Trade Reforms and Income Inequality in Colombia*

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1. Introduction

Starting in 1985, Colombia experienced gradual trade liberalization that culminated in the drastic tariff reductions of 1990-91. The trade reform was accompanied by major modifications of the labor regime in order to reduce labor rigidities, and reforms in the financial sector for the purpose of enhancing resource mobility. While protection levels declined throughout this period, the most radical reforms took place in 1985 and 1990-91. The 1985 tariff cuts almost reversed the protection measures implemented during the early 1980s, while the 1990-91 reforms resulted in the historically lowest levels of protection. The initial plan of the Gaviria government had been to gradually reduce tariffs and non-tariff barriers during its term of office, from 1990 to 1994. However, the current account surplus led to acceleration and widening of the scope of the reforms that were completed by 1992.

The purpose of the trade reforms was to expose domestic producers to international competition, increase efficiency, accelerate growth and reduce at the same time the prices faced by consumers. While the empirical evidence to date suggests that the reforms have indeed been associated with increased efficiency and growth, there have also been concerns that trade liberalization may have contributed to an increase in income inequality. These concerns are partly rooted in the experience of Mexico, which experienced a substantial rise in the skill premium and overall income inequality following the trade reform of the mid-1980's. While a causal link between the Mexican trade liberalization and inequality was never established beyond dispute, the chronological coincidence of the increase in wage dispersion with the trade reforms was nevertheless a disappointment to those who hoped that globalization would benefit the poor in developing countries. The purpose of our work is to provide an empirical investigation of the relationship between income inequality and trade liberalization in Colombia using detailed micro data.

In particular, we exploit data from the Colombian Encuesta Nacional de Hogares, or National Household Survey (NHS), which were made available to us through the Colombian National Statistical Agency (DANE) for the period 1984-1998. The NHS is a repeated cross-section that covers urban areas, and it is conducted four times a year. The survey includes detailed information on earnings, number of hours worked in a week, demographic

characteristics (age, gender, marital status, family background, educational attainment, literacy, occupation, job type), sector of employment, and region. We have constructed a data set that has pooled data from the June waves for 1984-1998. The reason we focus on the June waves only, is that these waves include in a special module detailed information on informality and firm characteristics. Since it is estimated that 50 to 70% of the Colombian labor force work in the informal sector, and since the labor reforms of the early 1990s have been shown to have had a significant impact on the allocation of labor across the formal and informal sectors, we believe it is particularly important to account for informality in an analysis of policy reform effects on the income distribution.

The household survey data are combined with data on trade policy changes obtained from the Colombian National Planning Department (DNP) and the United Nation's publication "Directory of Import Regimes", and data on imports and exports from the United Nations COMTRADE database. These data allow us to identify the sectors that have experienced the largest reductions in tariff and non-tariff barriers, and sectors that have generally faced substantial changes in trade exposure, as measured by imports and exports. By linking this information to the household survey data through the provided information on the household head's sector of employment, we hope to relate the magnitude and pace of the reforms to changes in the wage distribution.

We conduct our analysis in several steps. We start by documenting the basic facts concerning income inequality in Colombia over 1984-1998. We find that while inequality gradually increased over this period, the increase was by no means as pronounced as in Mexico. Next, we decompose inequality into a component that reflects changes in the returns to education, and a component that captures inequality within educational groups. While, consistent with the experience in other Latin American economies, the return to college education increases over our sample period, this increase is modest compared to Mexico. At the same time, we document an increase in inequality within educational groups, suggesting that the skill premium alone cannot explain the rise in income inequality. Additional factors, such as industry premia and changing returns to occupations and/or informality also play a role. This descriptive analysis motivates our focus on the skill premium, industry premia, occupations, and informality in the rest of the paper. For each of the above factors, we discuss through which channels trade reform

is expected to have an effect, and then examine whether our expectations are confirmed by the empirical results.

Our main findings can be summarized as follows: First, we find little evidence that the skill premium increase was driven by the adjustment mechanism indicated by the workhorse model of international trade, the Heckscher-Ohlin model. This mechanism would suggest labor reallocation from sectors that experienced larger tariff reductions (and hence a reduction in the price of their output) towards sectors that were affected less by trade liberalization. However, the industry employment shares remain stable over our sample period, and the small changes we observe cannot be related to trade policy. The rising proportion of skilled workers in every industry is consistent with skill-biased technological change. Nevertheless, we find that skill-biased technological change was larger in sectors that experienced larger tariff reductions, suggesting that skill-biased technological change itself was partly an endogenous response to increased foreign competition.

Second, we find that the trade reforms impacted industry wage premiums. Wage premiums represent the portion of industry wages that cannot be explained through worker or firm characteristics. They can be interpreted as either industry rents, or returns to industry specific skills that are not transferable in the short run, and are particularly relevant in the presence of imperfect competition, and/or in cases in which labor mobility is constrained. According to our results, sectors that were associated with proportionately larger decreases in protection experienced a decrease in their wage premiums relative to the economy-wide average. This suggests an additional channel through which the income distribution in Colombia was affected. Our empirical evidence suggests that trade liberalization was concentrated in labor-intensive sectors employing a high percentage of low-skill labor. If these sectors experienced a decrease in their wage premiums, then less-skilled workers were "hit" by the reforms twice: First they saw the average return to their skill decrease, and second they saw the industry specific return in the sectors they were employed go down. Moreover, the sectors that had the highest protection before the reform were typically characterized by the smallest wage premiums. Our finding of a trade reform induced reduction in wage premiums, therefore, explains, at least in part, the observed increase in inequality.

Finally, we find some evidence that the trade reforms contributed to an increase in the size of the informal sector. Critics of trade liberalization have expressed the fear that intensified

foreign competition may induce large and medium-sized firms to cut worker benefits in order to reduce costs. To this end, such firms may replace permanent by temporary workers, or outsource activities to small, informal firms, including home-based and self-employed microenterpreneurs. This view finds some support in our results, which indicate that sectors that experienced larger tariff reductions and an increase in imports saw a rise in informal employment. Because the informal sector does not provide benefits and is believed to offer lower job quality, this trend would contribute to an increase in inequality.

Overall, we conclude that the trade reforms in Colombia did affect the income distribution (via their impact on skill-biased technological change, industry wage premiums, and informality), but the overall effect was modest compared to other countries, especially Mexico. The difference between the Colombian and Mexican experience is interesting and worth further exploring, as it provides a fruitful ground for studying the conditions under which policies aimed at promoting growth and efficiency have no (or relatively small) adverse effects on the income distribution. One potential explanation for the larger effect of the reforms on income inequality in Mexico hinges on the role of foreign direct investment, which was large in Mexico (see Cragg and Epelbaum (1996) and Feenstra and Hanson (1997)). Another explanation is the active role of the Colombian government in improving social conditions and education, which may have partially offset the negative impact of the reforms on the income distribution. We do not attempt to resolve these issues in this paper, but we leave them as a topic for further research.

2. Data

2.1 Data on Trade Reforms

Colombia's trade policy underwent significant changes during the past three decades. Although Colombia considerably liberalized its trading environment during the late 1970s, the government increased protection during the early 1980s in an attempt to combat the impact of the exchange rate appreciation and intensified foreign competition.[1] As a result, the average tariff level increased to 27 percent in 1984. The level of protection varied widely across industries.

[1] High world prices of coffee, significant foreign borrowing by Colombia, and illegal exports all contributed to the large appreciation of the peso during the late 1970s and early 1980s (Roberts and Tybout (1997)).

Manufacturing industries enjoyed especially high levels of protection with an average tariff of 50 percent. Imports from the two most protected sectors, textiles and apparel, and wood and wood product manufacturing, faced tariffs of over 90 percent and 60 percent respectively. This suggests that Colombia protected relatively unskilled, labor-intensive sectors, which conforms to findings by Hanson and Harrison (1999) for Mexico. From 1985 to 1994, Colombia gradually liberalized its trading regime by reducing the tariff levels and virtually eliminating the non-tariff barriers to trade.

Table 1a provides the average tariff across all industries, across agriculture, mining and manufacturing, and across manufacturing from 1984 to 1998, the period of our study.[2] The average tariff declined from 27 to about 10 percent from 1984 to 1998. The average tariff level in manufacturing dropped from 50 to 13 percent during the same period. Table 1b summarizes the average Non-Trade Barriers (NTB) in 1986, 1988, and 1992.[3] In 1986, the average coverage ratio was 72.2 percent. As is the case with tariffs, NTB protection varies widely across industries, with textiles and apparel industry and the manufacturing of wood and wood products enjoying the highest level of protection. Between 1990 and 1992, the average NTB dropped to 1.1 percent.

What is remarkable about the Colombian trade reforms is that did not just reduce the *average* level of tariffs and NTBs, they more importantly changed the *structure* of protection. This is nicely illustrated in Figure 1 that plots tariffs in 1984 and 1998. Each two-digit SIC is indicated by the relevant number: for instance, sector 32 (textile and apparel) had tariffs of 90% in 1984 and below 20% in 1998. The relatively low correlation between the tariffs in 1984 and 1998 suggests that the structure of protection has changed. The same is true for NTBs; the

[2] The source of tariff information is the Colombian National Planning Department (DNP). The original data provide tariff levels and the number of tariff lines at the 3-digit ISIC level from 1984 to 1998. This information is missing in 1986. However, 4-digit ISIC tariffs on agriculture, mining, and manufacturing from the World Bank that cover the period up to 1988 indicate that almost no tariff changes occur between 1985 and 1986 at the 4-digit ISIC level. The tariff means in 1985 and 1986 are not statistically different from each other and the correlation in tariffs across the two years is .999. We thus use the 1985 tariff information from DNP for 1986. We aggregate tariffs to a 2-digit level, so that they correspond to the level of industry aggregation in the household survey. To aggregate to the 2-digit level, we weight 3-digit tariffs by the number of tariff lines they represent. We have also used 3-digit imports as weights, which yielded similar 2-digit ISIC tariff means. Tariff data are available for 2-digit agricultural sectors, mining sectors, manufacturing, as well as ISIC codes 41 (electricity), 83 (real estate and business services), 94 (recreational and cultural services), and 95 (personal and household services). For most of the latter categories, tariffs are usually zero, except for some years in the 1990s. This yields a total of 21 industries with tariff data.

[3] The source of NTB information is the United Nation's publication Directory of Import Regimes. NTBs are measured as coverage ratios. They are available for 2-digit ISIC sectors in agriculture, mining, and manufacturing, as well as ISIC 61 (wholesale trade).

correlation of NTBs between 1986 and 1992 is not significantly different from zero (.10 with a p-value of .69). In our empirical work we exploit this cross-sectional variation in protection changes to identify the differential impact of the reforms on earnings in each sector, and examine whether these changes contributed to the increase in inequality.

2.2 National Household Survey

We relate the trade policy measures to household survey data from the 1984, 1986, 1988, 1990, 1992, 1994, 1996, and 1998 June waves of the Colombian National Household Survey (NHS) administered and provided by the Colombian National Statistical Agency (DANE). The data is a repeated cross-section and covers urban areas. The data provide information on earnings, number of hours worked in a week, demographic characteristics (age, gender, marital status, family background, educational attainment, literacy, occupation, job type), sector of employment, and region. The survey includes information on about 18,000 to 36,000 workers in a year.[4] The industry of employment is reported at the 2-digit ISIC level, which gives us 33 industries per year. The retail trade industry employs about 20 percent of the Colombian workforce and it is Colombia's largest employer at the two-digit ISIC industry level. The manufacturing sector as a whole (1-digit ISIC 3) comprises about 21 to 24 percent of the overall labor force. Among manufacturing industries, textile and apparel accounts for about 10 percent of the Colombian employment, followed by food processing (3.5 percent) and manufacturing of machinery and equipment (3.5 percent).

We use the household survey to create several variables. We construct an hourly wage based on the reported earnings and the number of hours worked normally in a week.[5] Using the information on the highest completed grade, we define four education indicators: no completed education, completed primary school, completed secondary school, completed college (university degree). We distinguish between seven occupation categories: professional/technical, management, personnel, sales, service workers and servants, blue-collar workers in agriculture/forest, blue-collar industry workers. In addition, we control for whether an individual

[4] We have excluded all workers for which one or more variables were not reported.
[5] The survey allows the worker to report monthly, weekly, biweekly, daily, hourly, or ten-day earnings. For workers who receive room and board on a monthly basis, we incorporated the self-reported value of room and board into their earnings. For self-employed workers, we use their monthly net earnings from their business to calculate their hourly wage.

works for a private company, government, a private household, or whether a worker is an employer or is self-employed. Descriptive statistics for each year of the data are provided in Table 1c.[6]

Of particular interest in this table are the percentages of workers belonging to the various education groups. First, note the low proportion of individuals with completed college education. Second, the table indicates that while the proportion of individuals with college education and high school degrees increases during our sample period, Colombia, like other countries in Latin America, lags behind the economies of South East Asia in terms of human capital accumulation. Moreover, there are no signs that the gap is closing. This is consistent with the evidence presented in other papers. Attanasio and Szekely (2000) show that in the cohort of individuals born between 1955 and 1959, the proportion of individuals with at least secondary education is about 40% in Mexico and Perú, while Nuñez and Sanchez (2001) report that for the same Colombian cohort, the number is between 30 and 40%. In contrast, this proportion is almost twice as high in Taiwan. The aggregate numbers presented in Table 1c hide sizeable cohort effects in the proportion of college educated and high school graduates. These are well documented in Nuñez and Sanchez (2001) for Colombia, and in Attanasio and Szekely (2000) for Mexico, Perú, Taiwan, and Thailand.

Our data also provide detailed information on informality and workplace characteristics unavailable in many other labor force surveys. First, the survey asks each worker whether a worker's employer pays social security taxes.[7] The employer's compliance with social security tax (and thus labor market) legislation provides a good indicator that a worker is employed in the formal sector. Given that between 50 to 60 percent of Colombian workers work in the informal sector, the inclusion of information on informality seems crucial. Moreover, Colombia implemented large labor market reforms in 1990 that increased the flexibility of the labor market by decreasing the cost of hiring and firing a worker (see Kugler (1999) for details). These reforms likely affected the incentives of firms to comply with labor legislation and their hiring and firing decisions, as well as the worker's choice between formal and informal employment. Descriptive statistics suggest that about 57 percent of workers worked in informal sector prior to

[6] One potential shortcoming of the data on worker's characteristics is the lack of information on the union status. However, anecdotal evidence suggests that unions are ineffective in most industries. The only exception is the union in the petroleum industry, USO (Union Syndical Obrera), whose power stems from its close ties to the Colombian guerrillas.

[7] This information is not available in 1984.

92. This is also the share of informal workers in 1992, however the share fluctuates significantly thereafter from .51 in 1994 to about .6 in 1996 and 1997. Furthermore, the survey provides several workplace characteristics. We create four indicator variables to capture whether a worker works alone, whether the worker works in an establishment with 2 to 5 people, 6 to 10 people, or 11 or more people. We also use an indicator for whether a worker works in a permanent establishment in a building (as opposed to outdoors, kiosk, home, etc.).

