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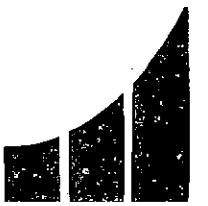

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THE CASE OF COLOMBIA

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1. Introduction

The pace of structural reforms in Latin America has been remarkable in the 1990s. Most countries have substantially reduced tariff and non-tariff protection while sub-regional free trade agreements have been signed at an unprecedented pace. Capital account transactions, especially in relation to foreign investment, have been liberalized. In some cases, reforms to paternalistic labor regimes have made labor markets more flexible. Privately-operated fully-funded social security regimes have replaced (or compete with) inefficient pay-as-you-go public systems. In a few countries, reforms have included the provision of health and education.

Without exception structural reforms have been motivated by the disenchantment with the economic and social performance during the past 15 years. In most countries, economic growth slowed down during the 1980s as a result of the collapse in investment and total factor productivity (TFP). Unemployment rates were rising and (where present) improvements in income distribution and other social indicators were regarded as unsatisfactory. The allocation of education and health perpetuated the vicious circle of inequality and poverty.

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Perhaps no other country has adopted the reform package as rapidly and comprehensively as Colombia[2]. Since 1990 a series of new laws drastically modified the regimes related to trade, foreign exchange, foreign investment, labor, social security, and health. In all cases, reforms reduced the presence of administrative controls and increased the role of markets in the allocation of resources. Moreover, in addition to efficiency considerations the reforms were intended to correct perverse effects on inequality generated by the existing legislation[3].

Based on Colombia's experience, this paper analyzes the initial effects on equity and efficiency of structural reform. Although it is still too early to reach a definite conclusion, the preliminary evidence could be of interest for other countries involved in reform initiatives. Neither growth nor TFP resumed immediately after reform. However, the removal of barriers to trade and foreign investment, as well as the reduction in the user cost of capital, spurred a substantial increase in the stock of capital. In fact, the increase in the stock of capital has been so spectacular that growth accounting equations leave a negligible role for the Solow residual.

In relation to equity, the conclusions are less clear cut. There is evidence indicating an increase in returns to education. The complementarity between skilled labor and capital has resulted in an additional demand for educated workers. Wage differentials have increased substantially, especially between university graduates and workers with less (but some) education. This, of course, worsens income distribution. However, unskilled workers were able to find employment in some rapidly expanding sectors, such as construction. Consequently,

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[2] See Fedesarrollo (1995) and Hommes, Montenegro and Roda (1994) for a complete account of the reforms implemented during the period 1990-1994.

[3] The strength of the trade reform was impressive. Quantitative restrictions were fully dismantled while average import tariffs were lowered from 43.7% in 1989 to a current level of 11.7%. Free trade agreements were signed with Venezuela, the Andean Pact countries, Chile, Mexico, and the Caribbean Community and Common Market (CARICOM) countries. Restrictions on capital transactions were eliminated. Labor and social security reform are discussed below.

unemployment rates (specially among workers with no education at all) fell from an average of 11.8% in the 1985-1990 period to 9.4% on average between 1991 and 1995. Salaries at the very bottom of the distribution have kept pace with those at the top. In terms of Gini coefficients the evidence is mixed. Top coded incomes in the household surveys require arbitrary assumptions about the level (and the distribution) of income in the top 2% of the population. Estimates of Gini coefficients are very sensitive to these assumptions.

The paper is structured as follows. Section 2 discusses the issue of efficiency based on the measurement of TFP in manufacturing. The link between efficiency and equity is established in section 3 which analyzes recent trends in the labor market. This section estimates the elasticities of substitution between capital and different types of labor. The result is an increase (after structural reform) in the degree of complementarity between capital and skilled labor in manufacturing. Section 4 deals with equity issues. The evidence on income distribution is based on measurement of wage differentials and Gini coefficients. As mentioned, proportionally larger increases in income have been observed at the bottom and top ends of the distribution. In addition, other statistics indicate a reduction in poverty levels (which could be related to the shift in social policy towards a system based on demand subsidies).

2. Efficiency

As mentioned in the introduction, the case for structural reform (especially in regard to trade liberalization and labor reform) was justified, to a large extent, by the recent decline in productivity in Colombia. In fact, based on national accounts data Clavijo (1990) found that

productivity increased at an annual rate of 1.9% between 1950 and 1980. In contrast, during the period 1981-1989 TFP fell at a rate of 0.7% per year[4].

The effects of structural reform on productivity can be analyzed with monthly data from the manufacturing sector based on the *Muestra Mensual Manufacturera* (MMM)[5]. In the framework chosen, gross output (Y_t) is produced by combining materials (M_t) and value-added (V_t) according to a Leontief technology:

$$Y_t = min(a^M M_t, a^V V_t) \quad (1)$$

where a^M and a^V are constants. This choice of technology is convenient given the lack of monthly data on materials inputs for the manufacturing sector. Moreover, yearly data from the more comprehensive *Encuesta Anual Manufacturera* (EAM) during the period 1974-1991 shows great stability in the parameters a^M and a^V[6]. In turn, value added is obtained by combining capital (K_t), production or factory labor (L_t), and non-production or administrative labor (D_t) according to[7]:

$$V_t = Z_t F(K_t, L_t, D_t). \quad (2)$$

Z_t is the exogenous productivity shock. Assuming that F shows constant returns to scale, the growth rate in productivity can be written as:

$$\Delta z_t = \Delta v_t - (1 - \alpha_t - \beta_t)\Delta k_t - \alpha_t \Delta l_t - \beta_t \Delta d_t \quad (3)$$

where Δ denotes first differences and lower case variables represent logarithms of the different variables. The variables α_t and β_t denote the share of factory labor and administrative labor in

[4] García (1988) and Ocampo (1989) find similar patterns.
[5] Hence, the results are not strictly comparable to those of Clavijo (1990 and 1995) who uses aggregated data and a different methodology.
[6] In fact, the coefficient a^M fluctuates between 0.57 (1982) and 0.63 (1987) with a standard deviation of 0.02.
[7] In general, the separation between two types of labor corresponds to unskilled and skilled workers.

total value added at time *t*. These shares were obtained at the annual frequency from the EAM. To produce monthly series it was assumed that these shares were constant within the year.[8]

Several assumptions had to be made in order to obtain a monthly measure of the capital stock (which is not directly available from the monthly manufacturing surveys). In order to obtain an estimate of this variable, capital goods imports in the manufacturing sector (available at this frequency) were used in the calculation of investment in manufacturing[9]. Dollar imports were expressed in constant terms using the price index for capital goods in the US. A capital stock index was constructed using a perpetual inventory equation with linear depreciation, i.e.

$$K_t = I_t + (1-\delta)K_{t-1} \tag{4}$$

Several depreciation rates (δ) in the range 5%-15% were used (with little impact on the results). In addition, investment (I) was defined in the following alternative ways where MKI denotes capital goods imports in the manufacturing sector in constant dollars:

$$I_t = MKI_{t-6} \tag{5a}$$

$$I_t = \frac{1}{12}\sum_{i=6}^{17} MKI_{t-i} \tag{5b}$$

$$I_t = MKI_{t-6} - 0.1(MKI_{t-6})^{1.15} \tag{5c}$$

Equation 5a captures the existence of a six month lag between the registration in customs and arrival at the firm of the new machinery and equipment. Equation 5b assumes 'time to build' in the sense that it takes one year for the new equipment to become fully functional. Equation 5c

[8] Interestingly, the results of this section do not depend on this assumption. In fact, when the shares were estimated econometrically (with and without the assumption of CRS) the results were very similar. An alternative method, based on the national accounts input-output matrix yielded the same conclusions.

[9] The motivation for this assumption is that between 1965 and 1992 imports accounted on average for 63% of the investment in machinery and transport equipment (the standard deviation was less than 4.5%).

uses a convex cost of adjustment function. Adding new capital requires resources which can be thought of as a loss of capital goods.

Figure 1 depicts the output, employment and capital indexes in the manufacturing sector (1990=100). The capital stock index shown corresponds to equation 5c (which is very similar to the one obtained with 5b) assuming an 8% rate of depreciation[10]. Interestingly, the stock of capital in manufacturing has increased nearly 35% after structural reforms took off in 1990 This sharp increase reflects the fact that between 1990 and 1994 the average annual rate of growth in real private investment was 20.4% (in contrast to a poor 0.2% during the 1980s). However, the rate of growth in gross output has been much lower (approximately one-half of the increase in capital). Noticeably, employment has remained stagnant in relation to the 1990 levels. In consequence, the capital-labor ratio has increased by nearly 40% while output per-worker is now 20% higher than in 1990 (Figure 2).

Based on equation 3, Figure 3 shows the results of the estimation of TFP using the alternative definitions of the capital stock (which in all cases was adjusted for capacity utilization)[11]. In addition, since gross output in manufacturing is significantly lower in December and January, equation 3 was estimated with seasonally adjusted data (for output and labor)[12]. When equation 5a is used to construct the stock of capital the measure of TFP does not reflect major efficiency gains after structural reforms. In this benchmark case, the unprecedented increase in the stock of capital has been much larger than that of gross output so that the Solow residual is relatively small.

[10] The growth rate in the stock of capital increases with the rate of depreciation.
[11] A measure of the business cycle based on an AR(1) model on output was used as a proxy for capacity utilization.
[12] On average, output falls 4.7% in December and 7% in January.

In contrast, when 'time to build' or 'adjustment costs' are explicitly accounted for the results are somewhat different. As shown in Figure 3, TFP increased approximately 8% after the reforms. In all cases there is evidence of a decline in TFP after 1995, reflecting the slowdown in manufacturing production. However, these results should be taken with care as they are based on a measure of the stock of capital that requires a number of assumptions. Precisely for this reason we offer an alternative measure of TFP based on factor prices.

As is well known, the first order conditions of the firm's profit maximization problem imply that:

$$\Delta z_t = a_t^M \Delta p_t^i + a_t^V \left[(1 - \alpha_t - \beta_t) \Delta p_t^K - \alpha_t \Delta w_t^l - \beta_t \Delta w_t^d \right] - \Delta p_t \qquad (6)$$

where (all the variables in logs) p is the producers' price index, p^i is the price of intermediate goods, p^K is the user cost of capital, w^l is the nominal wage of production workers and w^d is the nominal salary of non-production workers. Conveniently, we now have information of intermediate goods prices so we no longer need to assume that a^M and a^V are constants. In this sense, this estimation of the change in TFP (Δz) requires less assumptions than before. However, if the perfect competition assumption fails one can misinterpret changes in the profit margins as changes in TFP.

In order to estimate equation 6 it is necessary to have information about all factor prices. Fortunately, the MMM has information about wages paid to the two types of labor (including non-wage paid benefits and payroll taxes). However, the user cost of capital is not readily available from that source so it was necesary to calculate a measure of the tax adjusted rental price of capital. The following expression was used (see the appendix 1 for the derivation):

$$p_t^K = \frac{q_t}{p_t}\left(r_t + \delta - \frac{\dot{q}_t}{q_t}\right)\frac{1 + tv_t + tm_t}{1 - ty_t}, \qquad (7)$$

where q is price of capital goods, p is the producers' price, r is the interest rate, and δ is the depreciation rate. Income and value-added tax rates are *ty* and *tv*, respectively. Import tariffs are denoted by *tm*. In turn, the price of capital goods (q) is defined as the nominal exchange rate times the price of capital goods in the US (so that the ratio q/p is a measure of the real exchange rate for capital goods). δ was assumed equal to 8%. The resulting factor prices are shown in Figure 4 (all in terms of an index 1990=100)[13]. Unambiguously, the period after structural reform is characterized by a decrease in the rental price of capital and an increase in real wages of administrative (i.e., skilled) workers. As shown in detail in Cárdenas and Olivera (1995), the reduction in the user cost of capital has been the combined result of the decline in tariffs for capital goods, the real appreciation of the currency caused by capital inflows, and the reduction in domestic interest rates[14]. However, the correlation is much higher between changes in the user cost of capital and changes in domestic real interest rates.

