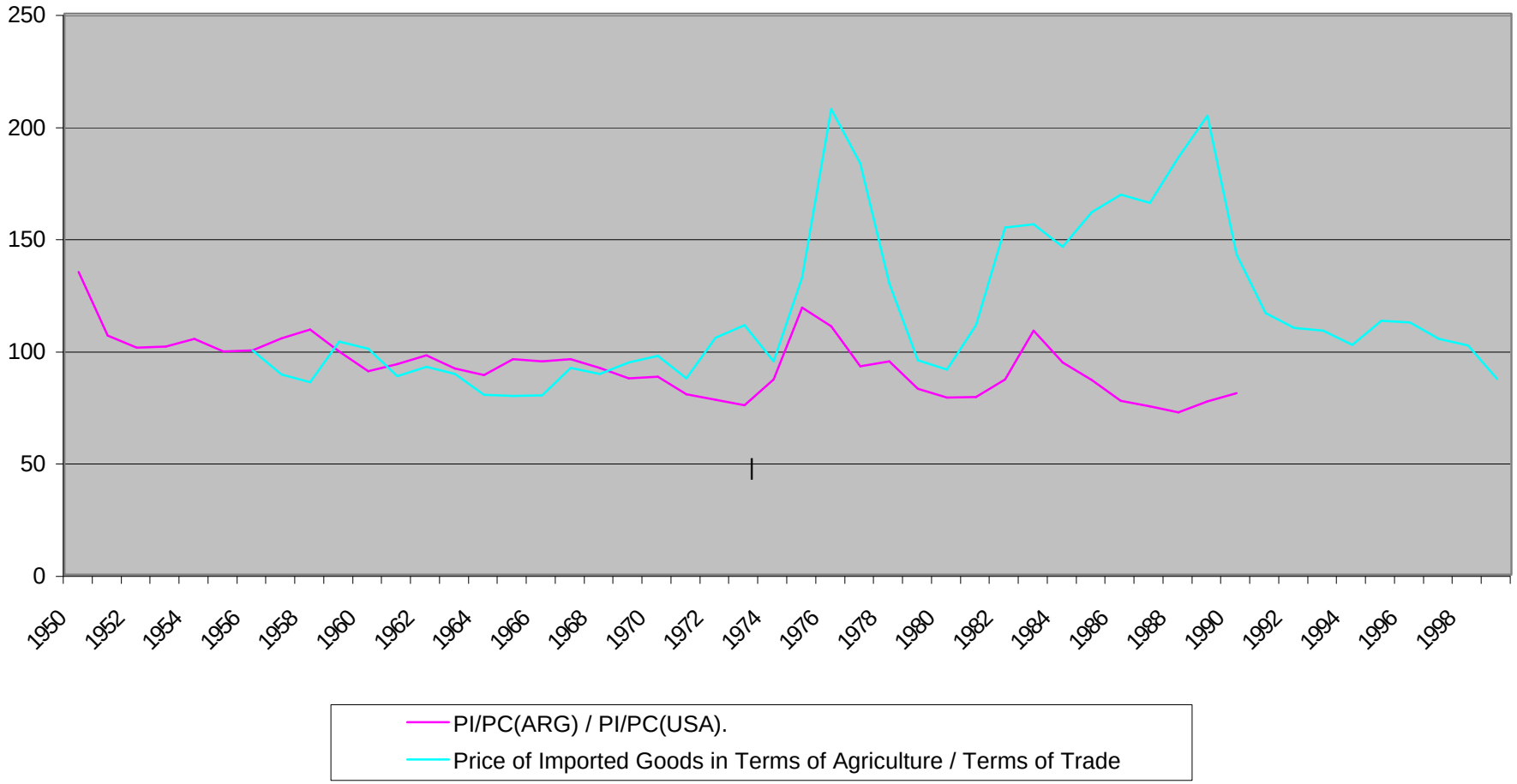


Figure 4. Trade Policy Index and Relative Price of Investment Goods



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)