These workplace characteristics potentially control for differences in the quality of the workplace across industries. In 1994 we can check this interpretation of our workplace controls by correlating them with particular measures of workplace quality that are available in a special module for 1994 only. Using the 1994 quality of work survey, we create an indicator for whether a worker has received job training at the current job, an indicator for whether a worker finds employee relations excellent or good, an indicator for whether a worker grades physical, mental, and social conditions at a workplace as excellent or good, and an indicator that is one when a worker finds his job excellent or good. Working in a larger firm or working in a permanent building/establishment is positively correlated with job training, satisfaction with workplace conditions, employee relations, and general job satisfaction. Working in the informal sector is negatively correlated with job satisfaction, good workplace conditions, good employee relations, and job training.

The negative correlation between informality and various measures of job quality suggests that it is potentially important to account for the informal sector in a study of inequality – where inequality is interpreted broadly as the gap between "good'' and "bad'' jobs. If trade liberalization leads to an increase in informality, and informality is associated with worse working conditions, then trade reform will widen the gap between those who are well off and those who are not.

3. Measuring Inequality over 1984-1998

We start by asking the basic question of whether inequality has increased over our sample period. We use two measures of inequality. The first one is the standard deviation of the log wages. The second one is the difference between the 90^{th} and 10^{th} percentile of the log wage distribution. The aggregate trends are documented in Table 2a and Figures 2a and 2b.

Both the standard deviation of the log wages and the difference between the 90th and the 10th percentile suggest a modest increase in inequality between 1990 and 1996, and a substantially larger increase between 1996 and 1998. In interpreting these trends, it is important to remember that our sample is confined to the urban sector in Colombia, which accounts for approximately 85% of the Colombian labor force. Accordingly, our inequality measures do not adequately capture changes in the income distribution that may result from changes in the relative incomes of rural workers; as Johnston (1996) has shown, this may result in underestimating the overall change in inequality. A further trend that is visible from Figures 2a and 2b is that the increase in the 90-10 differential over 1990-1996 is less pronounced than the increase in the standard deviation. This indicates that most of the change in the standard deviation of the log wages is accounted for by changes in the incomes of the top 10% of the population. Given that these top 10% are comprised primarily of college educated workers (the percentage of college educated individuals in our data ranges between 7 and 14%), it is likely that the increase in the wage dispersion can be partially accounted for by an increase in the returns to college education. The experience in other developing countries, especially Mexico, that experienced a large increase in the college premium in the aftermath of trade reforms, reinforces this interpretation. We investigate the relevance of this explanation more rigorously later in the paper.

To get a preliminary idea of whether changing returns to education are responsible for the increase in inequality, we compute how inequality has changed within well-defined educational groups. In particular, we distinguish between three groups: workers with completed primary, or less than primary education; workers with completed secondary education (and maybe some college); and workers with completed college education. For each group we compute the standard deviation of the log wages within the group, and the difference between the 90th and 10th percentiles. The results are displayed in Table 2b and Figures 2c and 2d.

The basic conclusion that we draw from these results is that within group inequality increased over 1990-1996 for all three groups, with the college-educated group exhibiting the largest increase. Though the increase in the inequality measures for the college-educated group may be exaggerated by changes in the top coding procedures in the NHS in the early 1990s, the message the results in Figures 2c and 2d send is clear: the college premium alone cannot explain

the increase in wage dispersion. Other factors, such as industry effects, or changing returns to occupations, are potentially important.

To investigate the contribution of alternative explanations in explaining wage dispersion in Colombia over this period, we regressed log wages in each year against a series of demographic controls, educational, occupational, and industry dummies, and workplace characteristics. The results from these regressions are displayed in Tables 3-6. Tables 3 and 4 include the whole sample; the difference between the two tables lies in the controls we include in the regressions. Because workplace variables were not available for 1984, Table 3 omits workplace controls from the estimation, so that 1984 can be included in the comparisons. Table 4 includes all available information on the workplace, but omits 1984. Tables 5 and 6 are similar to the previous two tables, but include only males in the estimation in an effort to eliminate the impact of selection effects that are potentially important in female labor supply. The results across the four tables turn out to be similar. The main difference between the full and the male-only samples seems to be in the magnitude of the estimated return to college education, which is higher for males only. Nevertheless, the trends across years remain robust across the different samples.

The results in tables 3-4 can be used to inform the investigation of inequality in two ways. First, the increase in the R^2 of the regression as we successively include more controls gives some indication as to which factors contribute most to explaining the variance of log wages. The problem of course with this inference is that the covariates tend to be highly correlated with each other, so that the contribution to the increase in the R^2 will depend on the order in which we add controls. Nevertheless, one can obtain a rough idea as to whether there is a set of controls (e.g., occupational dummies or industry dummies) that seems to have particularly high explanatory power. Our experimentation with various specifications in the above regressions failed to isolate such a set of variables. In terms of our inequality discussion this implies that there is not a single factor that we can attribute the increase in inequality to, but that the increase in inequality is the result of several forces working in the same direction.

Second, by examining the change in the coefficients across years, we can get a preliminary idea as to which returns to which worker characteristics seem to have changed most over this period. Given the experience in other developing countries, and the theoretical literature

on the effects of trade policy, there are four sets of variables that seem a-priori likely to have been affected by the reforms:

(1) Returns to education. Indeed, between 1986 and 1998, the return to college education increases by ca. 11% relative to the return to the lowest educational category (less than primary school); for the period 1990-1998, the effect is even larger (21%). The returns to secondary and primary education remain relatively stable in comparison.

(2) Industry wage premiums. These are captured through industry dummies in each year. While these dummies are not displayed in the tables for expositional reasons, the low correlation of their estimates across years suggests that industry premiums have changed substantially during this period, possibly because of the reforms.

(3) Returns to Occupations. In their study of the Mexican trade liberalization, Cragg and Epelbaum (1996) report significant changes in the returns to specific occupations, in particular professionals and managers. In fact, changing returns to occupations explain in Mexico a large fraction of the changing return to the college premium. However, this does not seem to be the case in the Colombian data. The returns to various occupations remain relatively stable over the 1986-1994 period; the stability of the returns to professionals in particular is in sharp contrast with the pattern reported for Mexico. Only in 1992 there is a substantial increase in the return to managers. This is intuitive, and consistent with the interpretation given by Cragg and Epelbaum for a similar finding for Mexico: During periods of substantial economic reforms managerial talent is in high demand. Since the Colombian reforms were concentrated in the 1991-1993 period, the increase in the managerial premium in 1992 is consistent with an increase in demand for managerial skill. Nevertheless, this increase gets reversed in later years, and it is not by itself sufficient to explain the overall increase in wage dispersion.

(4) Informality. The negative coefficients on the informality dummies imply that workers employed in the informal sector earn less than workers with similar characteristics in the formal sector throughout our sample period. However, the informality "discount" varies substantially across years. From 1986 to 1994, the difference between the compensation of formal and informal workers gradually declines; from 1994 on, however, the informality discount starts increasing, and it reaches unprecedented magnitudes in 1996 and 1998. At the same time, the informal sector seems to expand in the later years of our sample (the share of informal

employment rises from 56-57% to 59-60%). These trends contribute to the rise in inequality since the informal sector employs a higher fraction of low-wage workers.

Given these patterns we focus our discussion in the rest of the paper on three sets of variables: the skill premium, the industry premiums, and the informality discount. In each case, we start our discussion by indicating what the predictions of trade theory are regarding the effects of trade liberalization on each of the above variables. Next, we contrast these predictions with the data. We do not devote further attention to returns to occupations, both because (with the exception of the return to managers in 1992) these do not seem to substantially change over this period, and because it is unclear how trade reforms would affect particular occupations through channels other than industry affiliation or changing returns to education.

4. The Skill Premium

The evolution of the returns to education can be seen clearly in Figure 3 that plots the returns to university, secondary, and elementary education respectively, relative to the lowest educational group (less than elementary). The figure is based on the results in Table 4. The figure refers to the full sample, but similar graphs were obtained for the male-only sample. As pointed out above, the returns to secondary and elementary education remain stable over this period, while the return to college education increases by 21% between 1990 and 1998.

The increase in the college premium could be driven by changes in the rents of specific industries that employ a higher proportion of educated workers, or by changes in the returns to particular occupations that are highly correlated with education. To examine, to which extent the increase in the average skill premium can be accounted for by changes in occupational or industry returns, we compute in Table 7 the average returns to education based on a series of regressions, each of which controls for a different set of characteristics. The table includes two measures of educational returns: the secondary school premium relative to elementary education, and the university premium relative to elementary. If the rise in the skill premium were driven by changes in occupational returns and/or industry rents, we would expect the increase in the college premium to go down once we control for occupation and/or industry affiliation. However, this expectation is not confirmed in Table 7. In a regression without any industry or occupational controls, the change in the university degree-elementary premium is 16.8%

between 1986 and 1998 (top panel).[8] Controlling for both industry and occupational effects (bottom panel) reduces this increase to 14.1%. This suggests that only a very small fraction of the skill premium increase can be accounted for by changes in industry premiums and occupational returns.

To put these numbers in context, it is instructive to compare them to the ones obtained by Cragg and Epelbaum (1996), who conducted a similar exercise for Mexico. The increase in the skill premium in Mexico over 1987-1993 is substantially larger than our estimate for Colombia: the return to post-secondary education relative to secondary education is reported to rise by 60% between the two years. However, a large portion of this increase is accounted for by changes in the returns to occupations, the rising returns to managers and professionals in particular. Controlling for occupation alone reduces the increase in the Mexican skill premium to 40%. In contrast, the skill premium increase in Colombia is more modest, and cannot be accounted for by occupational returns.

A further exercise we conducted to investigate whether the increase in the skill premium was tied to particular sectors was to interact educational dummies with industry dummies. Almost all industry/college dummy interactions were insignificant. Interactions of industry dummies with dummies for either college or secondary education were statistically significant, but their inclusion did not affect the estimate of the average skill premium increase.

Despite the fact that these interactions were individually insignificant, F-tests could not reject the hypothesis that they were jointly significant (the p-values were always 0.00). To investigate whether there is a relationship between trade policy and changes in sector-specific skill premiums, we regressed the sector-specific skill premiums in each year (the college/industry dummy interactions) against tariffs, sector fixed effects and time indicators. If the increase in the skill premium were the consequence of trade liberalization, and if labor mobility were constrained in the short run (a reasonable assumption for Colombia), we would expect sectors with smaller tariff reductions to be associated with a larger increase in the (sector-specific) skill premium. All regressions, however, produced statistically insignificant coefficients. This could be interpreted as evidence that either trade policy was not the primary

[8] We omit 1984 from the comparisons, because firm size and informality controls were not available for this year. Without such controls, our estimate of the college premium becomes larger. This is intuitive since college educated workers work primarily in the formal sector, and wages in the formal sector are higher. The college premium in this case also captures the premium of working in the formal sector.

reason for the skill premium increase, or, alternatively, that labor was mobile across sectors, so that the returns to education were equalized across sectors. In this latter case, trade policy might have led to an increase in the economy-wide skill premium, still we would find no evidence of a differential impact in sectors with larger tariff reductions. We investigate this possibility in the next section.

To summarize, the results from this section lead us to conclude that the increase in the skill premium we document in Figure 3 represents an increase in the economy-wide return to college education that cannot be accounted for by sector specific or occupation specific effects. We now turn to the question of whether trade liberalization could be responsible for this change in the economy-wide skill premium.

4.1 Was the Increase in the Economy-Wide Skill Premium Due to the Trade Reforms?

The link between trade liberalization and changes in the economy-wide skill premium is provided by the workhorse model of international trade, the Heckscher-Ohlin model, and is companion theorem, Stolper-Samuelson. The Hecksher-Ohlin model predicts that countries will export goods that use intensively the factors of production that are relatively abundant, and import goods that use intensively the relatively scarce factors of the country. The Stolper-Samuelson theorem links factor prices to product prices. According to this theorem, trade affects wages only through changes in product prices. In its simple 2x2 version, the theorem states that a decrease in the price of a good will reduce the return to the factor that is used intensively in the production of this good, and increase the return to the other factor. Because trade policies change product prices, the Stolper-Samuelson theorem can be used to infer how factor prices (e.g., wages) will respond to a change in the trade regime.

It is the logic of the Stolper-Samuelson theorem that led to the hope that trade liberalization would benefit the poor in developing countries, and thus contribute to a decrease in inequality. To illustrate the argument, consider a stylized view of the world in which there are two countries, a developed and a developing one, and two factors of production, skilled and unskilled labor. The developed country is relatively skilled-labor abundant, while the developing country is relatively unskilled-labor abundant. According to Heckscher-Ohlin, the developing country will export unskilled-labor intensive products, let's say apparel, and import skilled-labor

intensive commodities, let's say manufactures. Now consider the effect of a trade barrier reduction in the developing country. The decrease in protection will lead to a drop in the price of the import sector, and a price increase in the export sector. According to Stolper-Samuelson, the price decrease in the import sector will hurt the factor that is used intensively in this sector (skilled labor), and benefit the factor that is used intensively in the export sector (unskilled labor). Note that the price changes affect only economy-wide, and not sector specific, returns. This is because the factors of production are assumed to be mobile across uses within the country, so that their returns are equalized across sectors; the relative price increase in the export sector leads to an increase in the demand for the factor that is used intensively in this sector (unskilled labor) and hence an increase in its economy-wide return. Labor mobility (along with perfect competition and given technology) is thus an essential ingredient of this argument.

Against this theoretical background, the experience in many developing countries that witnessed an increase in the skill premium and overall inequality in the aftermath of trade liberalization, has been both a disappointment and a puzzle. How can unskilled-abundant countries experience an *increase* in the skill premium when trade barriers are reduced? This pattern seems at first in sharp contrast with the prediction of the Stolper-Samuelson theorem.

Our claim in this paper is that the increase in the skill premium in Colombia is not only "not puzzling", but also perfectly consistent with the Stolper-Samuelson theorem. The reason is simply that the sectors that experienced the largest tariff reductions (and hence the largest reductions in the price of their output) were precisely the sectors that employed a higher fraction of unskilled workers. This is shown clearly in Figure 4 that plots the tariff decline between 1986 and 1998 for each industry against the share of unskilled workers in 1984 (unskilled is defined as having at most complete primary education). The graph shows a positive correlation between the size of tariff reductions and the share of unskilled workers. A regression of the annual change in tariffs against the share of unskilled workers in 1984 yields a coefficient of –9.2 for the share of unskilled workers (t-statistic=2.4), and an R^2 of .18. It is interesting to note that Hanson and Harrison (1999) report a similar pattern for Mexico. But then this is exactly what Stolper-Samuelson would predict: given that trade liberalization was concentrated in unskilled-labor-intensive sectors, the economy-wide return to unskilled labor should decrease.[9]

[9] What is perhaps more surprising (and inconsistent in some sense with the simple 2x2 version of the Heckscher-Ohlin model) is the fact that it was the unskilled-intensive sectors that were heavily protected prior to the reforms.