Figure 5 shows the results of the estimation of TFP through the cost function. It is of interest that according to this metric TFP remained relatively invariant until mid-1994. Only since then have the combined factor prices increased faster than producers' prices. It is likely, however, that what looks as changes in TFP may in reality be changes in firms' margins. In fact, given the market structure of the Colombian manufacturing sector it is hard to reject the

[13] A systematic decrease in wages in the month of December (since 1989) suggests the presence of an apparent anomaly in the series.

[14] Moreover, the recent investment boom can be successfully explained with variables that measure the user cost of capital, especially relative prices of capital goods and real interest rates (Cárdenas and Olivera, 1995). They argue that the elasticity of investment with respect to these variables has increased after structural reform. Presumably, firms are now unable to transfer changes in the user cost of capital to final prices.

possibility of a recent decline in profit margins. Analogously, the decline in TFP after the drastic fall in the user cost of capital in 1992 can be thought of as a windfall increase in profits.

Table 1 summarizes the main results in relation to efficiency. The statistics are based on the alternative calculations of technology shocks (equations 3 and 6). The table reports the average values of Δz_t and Δy_t, as well as the ratio of the variances and the correlation coefficients of these two variables. These statistics were computed with seasonally adjusted data for the entire sample as well as for the periods before and after structural reform, 1980:1-1990:12 and 1991:1-1995:7, respectively.

According to the results based on the Solow residual, the average annual change in TFP was positive (in the range 2%-3%) during the period 1980:1-1990:12, and negative (in the range between 0 and -0.55%) during the period 1991:1-1996:2. However, when TFP is measured trough factor prices the results are the opposite: Average annual TFP growth accelerated from 1.6% until 1991 to 4.9% in the post-reform period. Output growth also accelerated in the latter period.

Panel 2 in table 1 shows the ratios of growth in TFP to output growth. The date indicates that TFP growth represented more than 50% of total output growth in the periods prior to structural reform. In the post-reform period the Solow residuals do not explain output growth. In regard to the ratio of variances (Panel 3), the volatility of the technological change is lower than that of output, except when TFP is measured through factor prices. Moreover, the volatility of TFP relative to output has been relatively stable throughout the sample period. Correlation coefficients between growth in TFP and output growth (Panel 4) are low, and even negative in

the recent period. This implies that output growth in the recent period is explained mostly by factor accumulation rather than efficiency.

3. Labor Market

This section analyzes the effects of structural reform on employment. As it is well known, much of the impact of the change in the foreign trade and capital regimes (as well as the reforms introduced in the labor legislation) on poverty and income distribution depends on their effect on the labor market. In particular, it is worthwhile to explore the possibility of changes in the composition of labor demand, as well as in wage differentials. The section starts by looking in detail at the manufacturing sector. Some general trends in employment are also discussed.

The recent performance of the labor market in the manufacturing sector can be summarized in three major stylized facts. First, as mentioned in the previous section in relation to Figure 1, the average annual rate of growth in employment during the period 1991-1995 has been very slow (0.74% for administrative workers and -0.26% for factory workers[15]). Second, as can be seen in Figure 6, real wages of production workers (and to al lower extent non-production workers) in manufacturing have increased while the real minimum wage has remained relatively constant since 1991. However, as can be seen in Figure 7, relative wages in manufacturing (non-production/production) have increased substantially since 1991. In fact, the wage differential between these two types of labor is nearly 20% higher than at the beginning of the reforms (1990). Moreover, this differential remained virtually constant in the period before the *reforms*.

[15] In contrast, between 1986 and 1990 administrative and factory employment grew 2.64% and 1.06%, respectively (on average per year).

Third, the ratio of administrative (non-production) employment to factory (production) employment shows an upward slope.

A possible explanation for these stylized facts is that capital and administrative labor are complements in production so that the increase in the capital stock has been accompanied by an increase in demand for skilled labor. Given the constraints in the supply of qualified workers, the result has been a rapid increase in their real wages (reflecting the low elasticity of the demand for skill). Arguably, the lower demand for unskilled workers in manufacturing is a reflection of its increasing substitutability with capital services.

A standard framework based on the use of a generalized Leontief technology allows a simple test for these hypotheses. As is well known, the use of Cobb-Douglas and CES to represent the technology (F in equation 2) is inadequate when there are more than two factors of production. In fact, in the presence of heterogeneous labor these functional forms are not appropriate to answer the questions under analysis (except under very specific circumstances[16]). An interesting alternative is the generalized Leontief production (or cost) function which has the necessary flexibility to easily measure elasticities of substitution (or of complementarity) as well as factor price elasticities.

Based on the generalized Leontief (GL) cost function (see appendix 2) one can write factor demands as:

$$\frac{X_{it}}{V_t} = \sum_j b_{ij}\left(\frac{p_{jt}}{p_{it}}\right)^{\frac{1}{2}} + \alpha_i V_t + \gamma_i t + \mu_{it}, \qquad i = K, L, D. \tag{8}$$

[16] See Hamermesh (1986).

where p_{it} is the price of input i at time t. Accordingly, a change in the input-output ratio can be the result of (a) changes in the relative factor prices, (b) changes in the scale of production (if the production function is not homothetic), and (c) technological change. Diewert (1971) has shown that the GL cost function corresponds to a fixed coefficients technology (no factor substitution) if $b_{ij} = 0$ for all $i \neq j$. Also, the production function exhibits constant returns to scale if $\alpha_i = 0$ for all i (i.e., the function will be homothetic). Clearly, factor augmenting technological change does not occur if $\gamma_i = 0$ for all i.

Elasticities of Substitution

To proceed with the estimation of the system of equations (8) augmented Dickey-Fuller tests were performed on the three dependent variables (i.e., the input-output ratios) to check for stationarity. In all three cases the presence of unit roots was rejected at the 1% level of confidence.[17] The system was estimated with a (Gauss) Full Information Maximum Likelihood Procedure (FIML). In order to correct for first order serial autocorrelation of the error the lagged residuals were added to each equation (AR1).

The system was estimated with and without the symmetry restrictions ($b_{ij} = b_{ji}$). Conveniently, Theil has shown that minus twice the log of the likelihood ratio (i.e. maximum of the likelihood function imposing symmetry over the maximum of the likelihood function in the unconstrained case) has a Chi-square (χ^2) distribution (with degrees of freedom equal to the number of restrictions imposed)[18]. The test failed to reject the null hypothesis of symmetry. In

[17] The tests failed to reject the presence of unit roots in the original series of inputs and output so that the transformation of the series into input-output ratios results in I(0) series (which is another advantage of the GL representation).

[18] See López (1980).

fact, the estimated value of the statistic was 0.2934, well below the critical values of the χ^2 distribution at 10% levels of significance.

Interestingly, in the estimations the coefficient γ_i came out not significantly different from zero rejecting the hypothesis of factor-augmenting technological progress. This is surprising, given the perception that the technical change in the Colombian manufacturing has been labor-saving and capital augmenting. Apparently, changes in factor intensities have been the result of changes in factor prices alone.

Table 2 shows the results of the estimation after imposing the symmetry condition and excluding the t (trend) term from the equations. All the estimated b_{ij} are significantly different from zero, rejecting the existence of a fixed proportion technology (a Leontief production function). Importantly, the signs of the coefficients indicate that the two types of labor are substitutes, while capital and skilled labor are complements. The hypothesis of constant returns to scale is also rejected at high levels of significance. The estimated α_i coefficients are all negative and significant. This implies that there are efficiency gains as the scale of production is expanded (i.e. the production function is nonhomothetic).

Based on the estimated b_{ij}'s the Hicks-Allen partial elasticities of substitution between input i and input j ($\sigma_{ij} = \sigma_{ji}$) can be easily calculated. The appropriate expressions in the case of the GL technology are (s_j is the cost share of input j)[19]:

$$\sigma_{ij} = \frac{\frac{V}{2X_i} b_{ij} \left(\frac{p_j}{p_i}\right)^{\frac{1}{2}}}{s_j}, \qquad i \neq j, \quad i, j = K, L, D. \tag{9}$$

[19] The factor shares reported in the EAM Survey (see Section 2) were used as proxies for the cost shares.

Figure 8 presents the partial elasticities of substitution among all input pairs calculated at each point in time. Clearly, factory labor and capital show an increasing degree of substitutability. This is also the case between the two types of labor. However, in this case the elasticity of substitution is more stable and roughly equal to one. In contrast, administrative labor and capital are complements in production. These results imply that neither the Cobb-Douglas nor the CES functional form are adequate specification for the Colombian Manufacturing sector.

Structural Change

Several procedures were implemented in order to test the possibility of a structural change in the value of the parameters after the introduction of trade and labor reforms. On the one hand, the system of equations 8 was estimated with data for the period before structural reform (1980:1-1990:12). Interestingly, the estimated coefficients and their statistical significance did not change in comparison with those estimated for the entire period. In contrast, when the system was estimated with data from the period 1991:1-1995:7 only, the results changed somewhat in spite of the fact that the coefficients b_{KL} and b_{KD} remained unaltered. The coefficient b_{LD} (which captures substitutability between the two types of labor) turned out not significantly different from zero. This result would suggest that the substitutability between the two types of labor is now limited.

On the other hand, an alternative procedure yielded more conclusive results. In this case, the hypothesis of structural change was tested by expressing the system of factor demand equations in the following form:

$$\frac{X_{it}}{V_t} = \sum_j b_{ij}\left(\frac{p_{jt}}{p_{it}}\right)^{\frac{1}{2}} + \sum_j \beta_{ij}\left(\frac{p_{jt}}{p_{it}}\right)^{\frac{1}{2}} d + \alpha_i V_t + \gamma_i t + \mu_{it}, \qquad i = K, L, D. \qquad \textbf{(10)}$$

where d is a dummy variable that takes a value of 1 during the period 1991:1-1995:7. In this setting, the effect of relative prices on factor demands after structural reform is captured by b_{ij} + β_{ij}. Table 3 shows the results where none of the β_{ij}'s came out significant. This result is consistent with the idea that there has been no change in the way factor price changes affect factor demands. However, the estimated b_{ij}'s (and consequently the σ_{ij}'s) are lower in this case[20].

Implications

The implications of these results for labor demand are straightforward. Employment in manufacturing has been adversely affected by the increase in the price of labor relative to capital. This change in relative prices has been the result of different forces. First, as mentioned before, the reduction in real interest rates and tariffs, as well as the real appreciation of the currency, reduced the price of capital goods. Second, new investments in machinery and equipment induced an upward shift in the (skilled) labor demand. The result was an increase in real wages of skilled workers (exacerbated by its limited supply elasticity). Third, non-wage labor costs have increased as a result of labor (1990) and social security (1993) reforms. In fact, although labor reform substantially reduced the level (and the uncertainty) of severance payments, the burden of non-wage costs is now higher than under the previous legislation[21].

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[20] Interestingly, these results do not depend on the choice of dummy variable. When the period after structural reform was restricted to 1992:1-1995:7 the results were very similar.