While the above argument demonstrates that the rise in the skill premium documented in the previous section could *in principle* be attributed to the trade reforms, it does not of course constitute proof that it was the trade reforms that led to this rise. In search for Stolper-Samuelson effects on wages we take an indirect route. We check whether there is evidence that the general equilibrium adjustment mechanism suggested by the Heckscher-Ohlin model is at work. This mechanism implies a contraction of the sectors that experience a (trade-barrier reduction induced) decline in their output price, and an expansion of the sectors that experience a relative price increase. Accordingly, we would expect to see labor reallocation from the sectors with the largest tariff reductions to the sectors with the smaller tariff reductions. Table 8 shows the employment shares in each industry in 1984 and in 1998. These shares remain remarkable stable. There is certainly no evidence of labor reallocation across sectors. Regressing industry employment shares on industry tariffs, industry, and time indicators confirms this conclusion: the tariff coefficient is small in magnitude (0.0001) and statistically insignificant. In sum, the employment patterns over 1984-1998 are not consistent with an explanation that would attribute the rise in the skill premium to changes in trade policy, operating through Stolper-Samuelson effects. We should note that the stability of the employment patterns is consistent with the evidence from Mexico; Revenga (1997), Hanson and Harrison (1999), and Feliciano (2001) all report that the adjustment of the Mexican labor market to trade liberalization occurred through relative wage adjustments and not through labor reallocation across sectors. This adjustment process contrasts with the evidence from the United States, where Grossman (1986) and Revenga (1992) find greater employment than wage sensitivity to trade shocks. The differences in the adjustment mechanisms of Colombia and Mexico on one side, and the U.S. on the other, are suggestive of greater labor mobility in the United States compared to the other two countries. This is consistent with the view that labor market rigidities in developing countries often obstruct labor reallocation in response to economic reforms.

Having eliminated Stolper-Samuelson effects as the primary mechanism leading to the rise in the skill premium, we next consider the role of skill-biased technological change, since evidence from several countries seems to suggest that the latter has had important effects on the

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These sectors (especially textiles and apparel, and wood and wood products) are characterized by low imports. This pattern of protection could be explained within a political economy model of protection such as Grossman and Helpman (1994), or alternatively, by an extension of Heckscher-Ohlin to a three-factor (natural resources, unskilled, and skilled labor) version (see Wood (1999) and Leamer et al (2002)).

income distribution in the last two decades. To measure skilled-biased technological change, we use a rough measure that has been employed in earlier papers: the share of skilled workers in each industry. The right panel of Table 8 shows that this share has increased substantially in every industry between 1984 and 1998. This is strong evidence in favor of skilled-biased technological change, as any other explanation would suggest that firms should substitute away from skilled labor given the higher price of skilled workers (rising skill premium).[10]

The evidence in favor of skilled-biased technological change does not imply, however, that trade policy did not have an indirect effect on changes in the income distribution. To the extent that technological change was an endogenous response to intensified competition from abroad (a point made by Wood (1995) and more recently by Acemoglu (2001)), one could argue that the trade reforms were indirectly responsible for the increase in the skill premium.

To investigate this claim, we regress in Tables 9a and 9b the share of skilled workers in each industry against industry tariffs, industry and time indicators. Table 9a reports results from OLS. Table 9b uses 2SLS to account for the potential endogeneity of trade policy (for example, in setting tariffs, policy makers could be taking into account industry characteristics, such as the share of skilled or unskilled workers, wages, etc.). To find appropriate instruments for tariffs we rely on the history of protection in Colombia and the institutional details of the reforms. Anecdotal evidence and World Bank reports suggest that the Colombian government initiated liberalization in response to exchange rate fluctuations and the trade balance. This indicates that at the macroeconomic level, exchange rates are one of the factors responsible for the trade policy changes. However, exchange rates alone cannot explain why some sectors experienced larger tariff reductions than others. In explaining the latter, two facts seem of importance. First, before the onset of trade liberalization, there was substantial tariff dispersion across sectors. Second, the Gaviria government was committed to economy-wide liberalization for the purpose of

[10] Leamer has made the argument in several papers that it is sector-bias, and not factor-bias that is relevant for the income distribution. Skilled-biased technological change that is concentrated in unskilled-intensive sectors would benefit unskilled workers in the general equilibrium, while skilled-biased technological change concentrated in skilled-intensive industries would benefit skilled workers. Motivated by this argument we regressed the annual change in the share of skilled workers in each industry on the initial skill intensity of the industry in 1984. A positive coefficient would suggest bias that would favor skilled workers (skilled-biased technological change would be more pronounced in sectors that are initially skill-intensive). However, this regression did not produce a statistically significant coefficient. If anything, the negative sign of the "initial skill-intensity" coefficient would suggest the presence of skilled-biased technological change that is concentrated in low-skill sectors. Note, however, that Leamer's argument rests on the assumption of fixed product prices, which is unlikely to hold during trade liberalization.

exposing domestic producers to international competition among other things. This goal translated to proportionately larger tariff reductions in sectors that had historically higher tariff levels. The close link between the magnitude of tariff reductions and the initial level of protection in 1983 (a year prior to our sample) is evident in Figure 5 that pictures the relationship between the 1998-1984 decline in industry tariffs and the 1983 industry tariff level; it illustrates a strong positive correlation between tariff declines and the 1983 tariff level. A regression that relates the 1998-1984 tariff reductions to the 1983 tariff levels yields a coefficient on the 1983 tariff of 1.06 (with a T-statistic of 26.3) and an R^2 of .97. This again demonstrates that the 1998-1984 tariff declines were higher in industries with historically high tariff levels.
This discussion suggests that the 1983 industry tariff levels, and their interaction with exchange rates, are highly correlated with the industry tariff reductions and may provide good instruments for the tariff changes.

The most informative results (in both tables) are the ones in column 4 that were obtained with controls for both industry and time effects. This is similar to estimating the relationship between the share of skilled workers and protection in first differences; accordingly we interpret the coefficients as indicating how changes in tariff protection have affected changes in the share of skilled workers in each industry. The results indicate that the share of skilled workers in each industry is inversely related to protection; industries with larger tariff reductions experienced more rapid skill-biased technological change, as measured by the proportion of skilled workers. This is consistent with what Adrian Wood has labeled "defensive innovation"; firms in sectors facing intensified import competition (and these, in Colombia, are the sectors employing more unskilled workers) look for new methods of production that economize on unskilled labor.

In summary, our results suggest that the increase in the skill premium cannot be linked to developments in particular sectors of the economy – it was an economy-wide phenomenon. While this, in principle, opens the door for Stolper-Samuelson effects, we find no evidence of the labor reallocation mechanism across sectors that should accompany such effects. However, we do find evidence in favor of skill-biased technological change, which was more rapid in sectors that experienced larger tariff reductions. To the extent that skilled-biased technological change was induced, at least partially, by changes in the trade regime, we conclude that trade liberalization may have had an indirect effect on the rise of the skill premium.

5. Effects of Trade Reforms on Industry Wage Premiums

5.1 Theoretical Background and Methodology

As noted in Section 3, changes in the economy-wide returns to education can only partially explain the increase in inequality, since wage dispersion also increases within each educational group. To explain the rise in the within group inequality, we now turn to the role of other factors, such as changing industry premiums. Our focus on industry premiums is motivated by two considerations.

First, our empirical results suggest that industry premiums (captured through industry dummies in the regressions of Tables 3-4) change substantially over this period. Year-to-year correlations of industry premiums are as low as 0.14. This contrasts sharply with the evidence on wage premiums in the U.S., where wage premiums have been shown to be stable across years (year-to-year correlations are always estimated to be above 0.9).[11] This raises the possibility that the trade reforms changed the structure of industry wages.

Second, there are good theoretical reasons to believe that trade reforms that changed the structure of protection would affect relative, and not only economy-wide, wages. The focus on economy-wide returns that underlies our discussion of the skill premium is premised on the assumption that labor is mobile across sectors. Yet, this is an assumption that is unlikely to hold, especially in the short- and medium-run, and in developing countries like Colombia, where labor markets are characterized by significant labor rigidities. Indeed, our results on employment shares in Table 8 suggest limited labor mobility across sectors. In addition, there is substantial evidence that wages for observationally equivalent tasks differ across industries; this inter-industry variation is hard to reconcile with the assumption of perfect factor mobility.

The perhaps most natural point of departure for thinking about the effects of trade on relative wages is the specific factors model. This model is short-run by nature as it considers factors of production immobile across sectors. It predicts that sectors that experienced relatively large tariff cuts will see a decline in their wages relative to the economy-wide average, while

[11] See Dickens and Katz (1986), Krueger and Summers (1987) and (1988), Katz and Summers (1989), Gaston and Trefler (1994).

sectors with proportionately smaller trade barrier reductions will benefit in relative terms. The medium-run (Ricardo-Viner) model yields similar predictions. Note that these implications of models with constrained factor mobility differ from the ones of the Hecksher-Ohlin model, which predicts that trade reform should affect only economy-wide returns to the factors of production, but not industry specific returns, since all factors of productions are mobile across uses.

The above trade models assume perfectly competitive product and factor markets. Introducing imperfect competition opens up additional channels through which trade policy may impact wages. In the presence of unionization, it is possible that unions extract the rents associated with protection in the form of employment guarantees rather than wages (an idea developed in Grossman (1984)). Liberalization induced productivity changes may further impact relative wages. There is by now a voluminous literature on the effects of trade reform on firm productivity. While in theory the effects of liberalization on productivity are ambiguous (see Rodrik (1991) and Roberts and Tybout (1991, 1996) for a discussion), most empirical work to date has established a positive link between liberalization and productivity (Harrison for Cote d' Ivoire (1994), Krishna and Mitra for India (1998), Kim for Korea (2000), Pavcnik for Chile (2001a)). For Colombia specifically, Fernandes (2001) estimates that the trade reforms up to 1992 had a significant impact on plant level productivity. The productivity enhancements can occur either through exit of old inefficient plants and entry of new more efficient plants, or through better allocation of resources within existing plants. To the extent that productivity enhancements are passed through onto industry wages, we would expect wages to increase in the industries with the highest productivity gains. If these occur in the industries with the highest trade barrier reductions, industry wages would be positively correlated with trade liberalization.

The above discussion suggests that, based on theoretical considerations alone, it is not possible to unambiguously sign the effect of trade liberalization on industry wages. To empirically investigate this effect, we employ the two-stage estimation framework familiar from the labor literature on industry wages. The estimation has two stages. In the first stage we regress the log of worker i's wages ($\ln(w_{ij})$) on a vector of worker i's characteristics (H_{ij}) such as education, age, gender, marital status, occupation, geographic location, and a set of industry indicators (I_{ij}) reflecting worker i's industry affiliation (the regressions reported in Tables 3-6 correspond to this stage of the estimation):

$$\ln(w_{ijt}) = H_{ijt}\beta_{Ht} + I_{ijt} * wp_{jt} + \varepsilon_{ijt} \qquad (1)$$

The coefficient on the industry dummy, the wage premium, captures the part of the variation in wages that cannot be explained by worker characteristics, but can be explained by the workers' industry affiliation. Following Krueger and Summers (1988) we assume that the omitted industry has zero wage premium and express the estimated wage premiums as deviations from the employment-weighted average wage premium (wp_j).[12] This normalized wage premium can be interpreted as the proportional difference in wages for a worker in a given industry relative to an average worker in all industries with the same observable characteristics. The normalized wage differentials and their exact standard errors are calculated using the Haisken-DeNew and Schmidt (1997) two-step restricted least squares procedure provided to us by John P. Haisken-DeNew and Christoph M. Schmidt.[13] The first stage regressions are estimated separately for each year in our sample as the subscript t in equation (1) indicates. In the second stage, we pool the industry wage premiums wp_j over time and regress them on trade related industry characteristics.

$$wp_{jt} = T_{jt}\beta_T + D_{jt}\beta_D + u_{jt} \qquad (2)$$

The primary variable we include in T_{jt}, the vector of trade related industry characteristics, is tariffs. In addition, to address potential concerns about omitted variable bias, we also experiment with other controls in $T_{jt,}$ such as lagged imports, exports, import and export ratios, NTB measures, and interactions of the above variables with exchange rates. The vector D_{jt} consists of a set of industry and time indicators, which we include in our more complete specifications.

Since the dependent variable in the second stage is estimated, we estimate (2) with weighted least squares (WLS), using the inverse of the variance of the wage premium estimates from the first stage as weights. This procedure puts more weight on industries with smaller variance in industry premiums. We also account for general forms of heteroskedasticity and serial correlation in the error term in (2) by computing robust (Huber-White) standard errors clustered by industry.

The use of detailed information on worker characteristics and the panel structure of our data that allows us to control for unobserved sector heterogeneity through industry fixed effects

[12] The sum of the employment weighted normalized wage premiums is zero.
[13] Haisken DeNew and Schmidt (1997) adjust the variance covariance matrix of the normalized industry indicators to yield an exact standard error for the normalized coefficients.

alleviate potential concerns about the endogeneity of trade policy. Still, to the extent that *changes* in tariffs are correlated with unobserved characteristics that may also affect industry wages, our tariff coefficients could be biased. To address this concern, we also estimated specifications in which we instrument for tariff changes, using as instruments the same variables we discussed in the previous section: pre-reform tariff levels in 1983, exchange rates, and interactions of pre-reform tariff levels with exchange rates.

5.2 Results and Their Implications for Income Inequality

In the first stage of our estimation, we estimate equation (1) for each cross section of the household survey controlling for industry indicators and the following worker characteristics: age, age squared, gender, marital status, head of the household indicator, education indicators, literacy, location indicator, occupational indicators, and job type indicators.[14] This yields estimates of industry wage premiums conditional on observable worker characteristics. Note that we consider the use of individual wage data and worker characteristics to obtain an estimate of industry wage premium a plus. As Gaston and Trefler (1994) point out, average industry wages might vary across industries because different industries employ workers with varying characteristics. As a result, industries with a large share of unskilled workers are likely to have lower average wages. If these industries also have high tariffs, one could falsely predict that higher tariffs induce lower industry wages. Since we our industry wage premium estimates on individual characteristics in the first stage, the relationship between tariffs and wages in the second stage cannot be driven by (observable) differences in worker composition across industries.

Table 10a reports results from relating the wage premiums we obtained in the first stage to tariffs and the other trade exposure measures discussed above. Note that because trade flows are arguably endogenous (they depend on factor costs), we include the first lags of import and export measures in the estimation rather than their current values. We also experimented with including NTB measures in the estimation. Since NTB data are available for only three years,

[14]We have also experimented with several other specifications (see Goldberg and Pavcnik (2001)). The overall conclusions are similar to those reported in this paper. Moreover, the above specifications were estimated using both the log of the weekly earnings and the log of hourly earnings as dependent variables. The wage premiums based on these two definitions were highly correlated. We therefore focus our discussion on hourly wage premiums only.

this limits our sample considerably; however, for the three years we included in the estimation, the tariff coefficients were robust to the inclusion of NTBs.

The first two columns (column 1 and column 2) of the results refer to specifications that do not include industry fixed effects. Note that in all specifications the effect of tariffs on relative wages is negative (though not significant in the reported specifications).[15] Workers in industries with high tariffs receive lower wages than workers with identical observable characteristics in industries with low tariffs. One potential problem with these specifications is that they do not control for unobserved worker and industry attributes that affect protection and wages and could induce spurious correlation between tariffs and wages. Such characteristics could involve the ability to lobby the government for trade protection, or government's targeting of industries with specific characteristics. For example, some industries may easily organize and lobby for protection, while workers employed in these industries have higher wages than workers with the same observable attributes in other industries (potentially due to higher unobserved ability of these workers). Alternatively, policymakers may protect less productive industries, and these industries also pay lower wages. Or, workers in some industries may be willing to accept lower wages in return for higher job security. These workers are in turn protected by higher tariffs. To the extent that political economy factors and sorting based on unobserved worker attributes are time-invariant, we can control for them through industry fixed effects. Including fixed effects in columns 3 and 4 reverses the sign of the tariff coefficient, which is now positive and significant. This implies that increasing protection in a particular sector raises wages in that sector. The magnitude of the effect is significant. Suppose for example that in a manufacturing sector with an average level of protection in 1984 (50% tariff) the tariff level were reduced to zero. According to our estimates in column 4, this would translate to a 3.5% (0.07 x 50%) decrease in the wage premium in this sector. For the most protected sectors (91% tariff) this effect increases to 6.4% (0.07 x 91%).

Assuming that political economy determinants of protection do not vary much over relatively short time periods seems a reasonable identification assumption in many cases. However, given that the structure of protection changes over our sample period, time-variant political economy considerations are expected to be important. For example, if protection

[15] We should point out, however, that this coefficient was significant in some of the other specifications we estimated (not reported here).

responds to exchange rate pressures, and exchange rates also have a direct effect on wages, one would expect the tariff coefficient to be biased. We address this concern in two ways. First, in regressions reported in table 10a we control for variables such as lagged imports and exports, and most importantly, exchange rates in an effort to eliminate potential omitted variable bias. Second, we instrument for tariff changes, exploiting information on pre-sample protection measures. We exploit information on the institutional details of the Colombian trade reforms, which suggests that the pre-sample protection measures (1983 industry tariff levels), and their interaction with exchange rates, may provide good instruments for the tariff changes.[16]

Consider the following industry-level first-difference regression framework for industry j:

$$\Delta wp_{jt} = \alpha + \eta * \Delta t_{jt} + u_{jt}. \qquad (3)$$

Δwp_{jt} denotes the change in industry wage premium for industry j between t-1 and t, and Δt_{jt} denotes the change in tariffs in industry j between t-1 and t. The error term *u* may include variables omitted from the specification that drive changes in industry wages. Assuming that such omitted factors are uncorrelated with tariff levels in 1983, we can use the tariff levels in 1983 and their interactions with exchange rates as instruments for tariff changes, and estimate (3) using two-stage least squares (2SLS).

Table 10b contains results from the 2SLS estimation, in which we account for the potential endogeneity of trade policy *changes*. The first column reports the LS estimate of equation (3). Columns 2-4 report the 2SLS results. Although the magnitude of the tariff coefficient changes, the positive (and statistically significant) relationship between tariff reductions and declines in industry wage premiums is robust. The estimated effect of

[16] Anecdotal evidence and World Bank reports suggest that the Colombian government initiated liberalization in response to exchange rate fluctuations and the trade balance. This indicates that at the macroeconomic level, exchange rates are one of the factors responsible for the trade policy changes. However, exchange rates alone cannot explain why some sectors experienced larger tariff reductions than others. In explaining the latter, two facts seem of importance. First, before the onset of trade liberalization, there was substantial tariff dispersion across sectors. Second, the Gaviria government was committed to economy-wide liberalization for the purpose of exposing domestic producers to international competition among other things. This goal translated to proportionately larger tariff reductions in sectors that had historically higher tariff levels. A regression that relates the 1998-1984 tariff reductions to the 1983 tariff levels yields a coefficient on the 1983 tariff of 1.06 (with a T-statistic of 26.3) and an R^2 of .97. This demonstrates that the 1998-1984 tariff declines were higher in industries with historically high tariff levels. Overall, our findings suggest that the 1983 industry tariff levels, and their interaction with exchange rates, are highly correlated with the industry tariff reductions and may provide good instruments for the tariff changes.

liberalization on wages drops however from .0012 in column 1, to .0005 in column 2. The coefficient of .0005 implies that a 50-point tariff reduction would lead to a 2.5 percent decline in wage premiums.

These results suggest that trade policy had a significant effect on relative wages. Workers employed in industries with larger tariff reductions experienced a decline of their wages relative to the economy-wide average. This by itself does not imply an increase in inequality. If the industries with the larger tariff reductions had been the industries with the initially highest wage premiums, then trade policy would have reduced wage dispersion. However, our findings suggest exactly the opposite pattern. The sectors that experienced the largest tariff reductions were in fact the sectors with the highest shares of unskilled workers, and lowest wages (see section 4.1 and Figure 4). In the manufacturing sector in particular, where most of the trade liberalization was concentrated, the lowest wage premiums are estimated in textiles and apparel, food processing, and wood and wood processing, all sectors that were heavily protected prior to the reforms, and experienced the largest tariff cuts. In particular, textiles and apparel had tariff cuts around 73 percentage points between 1984 and 1998, while the tariff reductions in food processing and wood and wood processing were 29 and 49 percentage points respectively. These tariff reductions are to be contrasted with the ones in the high wage premium sectors of coal mining (tariff cut: 11 percentage points) and crude petroleum (tariff went actually up by 4 percentage points). The negative relationship between tariff reductions and wage premiums is also illustrated in Figure 6 that plots tariff reductions between 1984 and 1998 against the wage premiums in the first year of our sample, 1984. A regression of tariff reductions against wage premiums in 1984 confirms the impression conveyed by Figure 6: the wage premium coefficient is negative and statistically significant (coefficient: -6.4; t-statistic: -1.83) indicating that the larger the wage premium the smaller the tariff cut (note tariff cuts are positive numbers). The trade reform induced changes in the wage premiums could thus only increase inequality.

6. Effects of Trade Reforms on Informality

An emerging concern in many Latin American countries is that trade liberalization has contributed to the rise in the number of informal workers (Stallings and Peres (2000)). In Colombia, the informal sector employs 50 to 60 percent of the labor force and has been

expanding during the 1990s.[17] The presence of a large informal sector provides an additional margin through which labor markets can adjust to external shocks in developing economies. In particular, opponents of globalization have argued that firms exposed to increased international competition may try to reduce costs by cutting worker benefits. To do this, large and medium-sized firms, or multinationals, may outsource activities to small, informal firms, including home-based and self-employed microenterpreneurs. Alternatively, they may replace permanent, full-time workers, with temporary and/or part-time labor. Currie and Harrison (1997), for instance, indeed find that after the trade liberalization in Morocco firms started hiring more temporary workers.

Because the informal sector does not provide benefits and it is believed to provide lower job quality, a trade reform induced rise in informality may then contribute to the rise in inequality, where inequality is broadly defined as the gap between those who have well paid jobs with benefits and high job quality, and those who face lower wages, no benefits, and worse workplace conditions. This claim is controversial. There is a large literature that claims that employment in the informal sector is voluntary and should not therefore be considered an inferior option. However, a special module in the 1994 NHS contains questions about work conditions and job satisfaction that allow us to assess the validity of the claim that informality is associated with lower job quality. We find that working in the informal sector is indeed negatively correlated with job satisfaction, good workplace conditions, good employee relations, and job training.

While the concerns about informality have received a lot of attention recently, there is no sound empirical evidence linking the trade reforms to the increase in informal employment and addressing the possible effects increased informality may have on wage inequality. Our data set with its detailed information on the informal sector is ideal for filling in this gap. As described in section 2.2, the main criterion we use to assign firms to the informal sector is compliance with labor market regulation. The NHS June waves ask workers whether their employer contributes to social security. This information is an excellent proxy for formality, as it indicates whether or not the employer complies with labor legislation. Furthermore, this definition has an obvious

[17]An interesting feature of the Colombian data is that informality is present in *all* industries. This contrasts with the widely held view that informality is a feature of specific sectors, such as wholesale and retail trade. While these sectors do have the highest shares of informal workers in our sample (76 and 67% respectively), the share of informal employment in manufacturing is 48%. Moreover, this share has increased over time in manufacturing, peaking in 1996 and 1998.

appeal to trade economists as it relates to the debate on how labor standards/legislation affect prices of tradable goods, and trade flows.

We examine the claim that trade liberalization leads to an increase in informality by employing a two-stage empirical framework similar to the one in section 5, but with an indicator for whether a worker is employed in the informal establishment as the dependent variable. In the first stage, the informality indicator is regressed against the same regressors as in equation (1). The coefficients on the industry dummies capture the likelihood of a worker being employed in the informal sector if he/she works in a particular industry. In the second stage, these coefficients are pooled across years and related to trade policy changes as in equation (2). If the likelihood of employment in the informal sector increases with the magnitude of the tariff reductions, trade liberalization will have contributed to the increase in informality.

We should note that it is crucial to exploit both the cross-industry and time variation in the trade policy changes to look at how informality relates to trade reforms. During the early 1990s Colombia implemented labor reforms that are thought to have significantly reduced the rigidities in the formal labor markets and to have contributed to a shift from the informal to the formal sector (Kugler (1999)). The use of the cross-sectional and time variation in the trade policy changes enables us to separate the effects of industry specific trade policy changes from the effects of economy-wide labor reforms.

Table 11 presents the results. The table has 4 columns. Columns 1-2 refer to specifications that do not include industry fixed effects, while columns 3-4 control for industry fixed effects. In addition, specifications in columns 2 and 4 include year indicators. The most informative results are probably the ones reported in column 4 that control for both time-invariant industry characteristics and economy-wide macro economic shocks. As is the case in the analysis of wage premiums, year indicators capture business cycle effects that may otherwise lead to spurious correlation between tariffs and probability of informality. For example, during recessions government responds to lower domestic demand by increasing tariffs. At the same time, the probability of informal sector employment might increase as firms cut jobs in the formal sector. This would bias the tariff coefficient downwards. Moreover, industries with better ability to lobby the government for trade protection might also have a lower share of informal workers. We control for such unobserved industry characteristics with inclusion of industry fixed effects in our regressions.

The top panel of table 11 contains the results from regressions in which we relate informality to tariffs. In all specifications the effect of tariffs on informality is negative and significant. To interpret the size of the tariff coefficients, consider an industry from the manufacturing sector with an average level of tariffs in 1998 (13%). Suppose that we conducted the conceptual experiment of reducing tariffs to zero in this industry. Then the estimated coefficient in column 4 suggests that the probability of this worker having an informal job would rise by 1.2% (0.09 x 13%). The corresponding effect in 1984, when the average tariff was 50%, would be 0.09 x 50% = 4.5%. These are economically important effects.

Increased exposure to foreign markets could affect the probability of informal employment through channels other than tariff reductions such as import competition. The middle panel of Table 11 reports the results from regression specifications that include the first lags of imports and exports. The results reported in column 4 contain two noteworthy findings. First, the tariff coefficient seems robust to the inclusion of the additional trade controls. Second, the positive sign on the coefficient on imports suggests that the probability of informal employment is higher for workers employed in sectors with high import penetration than for workers with the same observable characteristics employed in sectors that face little import competition. This supports the view that increased foreign competition forces domestic firms to become more competitive and reduce cost by either subcontracting in the informal sector or by firing workers that in turn seek employment in the informal sector.

Finally, in the bottom panel of table 11 we allow the impact of imports and exports on informality to vary with exchange rate fluctuations. We control for exchange rate fluctuations by interacting the exchange rate with lagged values of imports and exports. While the inclusion of exchange rate hardly changes the magnitude of the coefficients on tariff, the coefficients become statistically insignificant. However, our results continue to suggest that workers in sectors with higher imports face higher probability of informal employment than the workers with the same observable characteristics in sectors with lower imports.

Given that the "discount" of informality increases in the later years of our sample, we also examined if this increase was driven by changes in the return to informality in specific sectors of the economy that were affected more by trade policy. To this end, we allowed in the framework described above interactions between industry premiums and informality, and related these interactions to industry tariffs. The tariff coefficients in these specifications were, however,

not statistically significant, indicating that the effect of trade policy on industry wages did not vary across the formal and informal sectors. Put differently, the falling wages in the informal sector cannot be attributed to decreasing wages in the informal sectors of industries that experienced larger tariff reductions.

In summary, our results provide some suggestive evidence that trade liberalization contributed to an increase in the size of the informal sector in Colombia during the 1980s and 1990s. Because jobs in the informal sector do not provide benefits and are associated with lower job satisfaction and quality of work, the rise in informality contributes to the increase in inequality.

7. Conclusions

In this paper we investigated the effects of the drastic tariff reductions of the 1980's and 1990's in Colombia on the income distribution. We identified three main channels through which the income distribution was affected: increasing returns to college education, changes in industry wages that hurt sectors with initially lower wages and a higher fraction of unskilled workers, and shifts of the labor force towards the informal sector that typically pays lower wages and offers no benefits. Our results suggest that trade policy played a role in each of the above cases. The increase in the skill premium was primarily driven by skilled-biased technological change; however, our evidence suggests, that this change may have been in part motivated by the tariff reductions and the increased foreign competition to which the trade reform exposed domestic producers. With respect to industry wages, we find that wage premiums decreased by more in sectors that experienced larger tariff cuts. Finally, we find some evidence that the increase in the size of the informal sector documented towards the end of the 1990's is related to increased foreign competition – sectors with larger tariff cuts and more trade exposure, as measured by the size their imports, saw a greater increase in informality. Nevertheless, increasing returns to education, and changes in industry premiums and informality alone cannot fully explain the increase in income inequality we observe over this period. This suggests that overall the effect of the trade reforms on the income distribution may have been small.