[21] Severance payments were the higher non-wage cost under the previous regime which entitled workers to one month salary per year of work (based on the current salary at the time of payment). Partial withdrawals were allowed and deducted in nominal terms from the final payment at time of exit. According to Ocampo (1987) the implicit "double retroactivity" of severance payments resulted in an average cost equal to 4.2% of the total wage bill. The new legislation eliminated this extra cost in all new labor contracts. According to Lora and Henao (1995), as a result of the

As shown in Table 4, the change in the pension and health regimes brought about by the social security reform gradually increased total contributions paid by firms from 9% (of the total wage bill) in 1993 to 18.1% in 1996. In the case of pensions, workers are now free to choose between a privately managed fully-funded system and the old pay-as-you system run by the government. In both cases, contributions rose from 6.5% to 13.5%[22]. Health contributions increased from 7% to 12% (July 1995) in order to expand the coverage of the system (to all family members and to subsidized groups of the population). As in the case of pensions, workers can direct the contributions to private or public health promoting firms. In addition, payroll taxes (earmarked for labor training, social welfare programs, and other privately-provided subsidies) continue to exercise a burden on employment generation.

In sum, to some extent the recent increase in the relative price of labor has been the result of changes introduced in the labor and social security legislation. Together with a reduction in the price of capital, the result has been a switch into capital intensive technologies that require skilled labor. Not surprisingly, the real wages of educated workers have increased substantially.

Aggregate employment

The trends observed in manufacturing employment do not provide a full picture of the labor market. Table 5 shows the average annual rates of growth in employment by sector of economic activity (based on quarterly data from the Household Surveys). The total rate of employment growth fell from 4.95% before structural reform to 2.61% after reforms were

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high turnover in employment only 20.7% of the working force in manufacturing is now entitled to the benefits of double retroactivity.

[22] See Schmidt-Hebbel (1995) and Ayala (1995) for a complete account of Colombia's social security reform.

introduced. Much of this change is explained by the slowdown in employment generation in manufacturing. Also, employment in agriculture and mining fell in absolute terms. The rapid growth in construction, which hires mainly uneducated workers, was until 1994 the largest source of new employment providing 27% of the new jobs. As we will discuss later, this additional demand has been sufficiently large as to induce an increase in the real wages of workers with no education. Qualified employment has been dynamic in other sectors (financial services, transportation and communications)[23].

Interestingly, urban unemployment rates fell from nearly 11% in 1990 and to 7.9 in 1994 in spite of the lack of employment growth in manufacturing[24]. This is partly the result of the stabilization in urban labor participation rates (which had a positive trend until 1991) and of the expansion in employment in other sectors. Still, the rate of rural unemployment increased from 4% in 1990 to 6% in 1994, mainly as a result of the overall contraction in agriculture and in spite of the collapse of labor participation rates in the rural areas. In sum, employment has been dynamic in the two tails of the distribution of skills. However, unemployment rates are particularly high among the young (especially women) with some (but insufficient) education[25].

3. Equity

This section analyzes the effects of structural reform on income distribution in Colombia. The analysis is carried out for Gini coefficients and wage differentials. The subject has generated

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[23] Commerce includes retail and wholesale, restaurants and hotels. Transportation and communications include storage services. Financial services include banking, insurance service, and leasing. Other services are mainly social, personal and comunitary activities.

[24] The natural rate of unemployment in Colombia has been traditionally estimated around 8%. However, Farné, Vivas and Yepes (1995) argue that it has recently fallen to somewhere between 6% and 7%.

[25] In June 1994, 60.6% of the unemployed had some secondary education, 60% were women, and 66% were under 30.

much debate and, still, no consensus has been reached. Based on Gini coefficients some have argued that trade liberalization resulted in greater income concentration but estimations are plagued with methodological problems. Others argue in the opposite direction. There is some evidence that population under poverty line has fallen after structural reform, but again data varies widely depending on the source and coverage of the surveys used for the estimations.

Moreover, other elements not directly associated to trade liberalization, such as reductions in world coffee prices, adverse climatic conditions on agriculture, appreciating real exchange rates (due to capital inflows and new oil discoveries) and increases in public and private spending, were simultaneously affecting income distribution. It is difficult to disentangle which changes in income distribution are exclusively associated with structural reform. From a theoretical point of view the problem is even more complex since the channels through which income distribution might be affected are multiple, and the direction of these effects is unclear[26].

Lora and Steiner (1994) have analyzed the issue using a Computable General Equilibrium (CGE) model for the Colombian economy. Specifically, they isolate the income distribution effects of trade liberalization (including trade integration) and tax reform. In their model, which ignores the effects of changes in productivity and of interest rates on investment, the elimination of quantitative restrictions might have improved income distribution through the reduction of the rents associated to the protective policies. As standard theory would predict, trade liberalization

[26] The Stolper-Salmueson theorem would suggest that liberalization should reduce the price of the factor of production that is relatively scarce or scarce enough in the terminology of Leamer and Levinsohn (1995) (capital and skilled labor in a country like Colombia). As shown in the previous section this is true in the case of capital but false for skilled labor. One can safely argue that the removal of barriers to capital flows has been a major force behind the reduction in the price of capital.

lowers the degree of market power by domestic producers. This implies a reduction in mark-ups and, consequently, returns to capital. Relative prices (manufacturing/agriculture) also fall.

The shift in relative prices favors the rural sector but the effect on rural income distribution is unclear. In relation to the real income of urban labor there are two opposing effects. One the one hand, the decrease in the price of manufactured goods increases real income. On the other, the reduction in urban labor demand acts in the opposite direction.

With respect to the reduction of tariffs, the effect on income distribution depends on the impact on the level and the composition of public spending. In the case of Colombia, tariff reduction was outweighed (from a public revenues viewpoint) by the effects of tax reform. In particular, increases in income and VAT taxation affected mostly the upper urban deciles and provided necessary revenues in order to expand government expenditures[27]. However, no studies have analyzed the income distribution effects of those expenditures.

This section analyzes the issue of income distribution by looking at new evidence on wage differentials. Estimated Gini coefficients are also reported, as well as other social indicators. Although the evidence is still fragmentary one can safely conclude that educational premiums have increased after structural reform. In the case of Gini coefficients the evidence is far from being conclusive.

Wage differentials

Wage differentials can be estimated with data from the quarterly Household Surveys (HS) (1973-1995). However, top coding problems are present in all HS. Until September 1993 the

[27] Food and services consumed by the lower deciles were exempted from VAT taxation (lowering its adverse effect on income distribution).

survey only allowed for incomes with up to Col$999.998 (approximately US$1.000 at the end of 1995 exchange rate)[28]. Since then the problem has been partially solved, allowing for incomes up to Col$10.000.000 (US$10.000). Rates of inflation of approximately 25% imply progressive underestimation of income in the higher deciles and introduce a bias in inequality measures (e.g., Gini coefficients). As will be discussed below, there are a variety of (arbitrary) procedures to correct truncation problems in the surveys.

In our estimations (based on the September surveys of 1984, 1989, and 1994) the top and bottom 2% of the distribution were excluded from the sample, eliminating the group of individuals with top coded earnings. Clearly, this procedure reduces estimated wage differentials. However, the results may shed some light since the underestimation should be similar for all three surveys. Workers were classified by level of education in five categories, those with no education, those with at least one year of primary education, those with at least one year of secondary education, and those with at least one year of university education (there is also the group of non-informants). Employment was classified in five categories: private employees, public employees, domestic service, self employed and employers. Family workers with no earnings where excluded from the sample.

Table 6 reports the average wage (monetary labor income) for each category (payments in kind and capital earnings were excluded). All wages have been expressed in terms of the salary of an uneducated male worker in the private sector. Interestingly, wage differentials fell between 1984 and 1989, and increased again 1994. The ratio of wages of workers with some university education to wages of uneducated workers fell from 3.95 in 1984 to 3.01 in 1989. In 1994 it

[28] In June 1993 the number of truncated earnings represented 0.9% of the surveyed population.

increased again to 3.28. The trend is similar for workers with secondary education. The table also shows that women (in all categories) are paid less than men.

ANOVA procedures were used in order to check for the statistical significance of wage differentials (between and within groups). In particular, the following model was estimated:

$$W = \alpha E + \beta L + \delta A + \gamma EL + \eta EA + \varepsilon \quad (11)$$

where W is the log of wages and the dummy variables for eduaction, employement category and economic activity are denoted by E, L, and A, respectively (EL is the combined effect of level of education and type of employment, and EA is the combined effect of level of education and economic activity). Accordingly, the variance of wages may be decomposed as:

$$\sigma_w^2 = \sigma_\alpha^2 + \sigma_\beta^2 + \sigma_\delta^2 + \sigma_\gamma^2 + \sigma_\eta^2 + \sigma_\varepsilon^2 \quad (12)$$

The results indicate that education, type of employment and economic activity are significant in determining wage differentials (at the 5% significance level), as well as the combined effects of education and type of employment, and education and economic activity. Other combined effects did not appear significant and where therefore excluded from the model. The variables explain 92% of the observed variance in wages: Education alone explains 25% of the variance, while occupational category accounts for 14% of it (and the combined effect of these two variables explained 31% of the variance in wages). Since it may be argued that educational category reflects unobserved human capital (different from educational category) such as labor quality, the results suggest that human capital alone is explaining more then 50% of the variation in wages among population. Economic activity alone explained only 3% of the wage differentials, but the combined effect of this factor with the level of education accounted for 25% of the explained variations in wages. Gender explained the remaining 4%.

Finally, additional procedures were performed to test for the significance of wage differentials within the three classifications used (level of education, type of employment and economic activity). The results show that the difference in wages within these groups is significant at the 95% confidence level[29], in other words, the mean wage perceived by a worker with at least one year of education is significantly different from the mean wage perceived by workers in other educational categories. The same is true for different economic activities and type of employments.

As reported in Table 7, which shows wage differentials by level of education in constant 1993 pesos, the premium for additional education decreased from 1984 to 1989 and increased again in 1994, except for primary education. Between 1989 and 1994 the difference in wages received by workers with some university education increased 24% with respect to an uneducated worker (29% with respect to workers with some primary education and 35% with respect to individuals with some secondary education). However, it is interesting to observe that between 1984 and 1994 the absolute returns to primary education (with respect to individuals with no education at all) fell continuously. However, in all cases wage differentials were still lower in 1994 than in 1984.

Table 8 shows the average annual change in real wages for workers classified according to the number of years of schooling. The series were constructed based on the September surveys throughout the period 1976-1994. Focusing on the period 1991-1994 it is interesting to observe proportionally higher increases in workers with higher levels of education as well as for those with no education (with opposing effects on income distribution). In the case that these two

[29] According to the Bonferroni test.

effects cancel out, Gini coefficients would not change much. However, workers with some primary and secondary education loose in relative terms. This is consistent with the mentioned trends in employment.

Gini Coefficients

The solution of the top-coding problems in the HS is critical for the calculation of Gini coefficients. There are a variety of estimates with an equal number of methods intended to impute income to the unobserved tail of the distribution (always in the top decile). An interesting alternative is to compute Gini coefficients based on a 1993 socioeconomic characterization survey (CASEN) which is free of truncation problems[30]. However, caution must be exercised when comparing results based on different surveys[31]. Table 9 summarizes the results of Gini coefficient estimations by several authors. The evidence is far from being conclusive. In all cases changes after structural reform are small. More importantly, their statistical significance has not been properly addressed.