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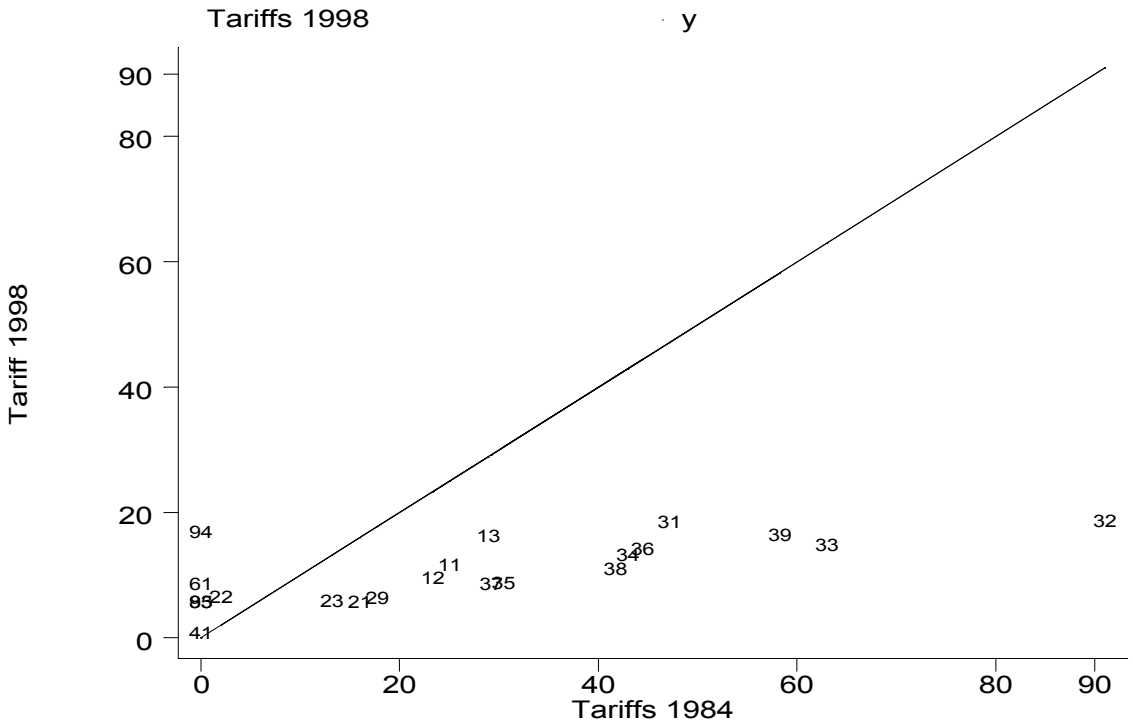


Note: the line is a 45-degree line.