Income distribution can be measured by income earner or by per capita family income. In the latter case, socio-economic factors that affect family size are taken into account. Typically, the reduction in family size is faster for high income families so that per capita family income tends to increase faster in the upper deciles. Hence, Gini coefficients based on individual income earnings tend to underestimate income concentration. Also, Gini coefficients can be obtained from rural, urban (3 or 7 cities) and national HS.

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[30] Designed in order to implement a new system of demand subsidies for health and education.

[31] IES data suffer from other problems. In particular, it only includes capital earnings from interest, rents, dividends and pensions. It does not take into account other capital earnings such as undistributed dividends and profits from corporations which, according to Sarmiento (1995), are concentrated in the higher deciles and may account for up to 20% of their total income.

One way of correcting truncation problems is to use a Pareto function which states that the number of individuals or families that receive earnings above certain level is a function of the level of income. i.e.,

$$N(y) = \beta\, y^{-\alpha} \qquad (13)$$

where y is value of income at the point of truncation, N the number of individuals with earnings above y. The parameter α is a measure of income distribution which can be interpreted as the elasticity of the number of individuals (N) with incomes greater than y with respect to that income. A major drawback of this procedure is that the results are highly sensitive to the value of α. For example, Urrutia (1994) finds a continuous improvement in income distribution both before and after correcting for top coding problem. He estimates per capita per family income Gini coefficients for rural and urban households, using a value of α between 4 and 5 (corresponding to the highest R^2 regression for the sub-samples of the upper decile)[32].

In contrast, Sarmiento (1995) uses an α between 1.5 and 1.8 (estimated for the observed highest sub-sample of the upper decile) and finds a deterioration of income between 1988 and 1993. In fact, the Gini coefficient increases from 0.488 to 0.502. The difference is even more significant since Sarmiento only uses seven capital cities (where poverty is lower) while Urrutia uses all the population.

Alternatively, Berry and Tenjo (1995) assume a log-normal distribution for income[33]. Based on the estimated mean and standard deviation (using the non-zero values in the truncated sample) they estimate mean income for the truncated portion (which is defined as the observed mean plus the standard deviation divided by mill's ratio at the point of truncation). Gini

[32] However, the estimated parameters (α and β) are extremely sensitive to the number of observations in the regression.
[33] However, normality of the log of income is rejected with Kolmogorov-Smirnov and Shapiro-Wilk tests.

coefficients are estimated for the three major cities (Bogotá, Cali and Medellín). According to the results, income concentration declined between 1976 and 1989, while an increase is observed between 1989 and 1993. As expected, the increase in the Gini coefficient is higher when estimated by per-capita family income (from 0.470 in 1989 to 0.507 in 1993).

Londoño estimates per capita Gini coefficients using the HS for 1971-1988 (without correcting for truncation) and the CASEN survey for 1993. His results suggest that income distribution improved continuously since 1971. However, there is no guarantee that the decrease in the Gini coefficient between 1988 and 1993 does not arise as a result of the change in the sample used.

An alternative procedure has been recently implemented by Sánchez and Rivas (1995) (reported as DNP in Table 9). The procedure is based on the estimation of the maximum values in the earnings of different occupational categories. For the initial survey (September 1976) these values are readily observed (assuming that the survey is free from truncation problems). For the September 1993 survey (where the truncation problem was partially corrected) an AR model on the reported incomes (in ascending order) is applied. Based on this model a second set of maximum incomes (corresponding to different occupational categories) is obtained. A linear fit (constant rate of growth) connecting the extreme points is used to obtain the maximum values for the remaining surveys. An exponential function was then used to distribute the truncated observations in the interval between the top coded earnings and the estimated maximum values. The results, which are also reported in Table 9, suggest a sharp deterioration in income distribution after 1990. Interestingly, in this case the increase in Gini coefficients seems to have started before structural reform.

Although the evidence on Gini coefficients is mixed there is clear evidence that some important changes in income distribution occur after structural reform. Increase demand for qualified labor naturally points in the direction of greater wage differentials. To overcome the possibly negative effects on income distribution of structural reform, governments must adopt additional reforms in social areas. Better targeting of social programs are a key elements. Colombia has been active in the reform of the health regime and, importantly, in the provision of low income housing. In this case, the inefficient system of subsidized public housing projects was replaced with a system of demand subsidies that has stimulated private projects (explaining the growth in construction) and has allowed poor families to buy homes. In other fronts, such as education, reforms have been very limited.

However, the overall balance point towards the relative success in terms of social progress. Table 10 shows other social indicators for Colombia. Interestingly, the figures show a continuous improvement in infant mortality rates, life expectancy, enrollment in secondary. In addition, poverty seem to have fallen substantially (the number of poor was reduced from 40.5% of the population in 1992 to 34.6% in 1993).

5. Conclusions

This paper has addressed the effects of structural reform on equity and efficiency. Although it is still to early to have a definite word on the topic, preliminary evidence suggests that the initial effects of reform involve a large increase in investment, with firms choosing more capital intensive technologies (especially in manufacturing). This has important implications for the labor market. Employment in manufacturing is concentrated on skilled workers whose

salaries increase in relative terms (given their relatively inelastic supply). Employment of unskilled workers becomes a critical issue from the viewpoint of income distribution. The problem can be worse if, as in Colombia, agriculture experiences a recession after the removal of trade barriers.

The expansion of unskilled labor-intensive sectors is required in order to counteract income concentration (arising from higher growth in employment and salaries at the top end of the distribution). In Colombia, this was achieved by the spectacular boom in construction, fueled (among other things) by the change in low income housing policies. In addition, the need to avoid a major worsening in income distribution requires other measures. Structural changes in institutions and policies regarding social sectors are particularly important. In Colombia, the shift in social expenditures to programs with an emphasis on demand subsidies is likely to have had an effect on poverty incidence. However, reforms to social sector require resources which point towards the need for progressive tax reform in order to avoid inflationary taxation (with a disproportionate effect on the poor). In sum, the package has to be comprehensive for the desired effects on equity and efficiency to be achieved.

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Appendix 1. User Cost of Capital

The formula for the after-tax user cost of capital can be easily derived from a standard model where K_t is the capital stock at time t, L_t is labor, and I_t is gross investment. Production is described by a concave technology F. There are three types of taxes: on income (ty), imports (tm), and on valued added (tv). Accordingly, the firm's net cash flow at time t (X_t) can be written as:

(A1) $$X_t = (1 - ty_t)\left[p_t F(K_t, L_t) - w_t L_t\right] - (1 + tv_t + tm_t) q_t I_t$$

where p is the price of output, w is the nominal wage, and q is the price of capital goods. A representative firm maximizes $\int_t^{\infty} X_t \, e^{-rt} \, dt$, subject to

(A2) $$\dot{K}_t = I_t - \delta K_t$$

where δ is the depreciation rate. The corresponding Hamiltonian is given by:

(A3) $$H_t = e^{-rt}\left[(1 - ty_t)(p_t F(K_t, L_t) - w_t L_t) - (1 + tv_t + tm_t) q_t I_t\right] + \mu_t (I_t - \delta K_t)$$

which in current value terms can be written as:

(A4) $$H_t^* = X_t + \lambda_t (I_t - \delta K_t)$$

where λ is the (shadow) price of unit of installed capital. First order conditions are given by:

(A5) $$F_L = \frac{w_t / p_t}{1 - ty_t}$$

(A6) $$\lambda_t = (1 + tv_t + tm_t) q_t$$

(A7) $$-\frac{\partial H_t^*}{\partial K_t} = \dot{\lambda}_t - r\lambda_t$$

Combining (A7) and (A6)

(A8) $$F_K = \frac{q_t}{p_t}\left(r + \delta - \frac{\dot{q}_t}{q_t}\right)\frac{1 + tv_t + tm_t}{1 - ty_t} = C_u$$

where the left hand side is the marginal product of capital and the right hand side is the user cost of capital.

Appendix 2. Generalized Leontief (GL) Cost Function

The GL cost function can be written as:

(A9) $$C(P,Q,t) = Q\sum_i \sum_j b_{ij} p_i^{1/2} p_j^{1/2} + Q^2 \sum_i \alpha_i p_i + Qt \sum_i \gamma_i p_i$$

where Q denotes output and p_i is the price of input i (t is time). The function is homogeneous of degree one in prices and does not impose symmetry, concavity or homotheticity. Assuming price-taking behavior in factor prices and using Shephard's Lemma one can derive cost-minimizing input demand functions:

(A10) $$X_i = \frac{\partial C}{\partial P_i} = \sum_j b_{ij}\left[p_j / p_i\right]^{1/2} Q + \alpha_i Q^2 + \gamma_i Qt$$

where X_i is the quantity demanded of input i. Factor demands can be expressed in terms of input-output ratios:

(A11) $$\frac{X^{ii}}{Q_t} = \sum_j b_{ij}\left[p_{jt} / p_{it}\right]^{1/2} + \alpha_i Q_t + \gamma_i t + \mu_{it}$$

Table 1. Basic Statistics of TFP in the Manufacturing Sector

	1990:1-1996:2	*1980:1-1990:12*	*1991:1-1996:2*
1. Average Annual Growth in:			
Gross Output	2.88%	2.61%	3.44%
TFP measures:			
a. Base	0.46%	1.28%	-1.19%
b. Time to Build	1.94%	3.05%	-0.07%
c. Cost of Adjustment	1.23%	2.13%	-0.55%
d. Factor Prices	2.66%	1.60%	4.92%
2. Ratio of Growth Rates (TFP/Gross Output):			
TFP measures:			
Base	15.82%	48.99%	-34.54%
Time to Build	67.45%	116.76%	-2.04%
Cost of Adjustment	42.81%	81.40%	-15.98%
Factor Prices	92.34%	61.43%	142.94%
3. Variance (output growth) / Variance (TFP growth):			
TFP measures:			
Base	18.51%	18.15%	18.98%
Time to Build	18.46%	17.90%	18.98%
Cost of Adjustment	18.40%	17.99%	18.93%
Factor Prices	99.95%	22.23%	238.75%
4. Correlation Coefficients (Output growth, TFP growth):			
TFP measures:			
Base	0.06	0.13	-0.07
Time to Build	0.04	0.11	-0.06
Cost of Adjustment	0.06	0.13	-0.07
Factor Prices	-0.12	0.02	-0.25

Note: Calculations based on seasonally adjusted data

TABLE 2. Estimates of the derived demand equations (Symmetry Restrictions Imposed)

	Capital	Administrative Labor	Factory Labor	Output	SSR	R2	DW
Capital	-492.000	-0.325	0.348	-0.013			
	(-0.953E-0	(-11.406)	(10.276)	(-48.332)	0.089	0.968	2.220
Administrative Labor		1.927	0.273	-0.011			
		(4.222)	(2.476)	(-35.792)	0.145	0.967	2.058
Factory Labor			1.965	-0.011			
			(4.258)	(-23.234)	0.278	0.976	2.049

Table 3. Estimates of the derived demand equations (with dummy variables)
Symmetry Restrictions Imposed

				Interacted with Dummy					
	Capital	Administrative Labor	Factory Labor	Administrative Labor	Factory Labor	Output	SSR	R2	DW
Capital	-109.48 (-0.47E-02	-0.59 (-3.214)	0.559 (2.40)	0.024 (1.32)	-0.134 (-0.537)	-0.0126 (-46.56)	0.0916	0.966	2.30
Administrative Labor		2.044 (20.39)	0.185 (3.61)		-0.0246 (-0.411)	-0.0114 (-39.29)	0.1189	0.9720	2.20
Factory Labor			1.830 (16.02)			0.0109 (-25.13)	0.2211	0.980	2.15