Figure 2a--Std. Log Wage

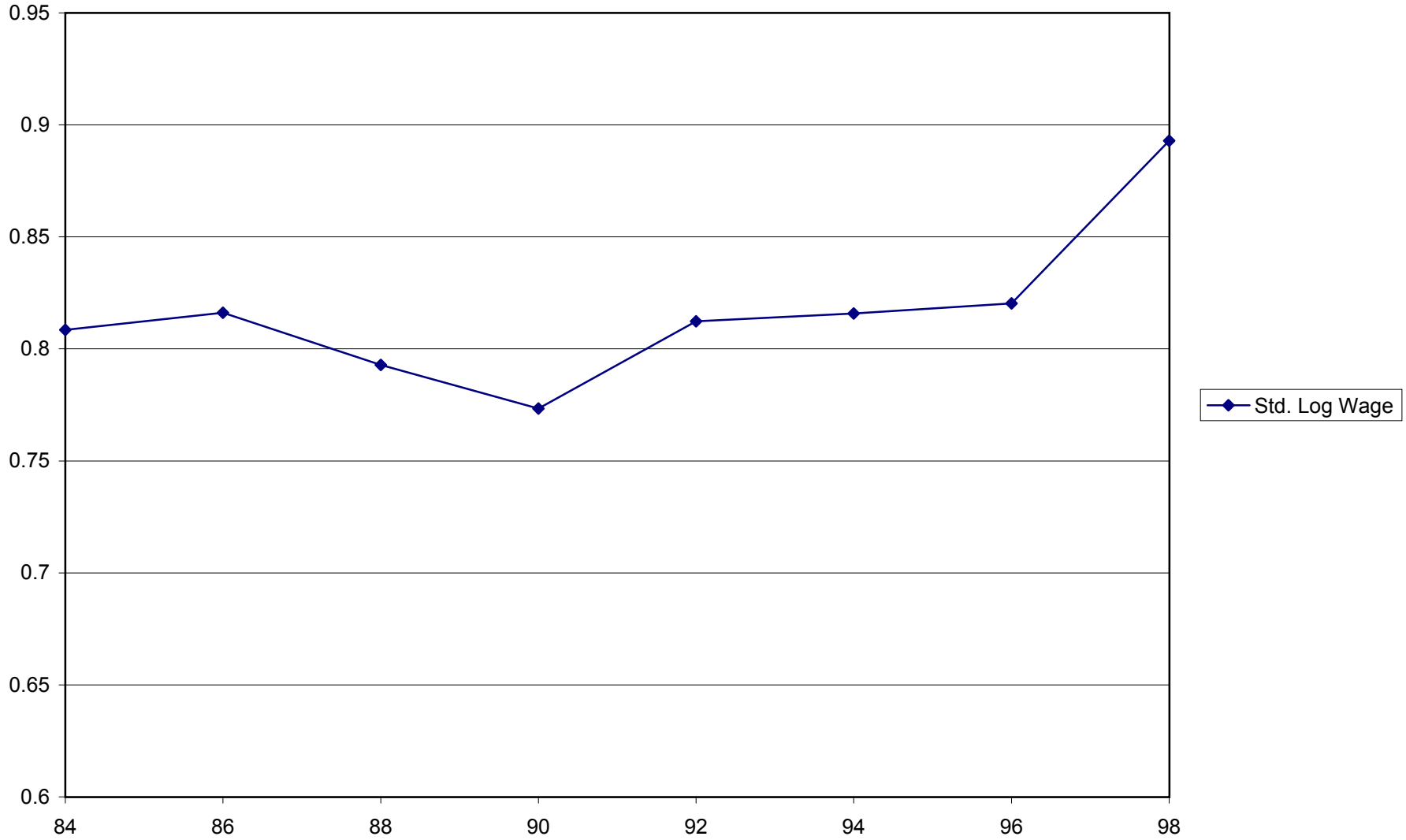


Figure 2b--90-10 Percentile

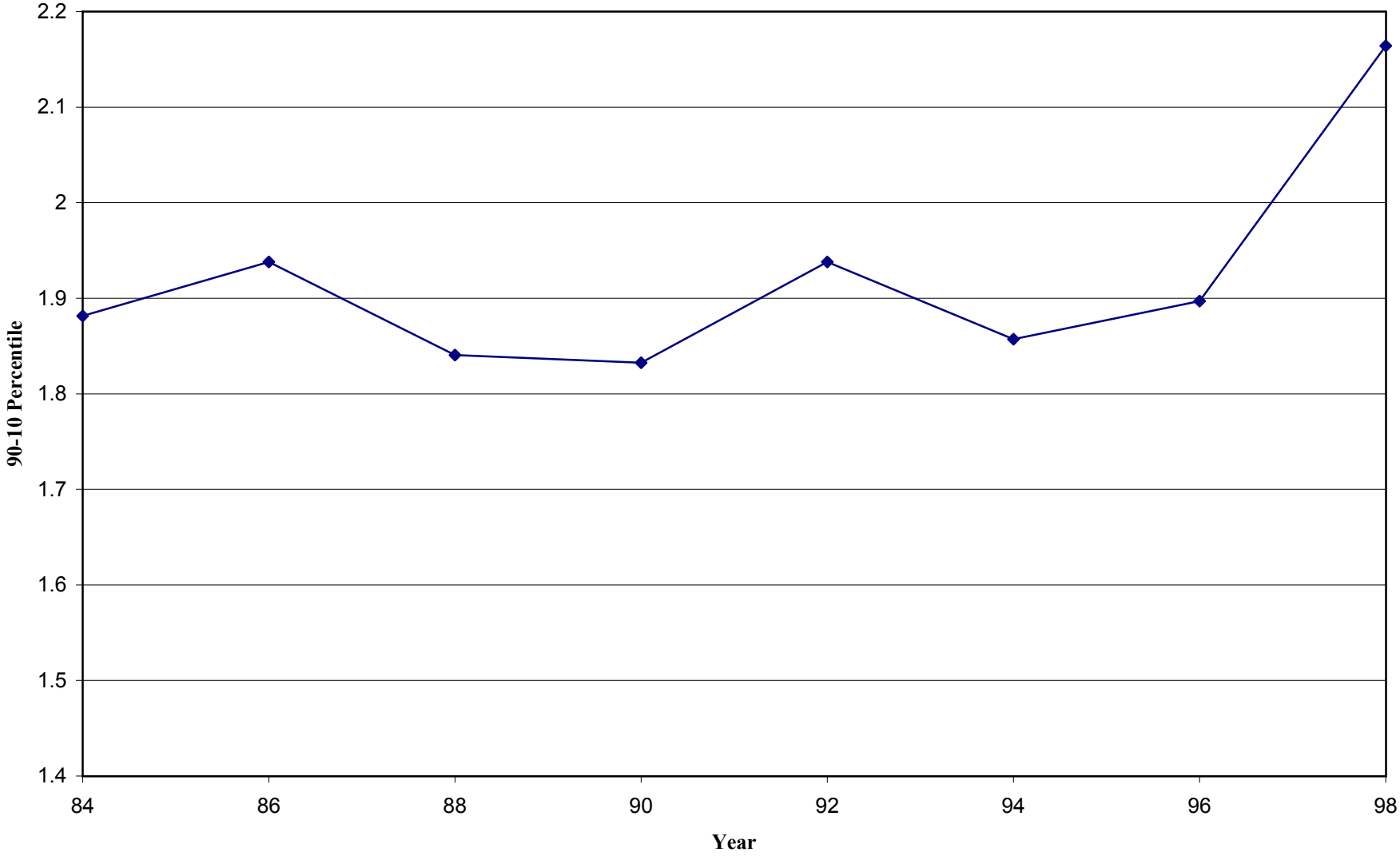


Figure 2c--Std. Log Wage by Education

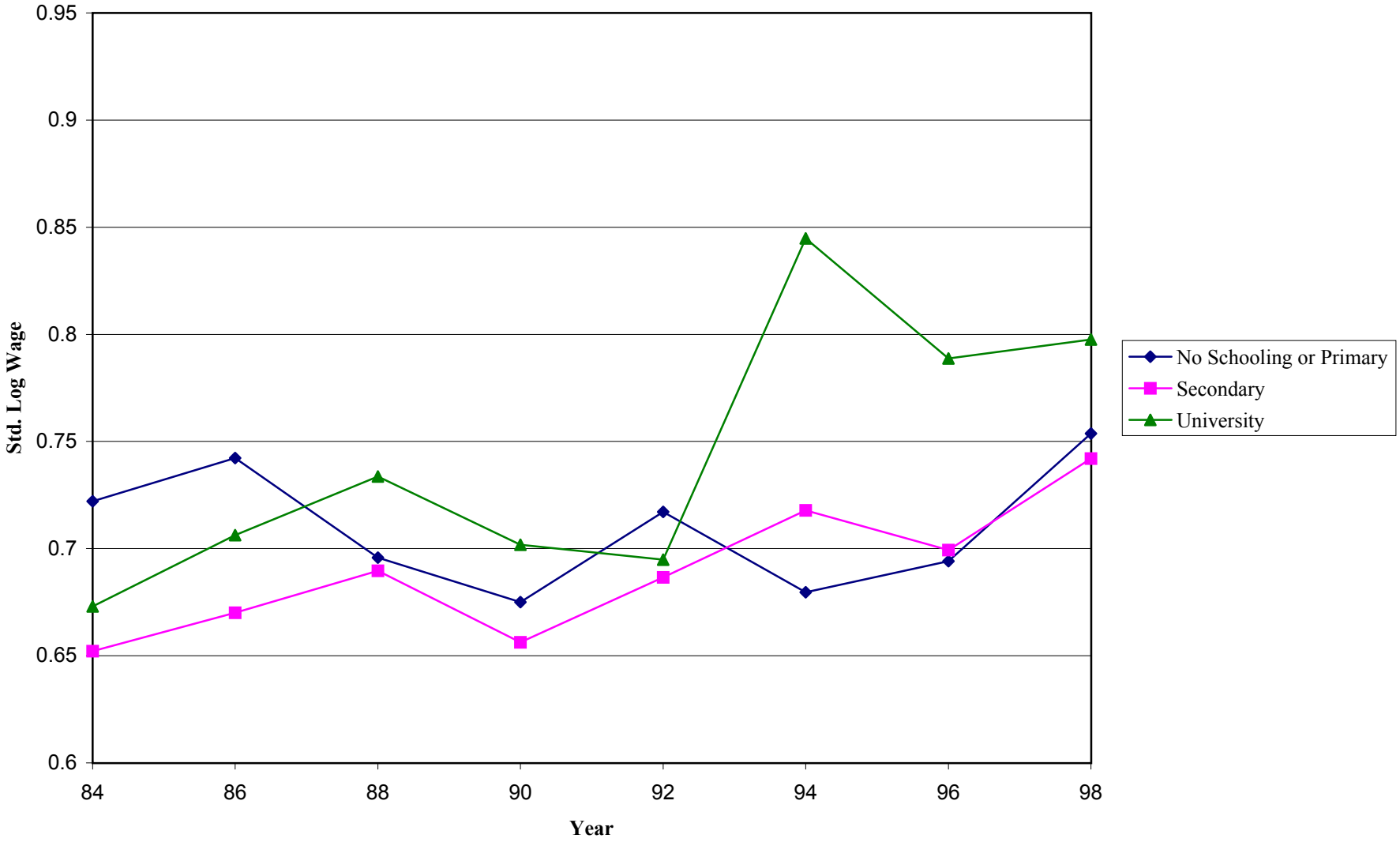


Figure 2d--90-10 Percentile By Education Category

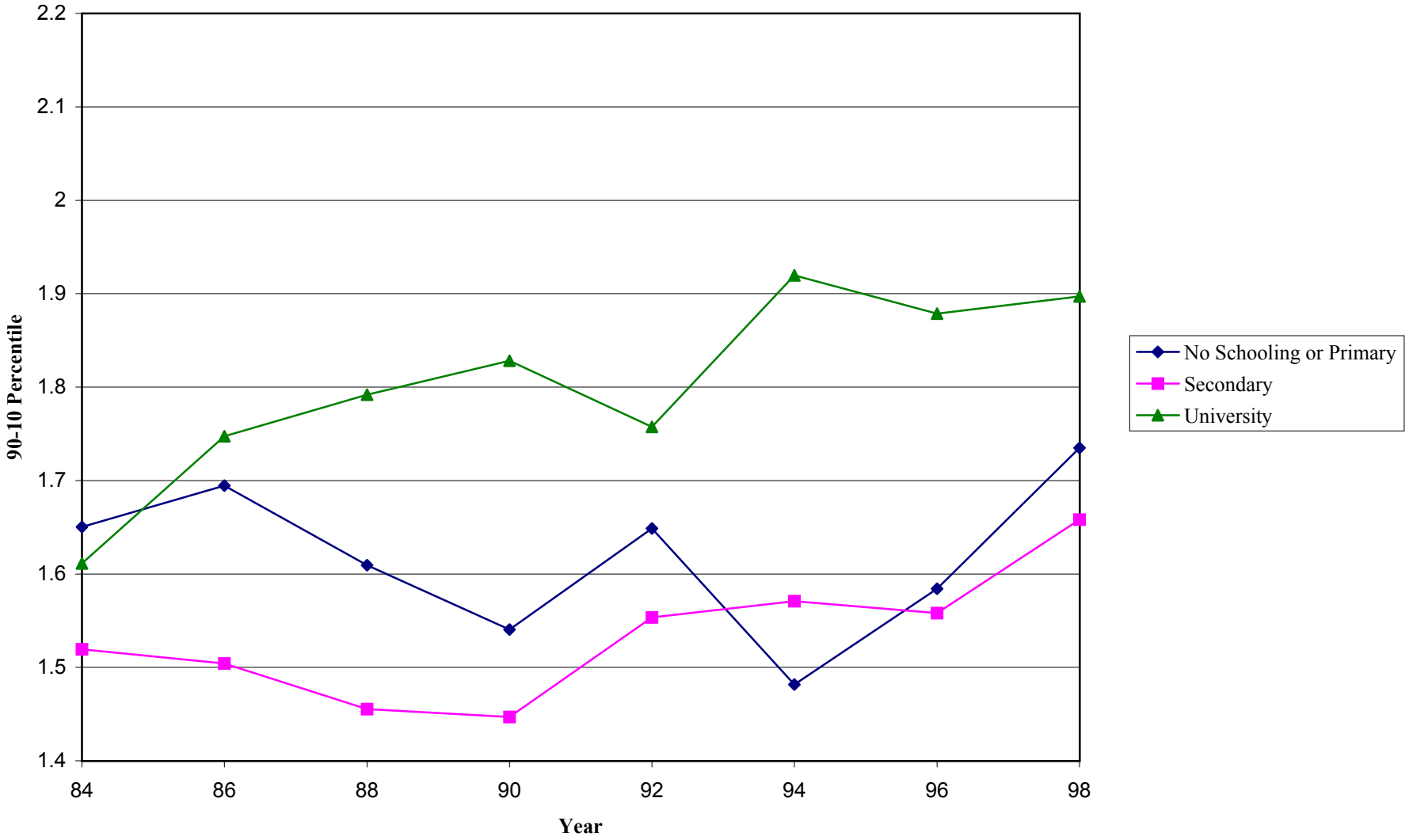


Figure 3--Returns to Education, Full Sample, Informality Controls

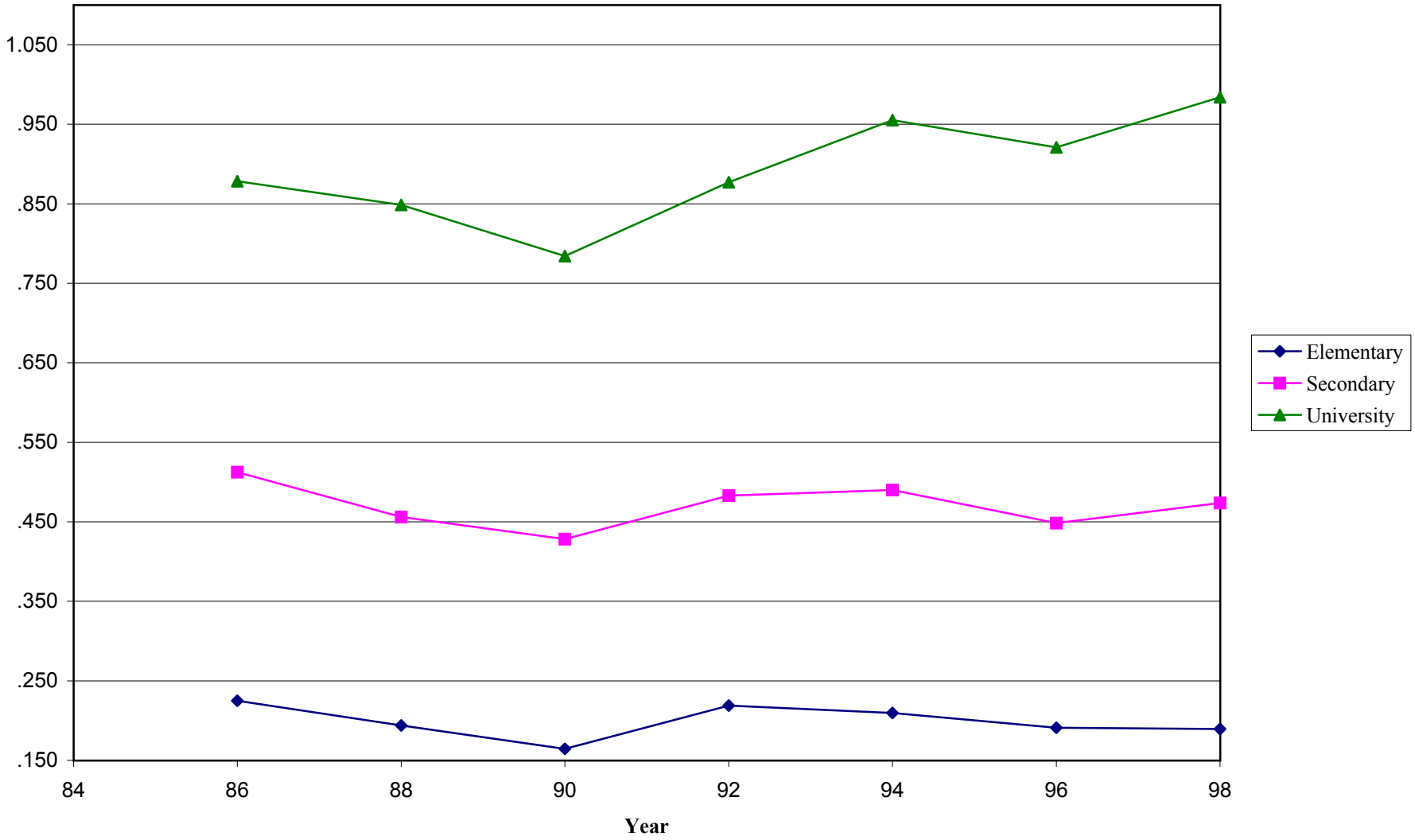


Figure 4 – Tariff Reductions and Share of Unskilled Workers

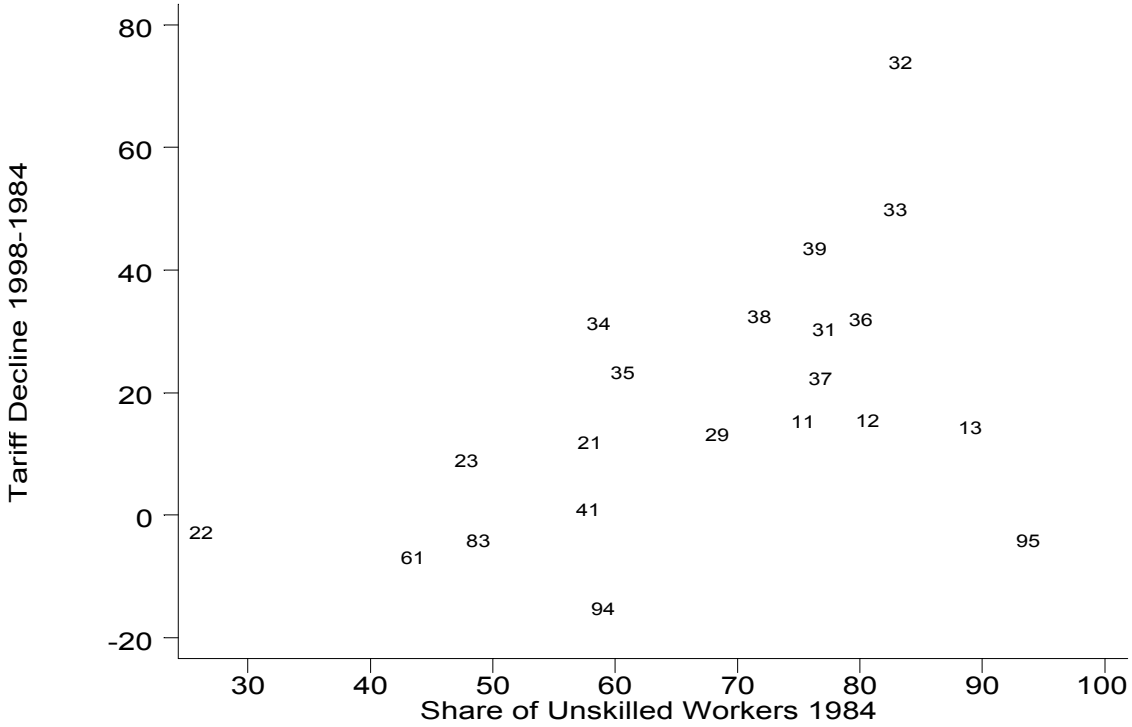


Figure 5 -Tariff Decline 1998-1984 and Tariffs in 1983

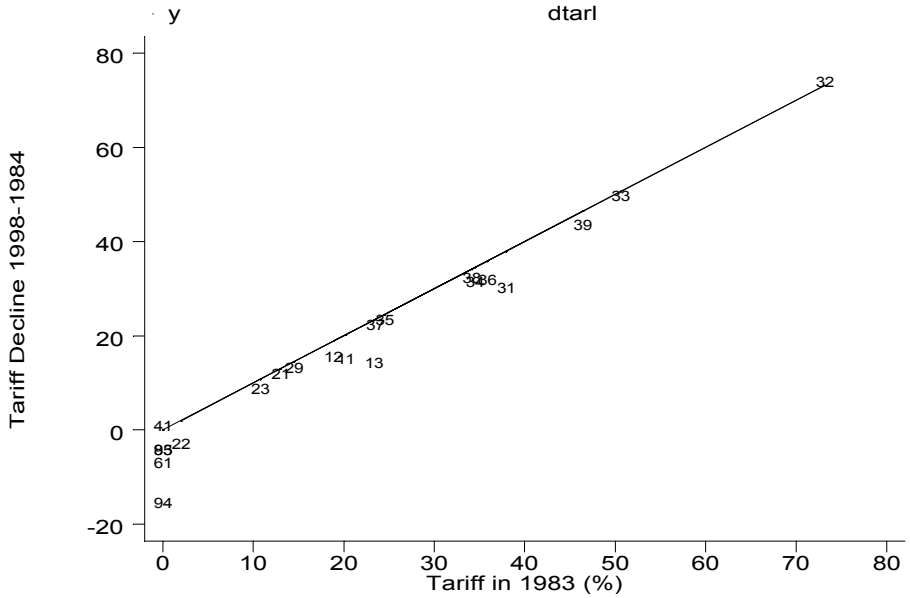
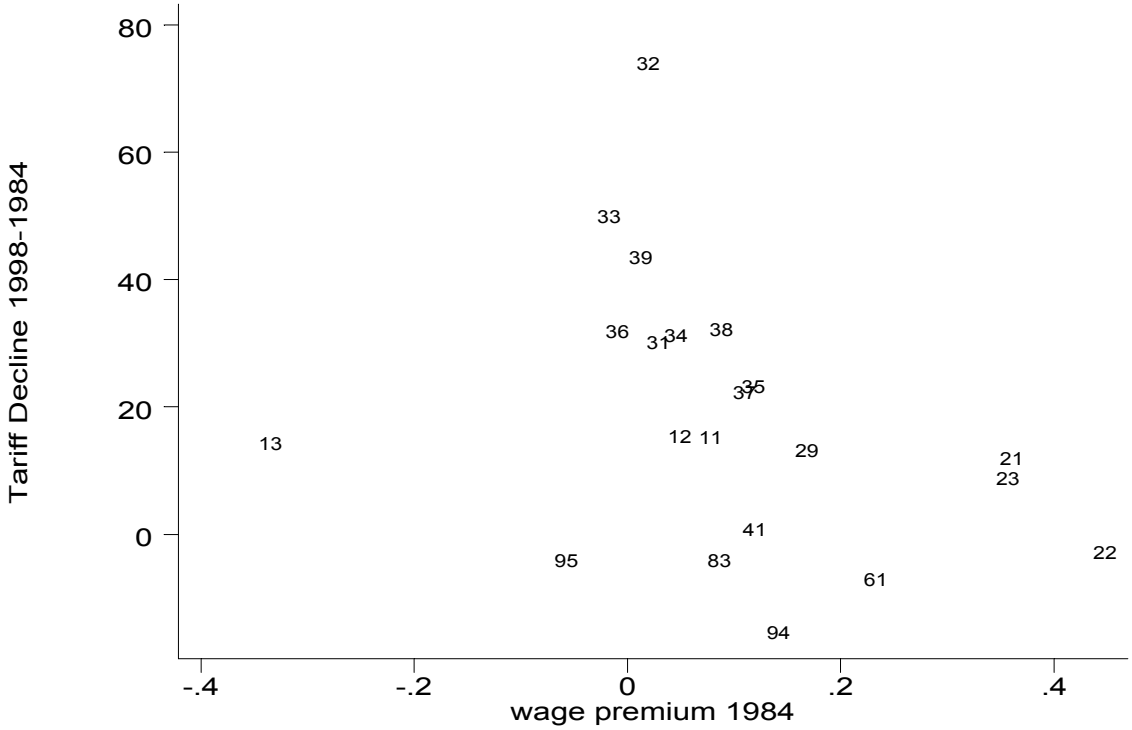


Figure 6— Tariff Decline 1998-1984 and Initial (1984) Wage Premiums



Note: Tariff Decline is a positive number.

Table 1a--Summary statistics for Tariffs 1984-1998

Year	N	Mean	S.D.	Min	Max
All Industries					
1984	21	27.4	24.8	0.0	91.0
1985	21	22.2	16.7	0.0	50.1
1988	21	20.7	16.0	0.0	48.7
1990	21	17.5	14.0	0.0	38.7
1992	21	10.6	4.1	5.0	17.7
1994	21	9.7	4.8	0.0	17.8
1996	21	9.8	5.1	0.0	17.9
1998	21	9.9	5.1	0.0	17.9
Agriculture, Mining, Manufacturing					
1984	16	35.9	22.1	2.0	91.0
1985	16	29.2	12.6	10.0	50.1
1988	16	27.2	12.4	10.0	48.7
1990	16	22.9	11.3	5.0	38.7
1992	16	10.4	4.2	5.0	17.7
1994	16	10.7	4.4	5.0	17.8
1996	16	10.8	4.5	5.0	17.9
1998	16	10.9	4.5	5.0	17.9
Manufacturing					
1984	9	49.8	19.0	29.2	91.0
1985	9	36.6	9.5	22.5	50.1
1988	9	33.5	11.1	17.1	48.7
1990	9	29.1	9.1	15.2	38.7
1992	9	12.9	3.4	8.4	17.7
1994	9	12.9	3.6	8.0	17.8
1996	9	13.0	3.9	7.5	17.9
1998	9	13.1	3.8	7.8	17.9

Note: N stands for number of industries in a given year. Source: Authors' calculations based on tariff data provided by DNP.