Table 4
Non-wage Labor Costs (% of wage cost)

	Pre-1990 Contracts		New Contracts		
	in 1990	*Current*	*with Full Benefits*	*Integral Salary*	*Temporary Workers*
Severance Payments					
Nominal Rate	9.30	9.30	9.30	...	9.30
Double Retroactivity	4.20	4.20	...	...	...
Other Benefits					
Vacation (15 working days per year)	6.70	6.70	6.70	6.70	6.70
Mandatory Bonuses (1/2 month per year)	8.90	8.90	8.90	...	8.90
Social Security Contributions					
Pension	6.50	13.50	13.50	14.50	13.50
(paid by worker)	(2.2)	(3.4)	(3.4)	(4.4)	(3.4)
Health	7.00	12.00	12.00	12.00	12.00
(paid by worker)	(2.3)	(4.0)	(4.0)	(4.0)	(4.0)
Payroll Taxes	9.00	9.00	9.00	9.00	9.00
Total	51.60	63.60	59.40	42.20	59.40
Total paid by firm	47.10	56.20	52.00	33.80	52.00
Total paid by worker	4.50	7.40	7.40	8.40	7.40
Memo: Shares in total employment in 1994					
Manufacturing	NA	20.70	53.60	1.50	24.30
Commerce	NA	14.50	71.00	0.60	13.90

Source: Pre-1990 figures on severance payments and other social benefits come from Ocampo (1987).
Integral salary refers to a newly created type of contract for workers earning more than 10 minimum wages. Under this contract workers wave severance payments and mandatory bonuses in exchange for higher wages.
Payroll Taxes are divided into 2% for labor training, 3% for social welfare programs, and 4% for family subsidies.
The memo items come from a survey conducted by Fedesarrollo in August, 1994.

Table 5. Average annual employment growth.

	Jun-82 to Dec-91		Dec-91 to Jun-95	
	Growth	Contribution	Growth	Contribution
Agriculture	6.74	0.08	-4.53	-0.05
Mining	7.01	0.03	-6.03	-0.02
Manufacturing	4.59	1.12	0.77	0.18
Electricity, Gas and Water	4.97	0.03	-1.33	-0.01
Construction	2.25	0.14	11.22	0.70
Commerce	5.72	1.45	2.34	0.62
Transportation and Communications	4.87	0.31	4.08	0.27
Financial Services	4.64	0.32	7.89	0.58
Other Services	5.11	1.44	1.30	0.36
Unspecified / Uninformed	23.40	0.02	-6.12	-0.01
Total	4.95	4.95	2.61	2.61

TABLE 6

Relative Wage by Level of Education and Type of Employment

Male private employee with no education = 1*

(Shares in total employment in italics)

MEN

TYPE OF EMPLOYMENT/ LEVEL OF EDUCATION	1984				1989				1994			
	None	Primary	Secondary	Terciary	None	Primary	Secondary	Terciary	None	Primary	Secondary	Terciary
Private Employee	1.00	1.18	1.46	3.45	1.00	1.18	1.36	2.71	1.00	1.16	1.41	2.89
	1.28	*20.86*	*25.23*	*7.23*	*0.73*	*17.89*	*29.76*	*8.78*	*0.96*	*17.33*	*31.05*	*8.87*
Public Employee	1.24	1.50	1.91	3.94	1.50	1.55	1.84	3.25	0.99	1.45	1.98	3.44
	0.12	*2.08*	*4.64*	*4.00*	*0.06*	*1.59*	*4.51*	*3.94*	*0.02*	*0.86*	*3.83*	*3.26*
Domestic Service	0.44	0.86	1.03	-	1.43	0.81	0.82	-	0.37	0.70	0.86	0.82
	0.02	*0.25*	*0.12*	*0.00*	*0.01*	*0.15*	*0.09*	*0.00*	*0.01*	*0.11*	*0.06*	*0.01*
Self Employed	0.81	1.20	1.85	3.88	0.79	1.13	1.63	3.03	0.87	1.27	1.73	3.44
	1.52	*13.40*	*10.90*	*3.11*	*1.01*	*11.34*	*10.41*	*3.29*	*1.03*	*11.47*	*12.27*	*3.13*
Employer	2.37	2.47	3.98	6.93	1.58	2.10	2.81	4.29	2.09	2.14	2.85	4.95
	0.05	*1.72*	*2.16*	*1.32*	*0.05*	*2.21*	*2.69*	*1.30*	*0.09*	*1.67*	*2.14*	*1.46*
Total	0.94	1.26	1.73	3.95	0.92	1.24	1.54	3.01	0.98	1.26	1.60	3.28
	2.99	*38.31*	*43.05*	*15.66*	*1.86*	*33.18*	*47.46*	*17.32*	*2.12*	*31.44*	*49.35*	*16.74*

WOMEN

TYPE OF EMPLOYMENT/ LEVEL OF EDUCATION	1984				1989				1994			
	None	Primary	Secondary	Terciary	None	Primary	Secondary	Terciary	None	Primary	Secondary	Terciary
Private Employee	0.82	0.90	1.23	2.18	0.73	0.89	1.18	1.96	0.79	0.89	1.24	2.38
	0.66	*11.65*	*24.36*	*7.69*	*0.48*	*10.35*	*27.32*	*11.34*	*0.40*	*9.92*	*29.44*	*12.92*
Public Employee	1.04	1.14	1.69	2.70	0.90	1.02	1.72	2.59	0.81	1.11	1.59	2.62
	0.05	*1.47*	*6.47*	*4.72*	*0.01*	*1.13*	*5.67*	*5.06*	*0.01*	*0.66*	*3.53*	*5.27*
Domestic Service	0.38	0.43	0.43	1.58	0.45	0.48	0.47	0.94	0.53	0.55	0.51	0.51
	2.09	*13.31*	*3.17*	*0.03*	*1.15*	*10.57*	*3.72*	*0.06*	*0.75*	*7.82*	*3.84*	*0.07*
Self Employed	0.51	0.64	1.04	2.84	0.56	0.68	1.16	2.44	0.57	0.78	0.94	2.67
	1.81	*10.94*	*7.93*	*2.08*	*1.18*	*8.19*	*8.48*	*2.53*	*1.01*	*8.07*	*10.58*	*2.87*
Employer	1.02	2.54	2.84	3.67	0.82	1.58	2.55	3.26	2.38	1.44	2.67	4.01
	0.03	*0.32*	*0.83*	*0.39*	*0.04*	*0.50*	*1.37*	*0.71*	*0.02*	*0.43*	*1.24*	*0.88*
Total	0.51	0.68	1.24	2.48	0.55	0.71	1.22	2.23	0.61	0.77	1.09	2.53
	4.65	*37.69*	*42.75*	*14.92*	*2.86*	*30.74*	*46.56*	*19.70*	*2.19*	*26.90*	*48.64*	*22.02*

Source: Authors' calculations with data from the National Household Surveys of September 1984, 1989 and 1994.

* Memo: Male private employee's wage was in constant pesos of 1994 col$122,532 in 1984, col$113,705 in 1989 and col$121,512 in 1994

Note: Excludes individuals who did not report level of education or economic activity.

TABLE 7

Mean Wage Differentials by Level of Education
(In 1993 constant pesos)

LEVEL OF EDUCATION			LEVEL OF EDUCATION			
			None	Primary	Secondary	Terciary
None		1984	-			
		1989	-			
		1994	-			
Primary		1984	32,492			
		1989	26,236			
		1994	24,831			
Secondary		1984	84,131	51,638	-	
		1989	58,995	32,760	-	
		1994	61,030	36,199	-	
Terciary		1984	276,131	243,638	191,992	-
		1989	167,840	141,605	108,845	-
		1994	208,761	183,930	147,730	-

* All wage differentials were significant at the 5% level according to Bonferroni (Dunn) T tests.

TABLE 8. Average Change in Real Wages

Years of Schooling	1976-1980	1981-1985	1986-1990	1991-1994	1976-1994
			Total		
0	1.1792	1.0662	-2.5757	5.9470	1.2323
1-5	4.0028	-0.7910	-2.2160	5.1864	1.7910
6-10	5.1528	-1.0470	-2.0905	3.4736	1.0785
11	-0.7292	-0.8695	-2.6096	7.2138	-0.2076
12-15	2.7665	-3.6859	-0.6726	6.6421	1.2311
16	-1.9697	-2.2547	-0.2619	9.8304	0.5883
			Men		
0	1.3523	-1.6562	-0.5861	1.5052	0.8018
1-5	3.7295	-1.1854	-1.7927	4.1158	1.6050
6-10	4.6442	-1.3257	-3.2001	3.5514	1.0332
11	-2.9067	-1.2519	-3.0834	7.1770	-0.8795
12-15	5.0244	-3.1447	-1.0634	-2.0172	0.5697
16	0.3163	-1.6499	0.6761	11.7917	1.4083
			Women		
0	4.4490	2.6871	-3.6302	11.6471	2.4903
1-5	5.6680	0.9395	-2.2150	5.6153	2.2440
6-10	8.1170	-0.1500	-1.3356	1.1922	1.3977
11	1.5806	-0.1271	-2.2293	6.8126	0.8953
12-15	2.7995	-4.0549	0.7142	18.6309	3.0535
16	0.1118	-1.3554	-0.0653	9.0891	2.1362

Source: Household Surveys (September). Geometric averages (labor incom
Processed by DNP.

TABLE 9

Income Distribution in Colombia
Gini Coefficients Estimates

	(A)	(B1)	(B2)	(C)	(D)			(E)		(F1)	(F2)
	LONDOÑO	BERRY AND TENJO		SARMIENTO	URRUTIA (93)			URRUTIA (94)		DNP	
	National	Urban		Urban	National	Rural	Urban	Rural	Urban	Urban	
1971	0.526				0.530	0.420	0.530				
1976		0.520	0.500							0.538	
1977										0.536	
1978										0.527	
1978	0.481			0.488	0.485	0.436	0.446			0.524	
1979										0.533	
1980		0.492	0.464							0.480	0.476
1981										0.489	0.483
1982										0.503	0.495
1983										0.494	0.485
1984		0.475	0.442							0.493	0.486
1985										0.495	0.488
1986										0.485	0.476
1987										0.494	0.487
1988	0.476			0.488	0.450	0.380	0.415	0.460	0.470	0.506	0.497
1989		0.470	0.421							0.505	0.495
1990		0.459	0.413							0.525	0.516
1991		0.483	0.451		0.431	0.417	0.386			0.544	0.534
1992		0.494	0.468	0.502	0.430	0.370	0.395	0.450	0.440	0.545	0.534
1993	0.472	0.507	0.467							0.544	0.532

(A) By income earner
(B1) By per capita family income
(B2) By income earner (3 cities)
(C) By per capita family income (seven cities)
(D) By per capita family income (without correcting top coded incomes)
(E) By per capita family income (correcting truncation)
(F1) By economically active income earner (7 cities)
(F2) By all income earner (7 cities)

TABLE 10

Social Indicators for Colombia 1970-1994

	Infant mortality rate [1]	Life expentancy (years)	Gross enrollment rates in secondary education [2]	% of families under indigence line [3]	% of families under poverty line [3]	% population under indigence line [3]	% population under poverty line [3]	% population in poverty by UBN [4]	% population in misery by UBN [4]
1970	82.18	58	6.186						
1971	73.03	60	6.549						
1972	73.03	60	7.037						
1973	73.03	60	7.437					70.2	44.9
1974	73.03	60	7.924						
1975	73.03	60	8.345						
1976	59.43	60	8.772						
1977	59.43	62	9.181						
1978	59.43	62	9.527						
1979	59.43	62	9.570						
1980	59.43	62	9.513						
1981	41.16	64	9.967						
1982	41.16	64	9.189						
1983	41.16	64	9.426						
1984	41.16	64	10.337						
1985	41.16	64	10.247					45.6	22.8
1986	41.16	67	10.243	9.63	35.8	11.3	40.6		
1987	39.66	67	10.274	9.20	37.8	10.5	42.2		
1988	39.66	67	9.890	9.28	39.3	11.0	43.9		
1989	39.66	69	9.768	7.50	35.0	9.0	39.2		
1990	39.66	69	9.930	8.54	37.3	10.1	42.2		
1991	39.66	69	9.968	8.25	35.3	9.5	39.9		
1992	37.00	69	10.986	7.78	36.2	9.1	40.5		
1993	37.00	69	11.171	6.02	31.0	7.0	34.6	32.2	13.5
1994	37.00	69	11.284	n.d	n.d	n.d	n.d		

(1) Number of deaths per 1,000 live births.
(2) As percentage of total population over 12 years of age.
(3) For seven capital cities. Poverty line methodology defines minimum baskets of consumption and estimates the income necesary to purchase it.
(4) UBN (Unsatisfied basic needs) methodology uses characteristics associated with living conditions and public services.

Source: National Planning Department, Socieconomic Characterization Survey of 1993 (CASEN) and Statistics National Department (DANE)

Figure 1

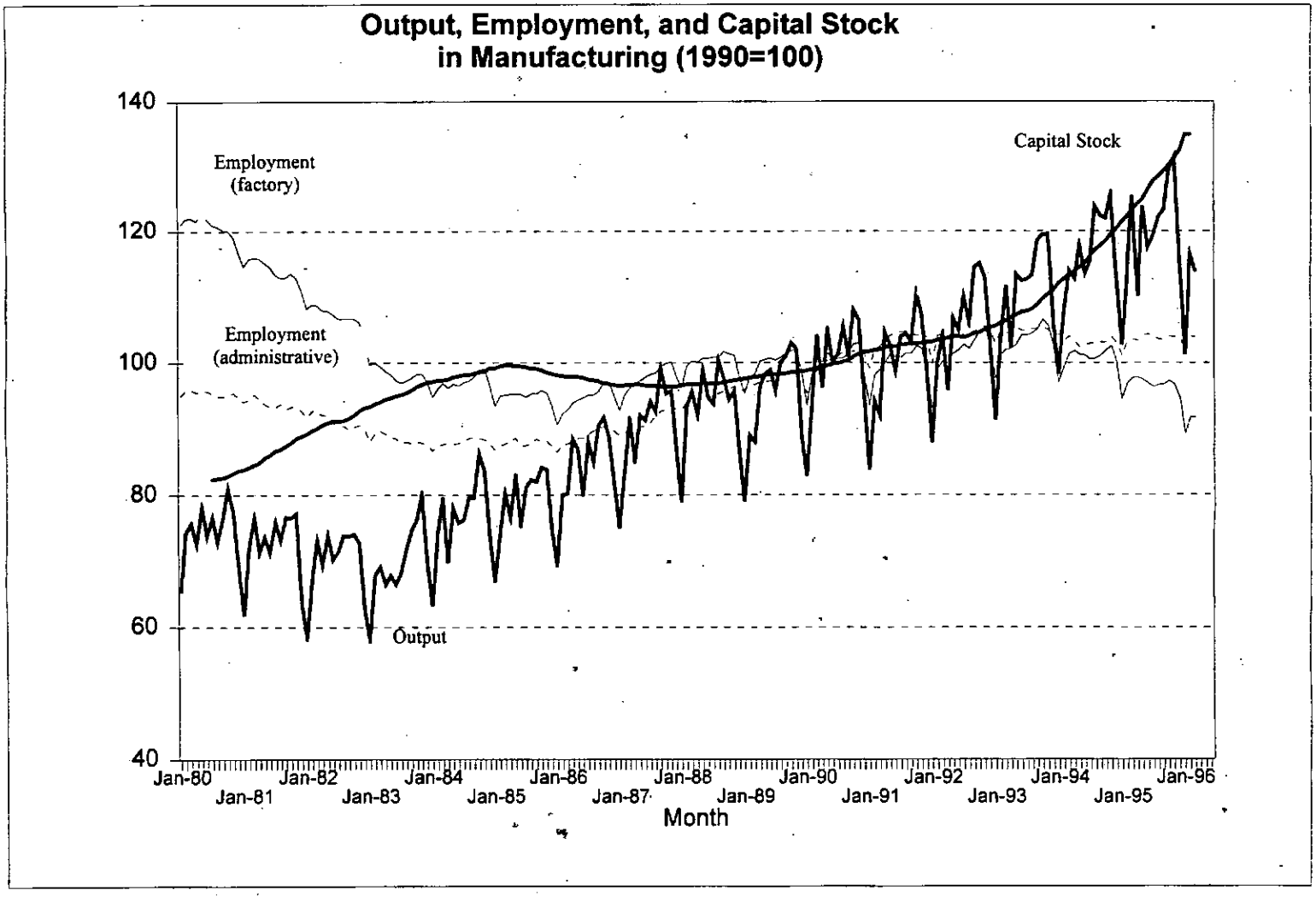

Output, Employment, and Capital Stock
in Manufacturing (1990=100)
140
120
100
80
60
40
Employment
(factory)
Employment
(administrative)
Capital Stock
Output
Jan-80
Jan-81
Jan-82
Jan-83
Jan-84
Jan-85
Jan-86
Jan-87
Jan-88
Jan-89
Jan-90
Jan-91
Jan-92
Jan-93
Jan-94
Jan-95
Jan-96
Month

Figure 2

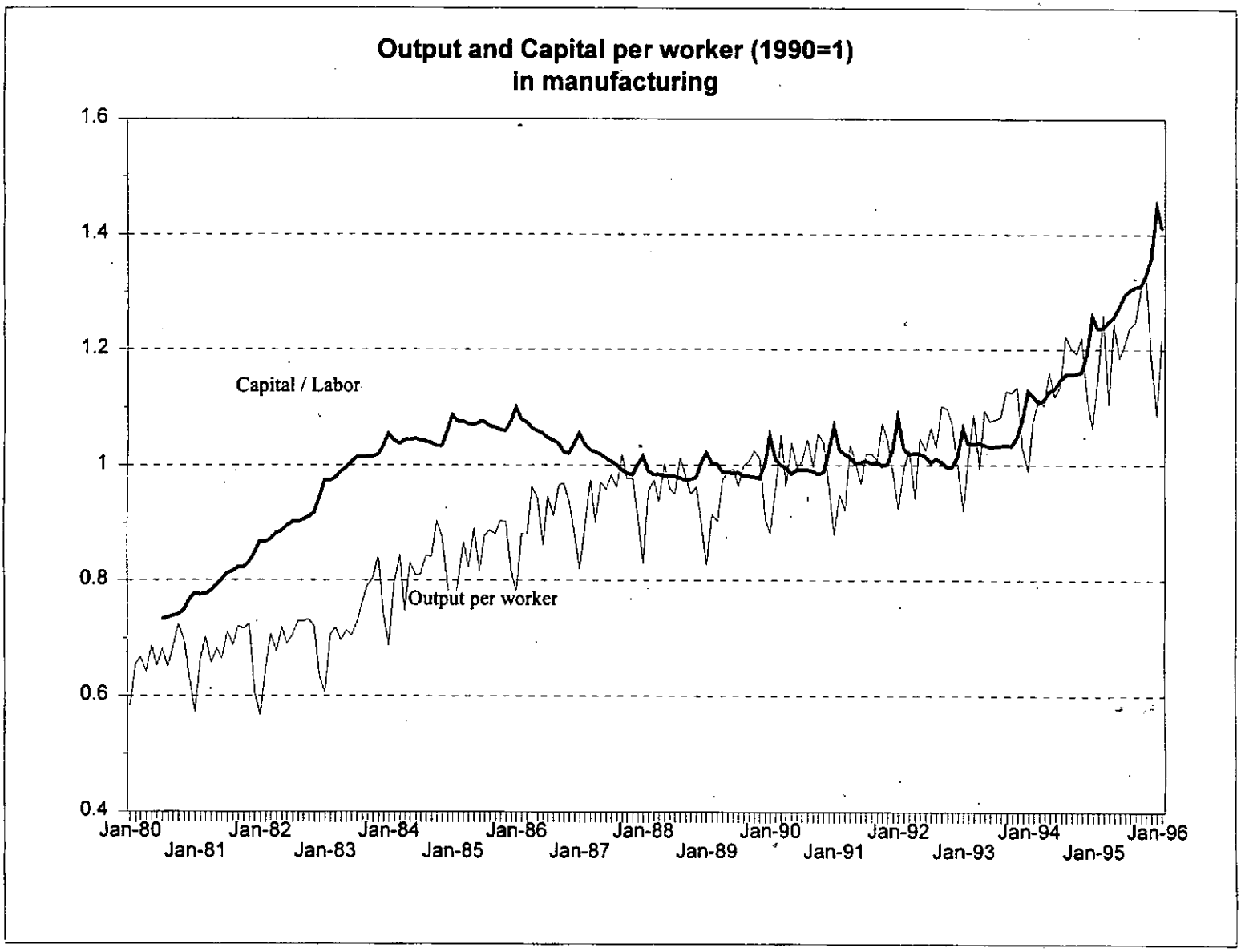

Output and Capital per worker (1990=1)
in manufacturing
1.6
1.4
1.2
1
0.8
0.6
0.4
Capital / Labor
Output per worker
Jan-80
Jan-81
Jan-82
Jan-83
Jan-84
Jan-85
Jan-86
Jan-87
Jan-88
Jan-89
Jan-90
Jan-91
Jan-92
Jan-93
Jan-94
Jan-95
Jan-96