Table 1b--Summary statistics for NTBs 1986-1992

Year	N	Mean	S.D.	Min	Max
1986	17	72.4	15.3	38.5	89.5
1988	17	72.9	16.1	37.7	93.7
1992	17	1.1	1.2	0.0	4.5

Note: N stands for number of industries in a given year. Source: Authors' calculations based on NTB data from the UN.

Table 1c--National Household Survey Summary Statistics

	1984	1986	1988	1990	1992	1994	1996	1998
Hourly wage (current pesos)	115.4	168.7	259.1	430.5	686.9	1337.6	1850.6	2725.0
log hourly wage	4.4	4.8	5.2	5.7	6.1	6.7	7.0	7.4
Weekly wage (current pesos)	5109.0	7158.4	11396.0	18787.2	30000.1	59260.2	79884.4	112281.7
log weekly wage	8.2	8.5	9.0	9.5	9.9	10.5	10.8	11.2
Male	.622	.619	.601	.606	.587	.591	.589	.553
Age	33.7	33.8	33.9	34.3	34.3	34.7	35.2	35.6
Married	.427	.413	.385	.411	.392	.357	.358	.356
Head of the household	.471	.468	.453	.474	.459	.462	.464	.457
Literate	.970	.973	.978	.980	.978	.985	.982	.981
No complete schooling	.218	.197	.178	.155	.144	.121	.118	.119
Elementary school complete	.489	.479	.480	.479	.473	.465	.434	.393
Secondary school complete	.218	.238	.250	.264	.282	.304	.326	.350
University complete*	.076	.087	.092	.102	.101	.109	.121	.137
Lives in Bogota	.434	.435	.424	.429	.402	.524	.439	.386
Occupation Indicators								
Professional/Technical	.103	.103	.107	.109	.113	.111	.121	.135
Management	.012	.013	.013	.018	.020	.020	.016	.021
Personnel	.138	.133	.128	.126	.124	.137	.130	.132
Sales	.180	.186	.195	.192	.190	.191	.201	.196
Servant	.194	.196	.188	.185	.191	.172	.174	.194
Agricultural/Forest	.013	.013	.015	.016	.013	.009	.010	.010
Manual Manufacturing	.360	.356	.354	.353	.348	.360	.347	.312
Job Type Indicators								
Private Employee	.530	.550	.551	.546	.564	.585	.569	.523
Government Employee	.118	.116	.107	.108	.099	.080	.085	.089
Private Household Employee	.064	.067	.058	.054	.050	.035	.032	.047
Self-employed	.242	.220	.227	.227	.224	.234	.261	.282
Employer	.046	.047	.056	.065	.064	.066	.053	.059
Place of work characteristics								
Work in single-person establishment		.250	.244	.253	.247	.252	.263	.311
Work in 2 to 5 person establishment		.218	.223	.192	.215	.193	.205	.196
Work in 6-10 person establishment		.080	.093	.063	.083	.085	.078	.073
Work in 11 or more person establishment		.451	.440	.492	.455	.470	.454	.420
Work in a building		.597	.600	.674	.608	.615	.616	.597
Work in informal sector		.577	.568	.574	.564	.516	.609	.590
Number of years at current job		5.7	5.8	5.8	5.9	6.3	6.5	6.2
Employed Prior to current job		.547	.592	.451	.555	.518	.552	.607
Number of observations	36,717	28,481	31,006	25,950	27,521	18,070	27,365	30,092

Note: The reported means are weighted using survey weights. We define complete university if a person completes 5 or more years of post secondary education. The number of observations for number of years at current job and employed prior to current job is lower than the reported one. However, we don't eliminate observations with those missing variables because we do not use them in most of the paper.

Table 2a--Aggregate Wage Inequality

Year	Std. Log Wage	90-10 Percentile
84	0.8085465	1.881
86	0.8160934	1.938
88	0.7928061	1.841
90	0.7733783	1.833
92	0.8123438	1.938
94	0.8157555	1.857
96	0.8203637	1.897
98	0.8929359	2.164

Table 2b--Wage Inequality Within Education Categories

	Std. Of Log Wage			90-10 Percentile		
	no sch/ primary	secondary	university	no sch/ primary	secondary	university
84	.722	.652	.673	1.650	1.519	1.611
86	.742	.670	.706	1.695	1.504	1.747
88	.696	.690	.734	1.609	1.455	1.792
90	.675	.656	.702	1.540	1.447	1.828
92	.717	.687	.695	1.649	1.553	1.757
94	.680	.718	.845	1.482	1.571	1.920
96	.694	.699	.789	1.584	1.558	1.879
98	.754	.742	.798	1.735	1.658	1.897

Table 3--Estimates of Earnings Equation with no Workplace Characteristics

	1984	1986	1988	1990	1992	1994	1996	1998
age	.036	.036	.033	.031	.035	.023	.029	.033
	(.002)	(.002)	(.002)	(.002)	(.002)	(.002)	(.002)	(.002)
agesq	-.0004	-.0004	-.0003	-.0003	-.0004	-.0002	-.0003	-.0003
	(.0000)	(.0000)	(.0000)	(.0000)	(.0000)	(.0000)	(.0000)	(.0000)
male	.143	.113	.136	.104	.119	.054	.074	.085
	(.009)	(.010)	(.009)	(.010)	(.010)	(.013)	(.010)	(.010)
married	.092	.108	.106	.085	.080	.084	.096	.102
	(.008)	(.009)	(.008)	(.009)	(.009)	(.011)	(.009)	(.009)
head of the HH	.100	.073	.084	.090	.077	.106	.106	.092
	(.009)	(.010)	(.009)	(.010)	(.010)	(.012)	(.010)	(.010)
elementy school	.235	.239	.211	.177	.233	.221	.210	.205
	(.009)	(.011)	(.010)	(.012)	(.012)	(.017)	(.013)	(.013)
secondary school	.583	.550	.502	.468	.523	.521	.503	.517
	(.012)	(.014)	(.013)	(.014)	(.015)	(.019)	(.015)	(.015)
university degree	.992	.928	.908	.833	.929	1.004	1.004	1.052
	(.020)	(.023)	(.020)	(.021)	(.022)	(.027)	(.022)	(.022)
literate	.159	.198	.238	.201	.191	.130	.161	.166
	(.019)	(.023)	(.024)	(.026)	(.026)	(.039)	(.029)	(.028)
lives in bogota	.049	.131	.112	.128	.091	.066	.186	.243
	(.007)	(.009)	(.009)	(.009)	(.010)	(.010)	(.010)	(.013)
Professional	.438	.399	.466	.475	.483	.486	.488	.461
	(.019)	(.022)	(.020)	(.020)	(.021)	(.027)	(.021)	(.021)
Management	.792	.613	.764	.858	.956	.724	.693	.635
	(.036)	(.040)	(.039)	(.035)	(.036)	(.040)	(.036)	(.037)
Personell	.164	.146	.141	.128	.161	.162	.175	.118
	(.015)	(.018)	(.016)	(.017)	(.017)	(.022)	(.017)	(.018)
Sales	.116	.120	.113	.121	.160	.194	.169	.121
	(.017)	(.019)	(.018)	(.018)	(.018)	(.023)	(.018)	(.019)
Blue collar worker Agriculture	-.008	.103	.190	.149	.144	.242	.093	.119
	(.045)	(.050)	(.047)	(.049)	(.049)	(.065)	(.056)	(.051)
Blue collar worker Manufacturing	.042	.055	.066	.051	.090	.089	.091	.014
	(.013)	(.016)	(.015)	(.015)	(.015)	(.020)	(.016)	(.016)
private firm employee	-.302	-.363	-.375	-.354	-.315	-.427	-.323	-.320
	(.017)	(.019)	(.016)	(.016)	(.017)	(.021)	(.018)	(.018)
government employee	-.175	-.229	-.235	-.195	-.169	-.241	-.158	-.122
	(.022)	(.026)	(.024)	(.024)	(.025)	(.033)	(.027)	(.026)
private HH employee	-.232	-.364	-.305	-.435	-.292	-.378	-.206	-.272
	(.025)	(.030)	(.026)	(.028)	(.028)	(.038)	(.031)	(.029)
self-employed	-.542	-.579	-.562	-.477	-.480	-.497	-.460	-.562
	(.017)	(.020)	(.017)	(.017)	(.018)	(.022)	(.019)	(.018)
born in urban area	.034	.054	.052	.079	.069	.037	.057	.085
	(.016)	(.020)	(.019)	(.020)	(.022)	(.029)	(.023)	(.025)
time in residence	-.002	.000	-.001	-.001	-.002	-.002	-.003	-.001
	(.001)	(.001)	(.001)	(.001)	(.001)	(.001)	(.001)	(.001)
urban birth*time in residence	.003	.001	.002	.001	.002	.002	.002	.000
	(.001)	(.001)	(.001)	(.001)	(.001)	(.001)	(.001)	(.001)
Industry Indicators	yes	yes	yes	yes	yes	yes	yes	yes

Table 4--Estimates of Earnings Equation including Workplace Characteristics

	1984	1986	1988	1990	1992	1994	1996	1998
age		.033	.030	.028	.032	.022	.026	.030
		(.002)	(.002)	(.002)	(.002)	(.002)	(.002)	(.002)
agesq		-.0003	-.0003	-.0003	-.0003	-.0002	-.0002	-.0003
		(.0000)	(.0000)	(.0000)	(.0000)	(.0000)	(.0000)	(.0000)
male		.119	.142	.107	.124	.059	.077	.085
		(.010)	(.009)	(.010)	(.010)	(.013)	(.010)	(.010)
married		.102	.098	.076	.076	.078	.083	.092
		(.009)	(.008)	(.009)	(.009)	(.011)	(.009)	(.009)
head of the HH		.065	.076	.081	.068	.098	.095	.082
		(.010)	(.009)	(.010)	(.010)	(.012)	(.010)	(.010)
elementy school		.225	.194	.165	.219	.210	.191	.189
		(.011)	(.010)	(.011)	(.012)	(.016)	(.013)	(.013)
secondary school		.512	.456	.428	.483	.490	.448	.474
		(.014)	(.013)	(.014)	(.015)	(.019)	(.015)	(.015)
university degree		.878	.849	.784	.877	.955	.921	.984
		(.023)	(.020)	(.021)	(.022)	(.027)	(.022)	(.022)
literate		.190	.229	.183	.186	.115	.152	.157
		(.023)	(.023)	(.026)	(.026)	(.038)	(.029)	(.028)
lives in bogota		.128	.112	.130	.087	.071	.177	.241
		(.009)	(.008)	(.009)	(.009)	(.010)	(.010)	(.013)
Professional		.397	.457	.476	.479	.477	.480	.459
		(.022)	(.020)	(.020)	(.020)	(.027)	(.021)	(.021)
Management		.600	.742	.836	.935	.701	.671	.613
		(.040)	(.038)	(.035)	(.035)	(.040)	(.036)	(.037)
Personell		.127	.120	.111	.143	.141	.144	.097
		(.018)	(.016)	(.017)	(.017)	(.022)	(.017)	(.018)
Sales		.155	.156	.147	.191	.218	.198	.149
		(.019)	(.018)	(.018)	(.018)	(.023)	(.018)	(.019)
Blue collar worker Agriculture		.117	.210	.156	.153	.257	.116	.143
		(.050)	(.046)	(.049)	(.049)	(.065)	(.056)	(.051)
Blue collar worker Manufacturing		.075	.092	.071	.104	.100	.110	.032
		(.016)	(.015)	(.015)	(.015)	(.020)	(.016)	(.016)
private firm employee		-.468	-.499	-.478	-.433	-.525	-.433	-.425
		(.020)	(.017)	(.018)	(.018)	(.023)	(.019)	(.019)
government employee		-.379	-.401	-.356	-.327	-.368	-.312	-.264
		(.027)	(.025)	(.025)	(.026)	(.035)	(.028)	(.028)
private HH employee		-.298	-.223	-.341	-.224	-.317	-.084	-.213
		(.032)	(.029)	(.032)	(.031)	(.044)	(.034)	(.032)
self-employed		-.527	-.496	-.394	-.402	-.459	-.336	-.498
		(.024)	(.021)	(.024)	(.024)	(.031)	(.024)	(.023)
born in urban area		.053	.051	.079	.070	.043	.058	.076
		(.020)	(.019)	(.020)	(.022)	(.028)	(.022)	(.025)
time in residence		.000	-.001	-.001	-.002	-.002	-.003	-.001
		(.001)	(.001)	(.001)	(.001)	(.001)	(.001)	(.001)
urban birth*time in residence		.001	.002	.001	.002	.002	.002	.000
		(.001)	(.001)	(.001)	(.001)	(.001)	(.001)	(.001)
informal sector		-.045	-.056	-.058	-.036	-.017	-.131	-.116
		(.011)	(.010)	(.009)	(.010)	(.013)	(.010)	(.011)
establishment with 2-5 people		-.015	-.016	.011	.025	-.035	.070	.016
		(.017)	(.015)	(.019)	(.019)	(.026)	(.018)	(.017)
establishment with 6-10 people		.044	.096	.128	.124	.043	.139	.088
		(.022)	(.020)	(.025)	(.023)	(.031)	(.023)	(.022)
establishment with 11 or more p.		.117	.129	.169	.190	.088	.181	.130
		(.020)	(.019)	(.022)	(.022)	(.028)	(.020)	(.019)
works in a building		.150	.176	.134	.117	.156	.138	.113
		(.011)	(.010)	(.011)	(.011)	(.014)	(.011)	(.011)
Industry Indicators	yes	yes	yes	yes	yes	yes	yes	yes

Table 5--Estimates of Earnings Equation with no Workplace Characteristics (Males)