Figure 3

Total Factor Productivity in Manufacturing (1980:7=1)
Alternative Measurements

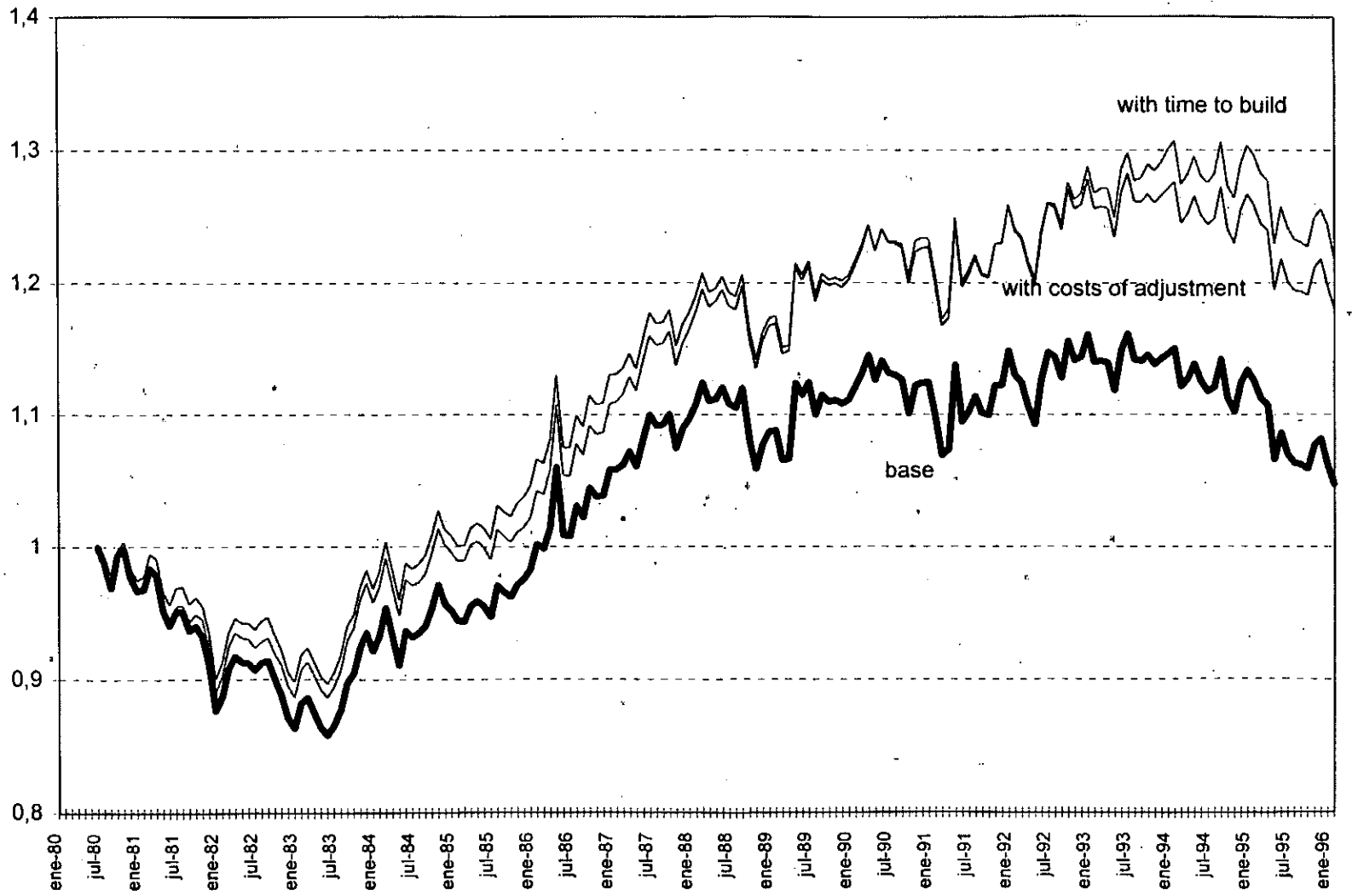


Figure 4

Factor Prices in Manufacturing (1990=100)

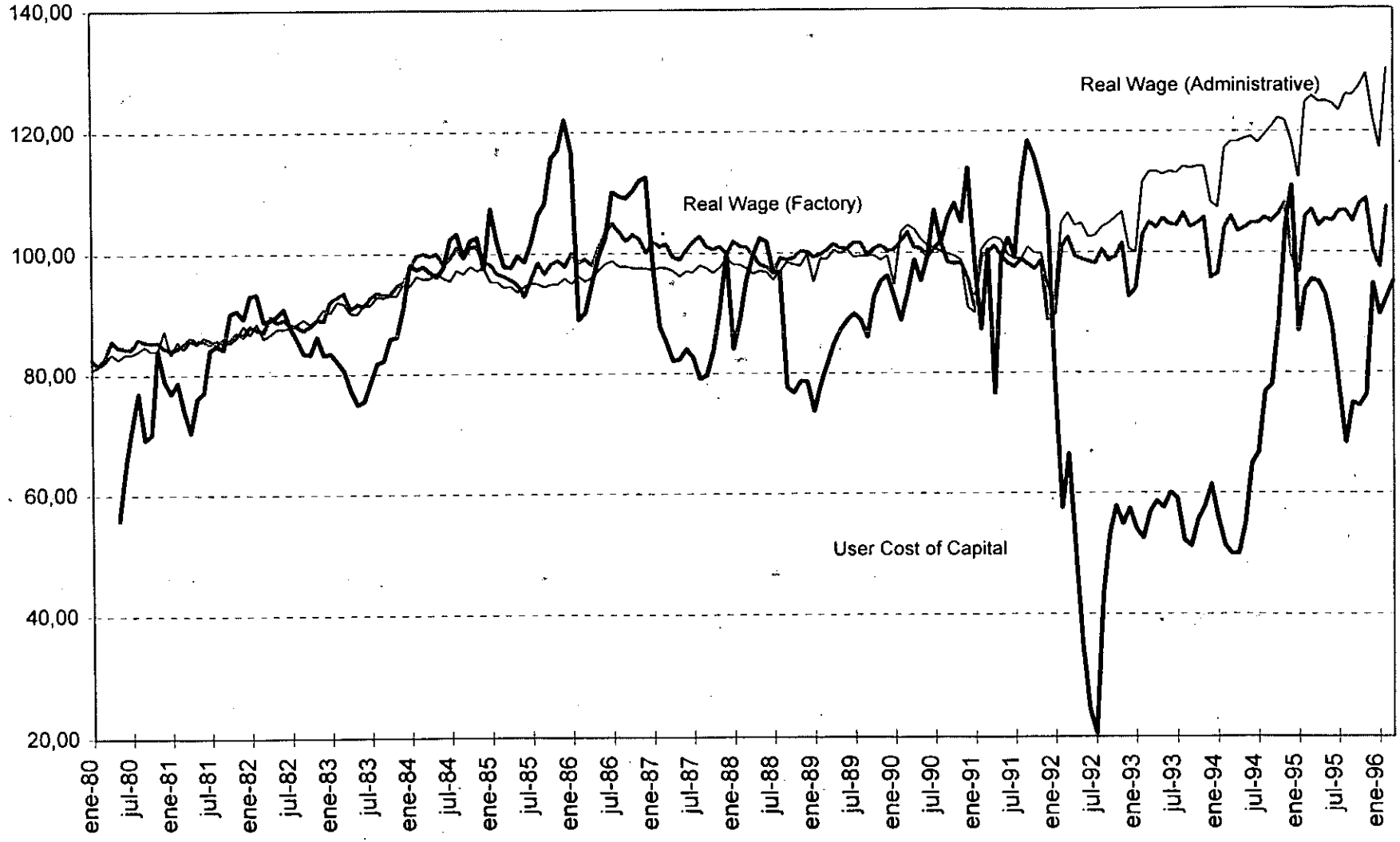


Figure 5

Total Factor Productivity in Manufacturing (1980:7=1)
Alternative Measurements

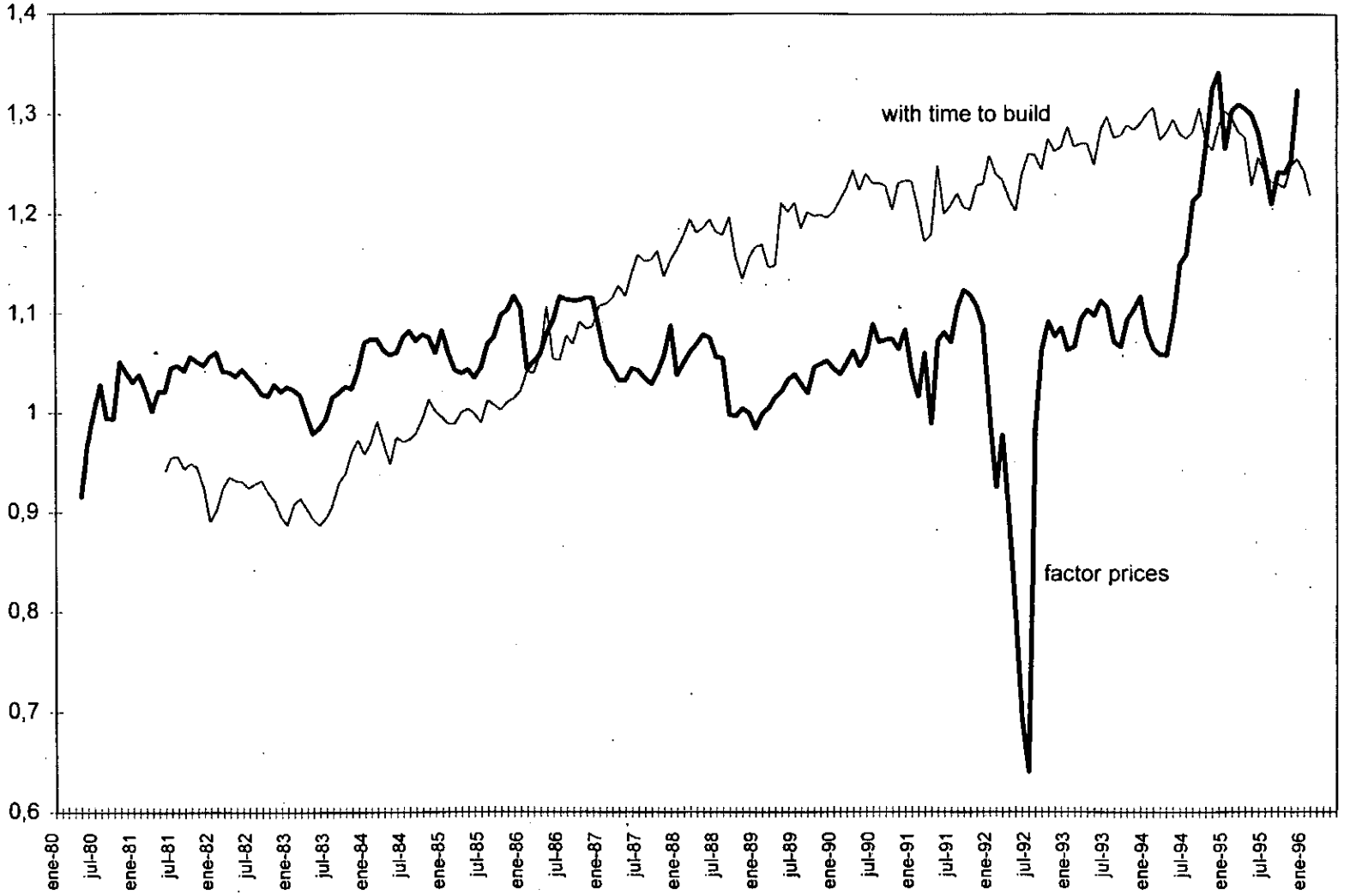


Figure 6

Real Wages in Manufacturing

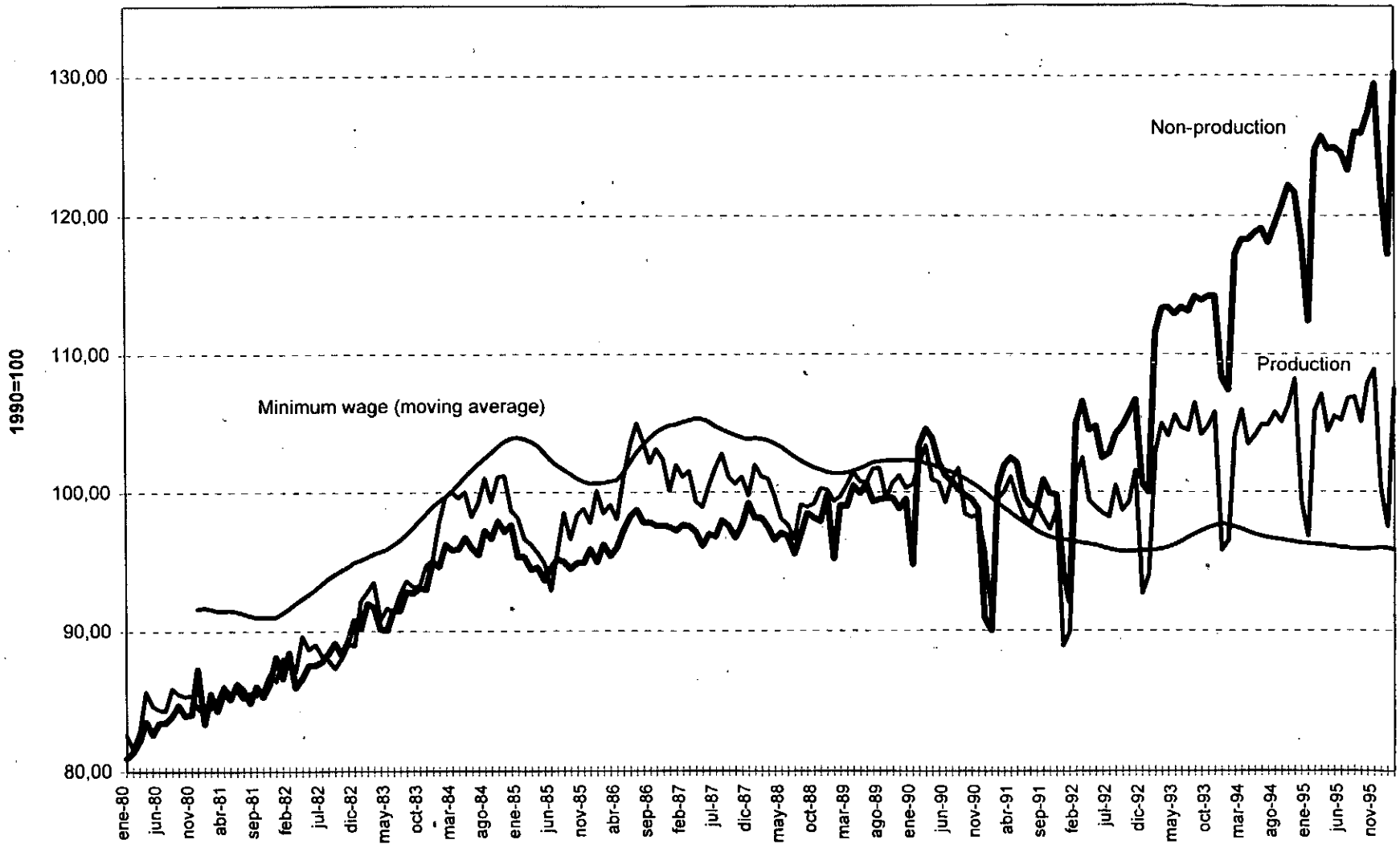


Figure 7

Relative Wages and Relative Employment (Administrative/Factory) in Manufacturing (1990=1)

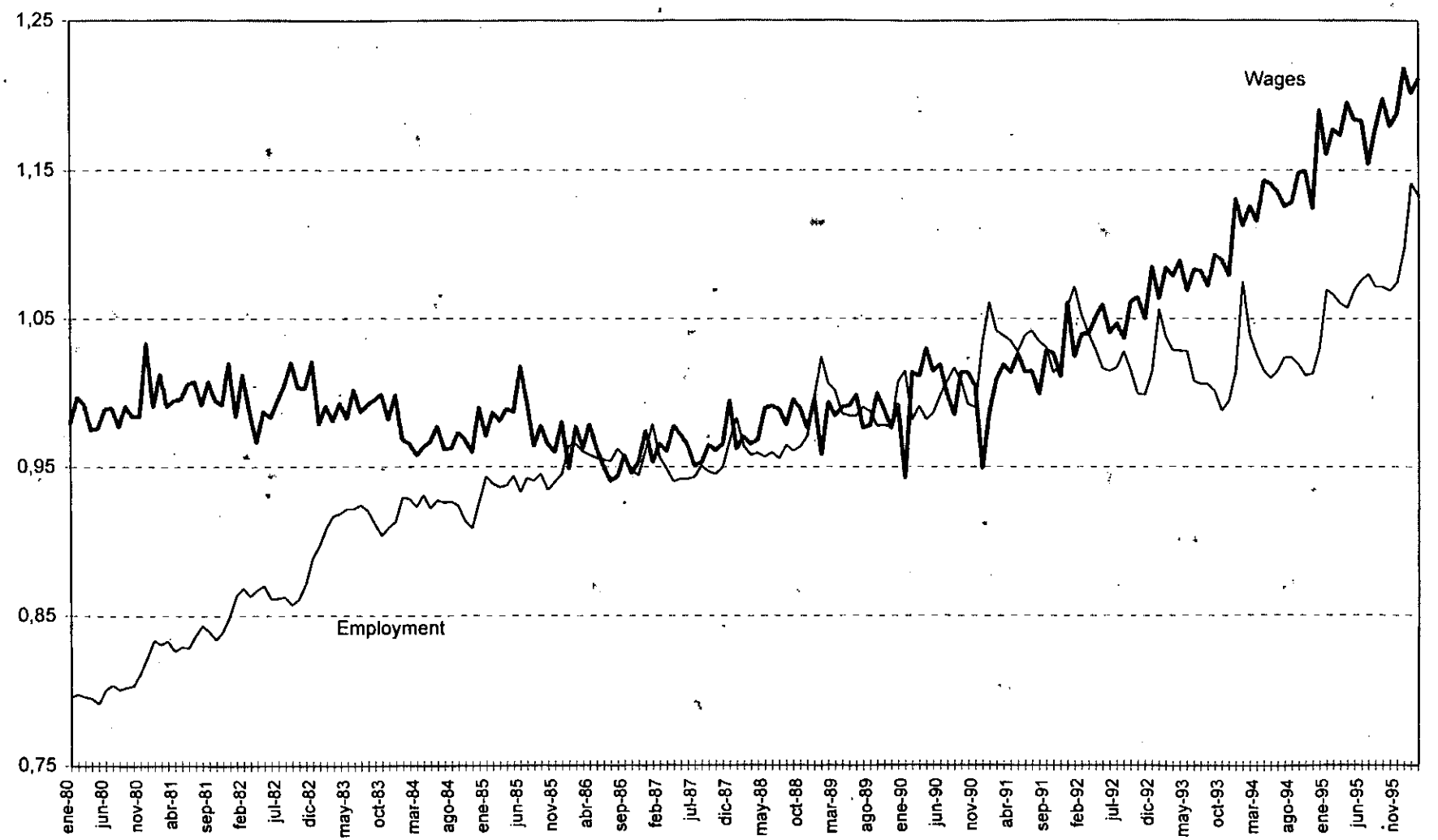
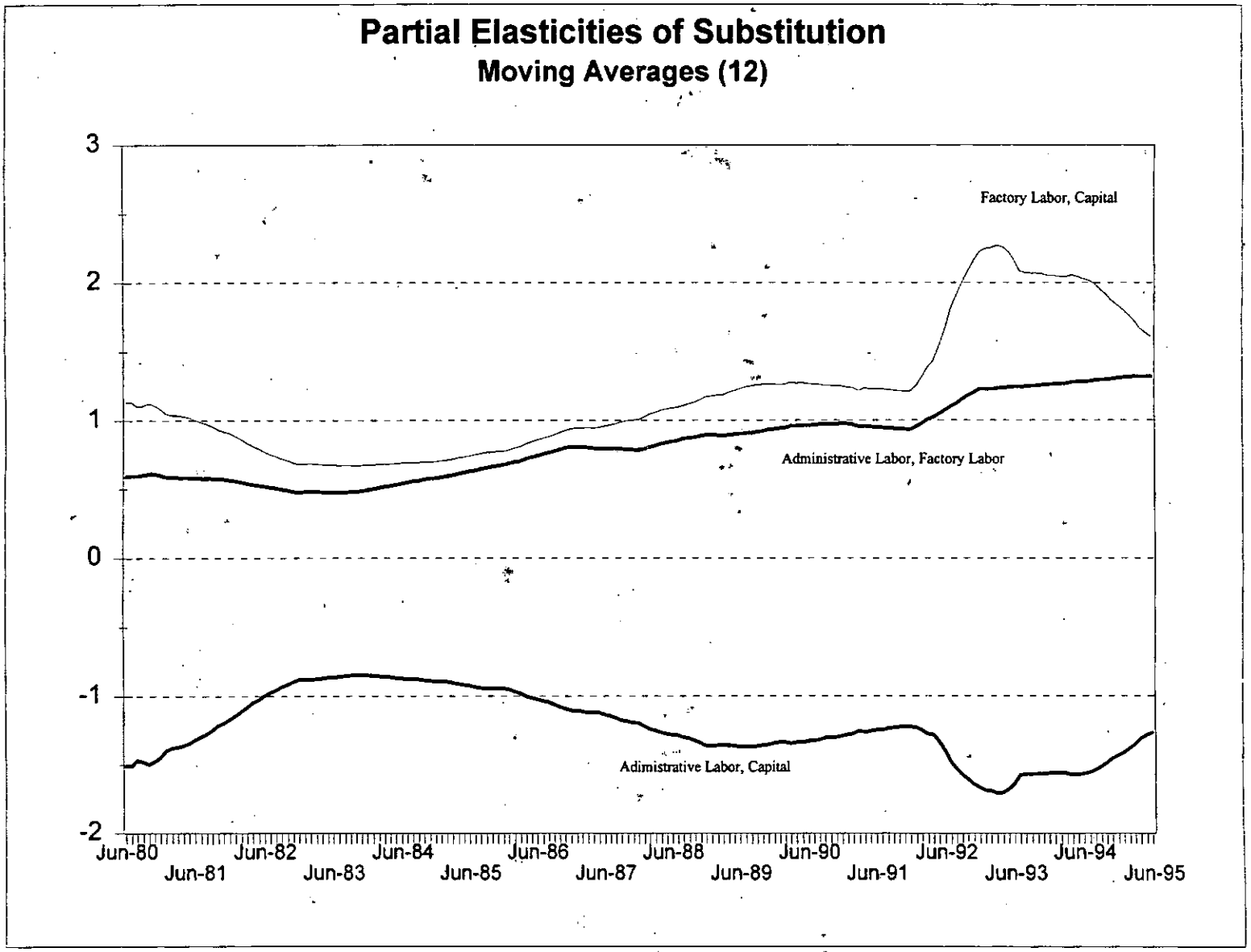
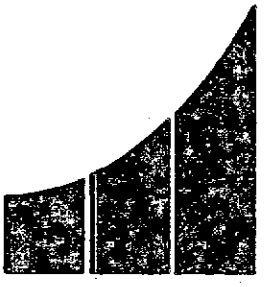


Figure 8


Partial Elasticities of Substitution
Moving Averages (12)
3
2
1
0
-1
-2
Factory Labor, Capital
Administrative Labor, Factory Labor
Adimistrative Labor, Capital
Jun-80
Jun-81
Jun-82
Jun-83
Jun-84
Jun-85
Jun-86
Jun-87
Jun-88
Jun-89
Jun-90
Jun-91
Jun-92
Jun-93
Jun-94
Jun-95



FEDESARROLLO

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Para el cumplimiento de sus objetivos, adelantará directamente o con la colaboración de universidades y centros académicos, proyectos de investigación sobre problemas de interés nacional.

Entre los temas de investigación que han sido considerados de alta prioridad están la planeación económica y social, el diseño de una política industrial para Colombia, las implicaciones del crecimiento demográfico, el proceso de integración latinoamericana, el desarrollo urbano y la formulación de una política petrolera para el país.

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