	1984	1986	1988	1990	1992	1994	1996	1998
age	.041	.041	.034	.031	.038	.027	.032	.035
	(.002)	(.002)	(.002)	(.002)	(.002)	(.003)	(.002)	(.002)
agesq	-.0004	-.0004	-.0003	-.0003	-.0004	-.0003	-.0003	-.0004
	(.0000)	(.0000)	(.0000)	(.0000)	(.0000)	(.0000)	(.0000)	(.0000)
married	.114	.121	.116	.083	.088	.094	.095	.097
	(.011)	(.012)	(.011)	(.012)	(.012)	(.015)	(.012)	(.013)
head of the HH	.076	.049	.061	.078	.060	.096	.108	.092
	(.012)	(.014)	(.013)	(.014)	(.014)	(.017)	(.014)	(.014)
elementy school	.249	.249	.227	.202	.233	.244	.224	.213
	(.011)	(.013)	(.013)	(.014)	(.016)	(.021)	(.017)	(.017)
secondary school	.593	.553	.516	.497	.526	.539	.506	.528
	(.015)	(.017)	(.016)	(.018)	(.018)	(.024)	(.019)	(.019)
university degree	1.032	.972	.977	.883	1.005	1.070	1.071	1.120
	(.024)	(.028)	(.026)	(.027)	(.028)	(.036)	(.028)	(.029)
literate	.167	.233	.231	.206	.197	.090	.181	.187
	(.026)	(.032)	(.032)	(.035)	(.035)	(.053)	(.038)	(.037)
lives in bogota	.028	.111	.090	.106	.073	.052	.194	.239
	(.009)	(.012)	(.011)	(.012)	(.012)	(.014)	(.013)	(.018)
Professional	.428	.414	.487	.512	.463	.469	.527	.510
	(.024)	(.030)	(.027)	(.028)	(.028)	(.037)	(.029)	(.030)
Management	.772	.636	.818	.894	.917	.725	.806	.695
	(.042)	(.046)	(.046)	(.042)	(.044)	(.052)	(.045)	(.047)
Personell	.135	.134	.130	.100	.140	.123	.209	.158
	(.020)	(.024)	(.023)	(.024)	(.025)	(.032)	(.025)	(.026)
Sales	.155	.167	.181	.173	.203	.227	.262	.193
	(.022)	(.025)	(.024)	(.025)	(.025)	(.033)	(.026)	(.027)
Blue collar worker Agriculture	.032	.142	.233	.228	.132	.192	.132	.172
	(.050)	(.055)	(.051)	(.056)	(.056)	(.075)	(.063)	(.059)
Blue collar worker Manufacturing	.059	.090	.110	.092	.127	.106	.152	.093
	(.017)	(.021)	(.020)	(.021)	(.021)	(.028)	(.022)	(.023)
private firm employee	-.302	-.351	-.391	-.352	-.321	-.419	-.305	-.309
	(.018)	(.021)	(.019)	(.019)	(.019)	(.025)	(.021)	(.022)
government employee	-.177	-.228	-.285	-.206	-.198	-.210	-.209	-.172
	(.027)	(.031)	(.030)	(.031)	(.032)	(.046)	(.037)	(.036)
private HH employee	-.226	-.257	-.314	-.263	-.305	-.162	-.079	-.255
	(.079)	(.097)	(.080)	(.114)	(.105)	(.211)	(.151)	(.105)
self-employed	-.470	-.505	-.499	-.429	-.449	-.451	-.433	-.528
	(.019)	(.022)	(.019)	(.019)	(.020)	(.026)	(.022)	(.022)
born in urban area	.052	.102	.092	.102	.107	.061	.049	.167
	(.021)	(.027)	(.026)	(.026)	(.029)	(.037)	(.030)	(.034)
time in residence	-.001	.003	.000	-.001	.001	-.001	-.003	.003
	(.001)	(.001)	(.001)	(.001)	(.001)	(.002)	(.001)	(.001)
urban birth*time in residence	.003	-.001	.001	.000	-.001	.002	.002	-.004
	(.001)	(.001)	(.001)	(.001)	(.001)	(.002)	(.001)	(.001)
Industry Indicators	yes	yes	yes	yes	yes	yes	yes	yes

Table 6--Estimates of Earnings Equation including Workplace Characteristics (Males)

	1984	1986	1988	1990	1992	1994	1996	1998
age		.038	.030	.028	.033	.024	.028	.031
		(.002)	(.002)	(.002)	(.002)	(.003)	(.002)	(.002)
agesq		-.0004	-.0003	-.0003	-.0003	-.0002	-.0003	-.0003
		(.0000)	(.0000)	(.0000)	(.0000)	(.0000)	(.0000)	(.0000)
married		.113	.104	.072	.080	.084	.078	.081
		(.012)	(.011)	(.012)	(.012)	(.015)	(.012)	(.013)
head of the HH		.047	.056	.071	.053	.091	.098	.083
		(.014)	(.013)	(.014)	(.014)	(.017)	(.014)	(.014)
elementy school		.235	.210	.189	.216	.231	.204	.194
		(.013)	(.013)	(.014)	(.016)	(.021)	(.017)	(.017)
secondary school		.515	.470	.454	.480	.503	.447	.480
		(.017)	(.016)	(.018)	(.018)	(.024)	(.019)	(.019)
university degree		.923	.914	.828	.949	1.011	.975	1.040
		(.028)	(.026)	(.027)	(.028)	(.036)	(.028)	(.029)
literate		.228	.220	.190	.192	.068	.170	.180
		(.031)	(.032)	(.035)	(.035)	(.052)	(.037)	(.037)
lives in bogota		.108	.091	.111	.070	.059	.187	.237
		(.012)	(.011)	(.012)	(.012)	(.014)	(.013)	(.018)
Professional		.424	.493	.531	.471	.477	.539	.526
		(.030)	(.027)	(.028)	(.028)	(.037)	(.029)	(.030)
Management		.636	.814	.888	.907	.717	.803	.685
		(.046)	(.046)	(.042)	(.043)	(.051)	(.045)	(.047)
Personell		.127	.122	.092	.131	.114	.193	.154
		(.024)	(.023)	(.024)	(.024)	(.032)	(.025)	(.026)
Sales		.213	.242	.219	.255	.269	.315	.237
		(.025)	(.024)	(.025)	(.025)	(.032)	(.026)	(.027)
Blue collar worker Agriculture		.168	.261	.246	.153	.230	.170	.204
		(.054)	(.051)	(.055)	(.056)	(.074)	(.062)	(.058)
Blue collar worker Manufacturing		.118	.145	.123	.152	.129	.186	.123
		(.021)	(.020)	(.021)	(.021)	(.028)	(.022)	(.022)
private firm employee		-.440	-.502	-.468	-.438	-.514	-.405	-.403
		(.022)	(.020)	(.020)	(.020)	(.027)	(.022)	(.023)
government employee		-.362	-.445	-.358	-.357	-.339	-.358	-.305
		(.033)	(.032)	(.032)	(.034)	(.048)	(.038)	(.037)
private HH employee		-.224	-.257	-.182	-.248	-.061	.002	-.189
		(.097)	(.080)	(.114)	(.105)	(.212)	(.149)	(.105)
self-employed		-.489	-.486	-.376	-.387	-.398	-.329	-.458
		(.027)	(.025)	(.028)	(.029)	(.038)	(.028)	(.028)
born in urban area		.100	.086	.099	.107	.068	.048	.157
		(.027)	(.026)	(.026)	(.029)	(.037)	(.030)	(.034)
time in residence		.003	.000	-.001	.001	-.001	-.003	.003
		(.001)	(.001)	(.001)	(.001)	(.002)	(.001)	(.001)
urban birth*time in residence		-.001	.001	.000	-.001	.001	.002	-.003
		(.001)	(.001)	(.001)	(.001)	(.002)	(.001)	(.001)
informal sector		-.034	-.049	-.058	-.035	-.038	-.150	-.126
		(.013)	(.012)	(.012)	(.013)	(.016)	(.013)	(.014)
establishment with 2-5 people		-.045	-.059	-.009	.021	-.003	.060	.030
		(.021)	(.020)	(.024)	(.025)	(.033)	(.023)	(.022)
establishment with 6-10 people		.038	.067	.097	.115	.078	.138	.105
		(.027)	(.025)	(.031)	(.030)	(.039)	(.029)	(.029)
establishment with 11 or more p.		.089	.101	.156	.207	.119	.160	.133
		(.024)	(.023)	(.028)	(.028)	(.035)	(.025)	(.024)
works in a building		.130	.151	.126	.109	.145	.143	.118
		(.013)	(.012)	(.012)	(.012)	(.016)	(.013)	(.013)
Industry Indicators	yes	yes	yes	yes	yes	yes	yes	yes

Table 7--Returns to Education relative to Elementary School (Full Sample)

	1984*	1986	1988	1990	1992	1994	1996	1998	Change 1998-86
No Industry or Occupation Indicators									
secondary school-elementary	.467	.369	.346	.350	.343	.352	.321	.346	-.024
university degree-elementary	1.103	.941	.961	.963	1.007	1.070	1.037	1.109	.168
Industry Indicators									
secondary school-elementary	.435	.342	.316	.327	.321	.333	.301	.322	-.020
university degree-elementary	1.040	.887	.899	.905	.956	1.025	.988	1.048	.161
Industry Indicators*(Secondary or College Education) Interaction									
secondary school-elementary	.472	.400	.348	.334	.338	.408	.311	.368	-.032
university degree-elementary	1.066	.927	.917	.892	.956	1.088	.985	1.083	.156
Occupation Indicators									
secondary school-elementary	.364	.302	.275	.275	.272	.290	.269	.295	-.006
university degree-elementary	.784	.680	.680	.650	.681	.776	.756	.818	.138
Industry and Occupation Indicators									
secondary school-elementary	.348	.287	.262	.264	.264	.280	.257	.284	-.003
university degree-elementary	.757	.653	.655	.620	.658	.745	.730	.795	.141

Note: Entries are the percentage differences between estimated education returns for secondary school and primary school (university degree and primary school) based on education coefficients from regressions that always include the following regressors: age, age squared, male, married, head of the HH, literate, lives in Bogota, job type indicators (private firm employee, government employee, private HH employee, self-employed), informal, establishment with 2-5 people, establishment with 6-10 people, establishment with 11 or more people, works in a building.

Table 8--Industry Employment

ISIC Code	Industry Share in Overall Employment		Share of Skilled Workers in Industry	
	1984	1998	1984	1998
11	.0130	.0091	.247	.289
12	.0001	.0001	.194	.272
13	.0003	.0006	.110	.481
21	.0015	.0005	.421	.537
22	.0015	.0017	.738	.899
23	.0002	.0001	.522	.371
29	.0005	.0005	.317	.380
31	.0358	.0343	.230	.498
32	.0908	.0763	.167	.336
33	.0194	.0166	.171	.321
34	.0158	.0120	.414	.603
35	.0241	.0211	.394	.621
36	.0107	.0097	.200	.490
37	.0034	.0031	.232	.389
38	.0348	.0280	.283	.471
39	.0063	.0053	.237	.505
41	.0049	.0047	.422	.665
42	.0028	.0016	.295	.701
50	.0691	.0570	.141	.267
61	.0108	.0155	.565	.625
62	.1932	.1955	.249	.456
63	.0354	.0406	.133	.278
71	.0560	.0624	.233	.416
72	.0054	.0109	.502	.830
81	.0219	.0202	.776	.947
82	.0058	.0057	.752	.918
83	.0436	.0564	.512	.685
91	.0425	.0369	.545	.851
92	.0017	.0015	.328	.502
93	.0883	.1078	.705	.857
94	.0132	.0175	.410	.626
95	.1469	.1461	.063	.194
96	.0003	.0005	.555	.953

Note: Skilled workers are workers with complete secondary or university education.

Table 9a--Share of Skilled Workers and Trade Policy

	(1)	(2)	(3)	(4)
Nominal tariff	-.0052 **	-.0051 **	-.0033 **	-.0017 **
	(.0014)	(.0018)	(.0007)	(.0008)
Year Indicators	no	yes	no	yes
Industry Indicators	no	no	yes	yes

Note: ** and * indicate 5 and 10 % significance, respectively. Reported standard errors are robust and clustered on industry.

Table 9b--Share of Skilled Workers and Trade Policy (2SLS Results)

	(1)	(2)	(3)	(4)
Nominal tariff	-.0072 **	-.0060 **	-.0058 **	-.0009
	(.0028)	(.0022)	(.0021)	(.0006)
Instruments	tariffs 83	exchange rate*tariffs 83	tariffs 83, exchange rate* tariffs	exchange rate*tariffs 83
Year Indicators	yes	yes	yes	yes
Industry Indicators	no	no	no	yes

Note: ** and * indicate 5 and 10 % significance, respectively. Reported standard errors are robust and clustered on industry.

Table 10a-- Industry wage premiums and tariffs

	(1)	(2)	(3)	(4)
Nominal tariff	-.0001	-.0002	.0007 **	.0007 **
	(.0008)	(.0010)	(.0001)	(.0002)
Lagged Imports	-.00010	-.00006	-.00009 **	-.00008 **
	(.00009)	(.00007)	(.00001)	(.00002)
Lagged Export	-.00013	-.00007	-.00001	.00004
	(.00026)	(.00023)	(.00009)	(.00011)
Lagged Imports*Ex.Rate	.0000025 **	.0000022 **	.0000004 **	.0000003
	(.0000007)	(.0000007)	(.0000002)	(.0000004)
Lagged Exports*Ex.Rate	.0000011	.0000007	.0000006 **	.0000005 **
	(.0000011)	(.0000008)	(.0000001)	(.0000002)
Year Indicators	no	yes	no	yes
Industry Indicators	no	no	yes	yes

Note: ** and * indicate 5 and 10 % significance, respectively.

Table 10b--Industry Wage Premiums and tariffs, First Differences, 2SLS results

	(1)	(2)	(3)	(4)
Nominal tariff	.0012 **	.0005 **	.0004 **	.0004 *
	(.0003)	(.0002)	(.0001)	(.0002)
Instrument	none	tariffs 83	exchange rate* tariffs 83	tariffs 83, ex. rate* tariffs 83
Year Indicators	yes	yes	yes	yes

Note: ** and * indicate 5 and 10 % significance, respectively. Reported standard errors are robust and clustered by industry.

Table 11--Probability of informal employment and trade policy

	(1)	(2)	(3)	(4)
Nominal tariff	-.0025 *	-.0029 *	-.0007 **	-.0009 **
	(.0015)	(.0016)	(.0002)	(.0004)
Nominal tariff	-.0018 *	-.0018	-.0008 *	-.0010 **
	(.0011)	(.0013)	(.0005)	(.0005)
Lagged Imports	-.00041 **	-.00041 **	.00022 **	.00025 **
	(.00014)	(.00014)	(.00004)	(.00007)
Lagged Exports	-.00040 **	-.00040 **	-.00035 **	-.00034 **
	(.00014)	(.00015)	(.00017)	(.00016)
Nominal tariff	-.0017	-.0017	-.0008	-.0009
	(.0012)	(.0013)	(.0006)	(.0006)
Lagged Imports	.00056 **	.00063 **	.00041 **	.00045 **
	(.00009)	(.00011)	(.00003)	(.00009)
Lagged Exports	-.00068 **	-.00055 **	-.00040 *	-.00030
	(.00036)	(.00028)	(.00026)	(.00027)
Lagged Imports*Ex.Rate	-.0000099	-.0000106 **	-.0000026 **	-.0000027 **
	(.0000020)	(.0000023)	(.0000002)	(.0000007)
Lagged Exports*Ex.Rate	.0000024	.0000013	.0000003	-.0000004
	(.0000027)	(.0000020)	(.0000010)	(.0000012)
Year Indicators	no	yes	no	yes
Industry Indicators	no	no	yes	yes

Note: ** and * indicate 5 and 10 % significance, respectively. Reported standard errors are robust and clustered on industry. The three panels indicate separate regressions. The information about the inclusion of year and industry indicators at the bottom of each column applies to all specifications reported in a given column. N is 147.