Returns to education, sector premiums, and male wage inequality in Mexico

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As measured by the Gini coefficient, male wage inequality in Mexico rose 10 points between 1984 and 1994—a considerable jump. Many studies indicate that the increase in male wage inequality was due to an increase in returns to education and skills—a common trend in Latin American countries. This paper examines Mexico's increase in wage inequality using data from household surveys (*Encuesta Nacional de Ingreso Gasto de los Hogares de México*) produced by the Mexican Institute for Statistics, Geography and Informatics (*Instituto Nacional de Estadística, Geografia e Informática*). An econometric simulation technique based on Juhn, Murphy, and Pierce (1993) and developed for the household level by Bourguignon, Fournier, and Gurgand (1998) is used to measure the contribution of changes in skill premiums and sector returns to the increase in inequality in Mexican males' wages during the period of analysis.

The increase in wage inequality in Latin America coincides with the liberalization of trade in most countries. Many studies consider the increase in wage inequality to be a direct effect of the trade reform. The household surveys used in this paper make it possible to decompose some of the changes in inequality in Mexico after trade reform in the mid-1980s.

The regressions and simulation technique confirm that male Mexican wage earners experienced an important increase in skill premiums and a decrease in sector wage premiums after the trade reform. The increase in skill premiums was unequalizing, while the decrease in sector premiums was equalizing.

Returns to skills and changes in wage inequality

Many studies have explored the effects of changes in demographic characteristics, returns to skills and trade in wage inequality. Bound and Johnson (1992) use econometric techniques to trace changes in mean U.S. wages between 1973 and 1988 for 32 demographic characteristics of workers (defined by education level, experience level, and gender) in 17 industries. The authors regress the logarithm of wages on dummy variables for the demographic characteristics and then compare the evolution of mean wages by category over time. They find that real wages fell

for almost all education and experience categories except college-educated males and a wider educational range of females.

Juhn, Murphy, and Pierce (1993) decompose changes in inequality for U.S. male workers assuming that the wage regression can be represented as $Y_{it} = X_{it}\beta_t + u_{it}$, where Y_{it} is the log weekly wage for individual *i* in year *t*, X_{it} is a vector of individual characteristics, and u_{it} is the component of wages accounted for by unobservable characteristics. The authors define the following function for unobservable characteristics: $u_{it} = F_t^{-1}(\theta_{it}/X_{it})$, where $F_t(\bullet)$ is the distribution function of the wage equation residuals and θ_{it} is the individual's percentile in the residuals' distribution. Under this assumption and considering available data for many periods, the level of inequality in a given year can be decomposed as:

$$Y_{it} = X_{it}\overline{\beta} + X_{it}(\beta_t - \overline{\beta}) + \overline{F}^{-1}(\theta_{it}/X_{it}) + [F_t^{-1}(\theta_{it}/X_{it}) - \overline{F}^{-1}(\theta_{it}/X_{it})],$$

where $\overline{\beta}$ is the average price of observable characteristics over the whole period and $\overline{F}(\bullet)$ is the average cumulative distribution of unobservable characteristics. The first term on the right-hand side of the expression captures the effect of changing individual characteristics at fixed prices. The second term captures the effects of changing prices at fixed individual characteristics, and the final term captures the effects of changes in the distribution of wage residuals. Under this framework the authors find that the increase in U.S. wage inequality between 1963 and 1989 is mainly due to an increase in unobservable skills and in prices of observable characteristics (education and experience).

Another way to look at the change in wage inequality over a certain period is to look at changes in employment, to explain the changes in wages. Bound and Johnson (1992) decompose the change in mean wages across types of U.S. workers (constructed using econometric techniques) into changes in technology, in factor supply, in an index of industrywide demand. They calculate the effects of technological changes as a residual.

Katz and Murphy (1992) use the product vector $[W_t - W_\tau] \bullet [X_t - X_\tau]$, where W and X are vectors of wages and relative labor supply across 64 demographic categories of workers (defined by education level, experience level, and gender), to test the hypothesis of stable demand across types of workers. They find that the vector product is positive and that this, combined with the increase in supply of better-educated workers and the decrease in supply of less-educated ones, reveals an increase in the demand for skilled labor. The authors also decompose the overall shift for labor type in the United States between within-industry demand and between-industry shifts. Katz and Murphy also estimate the effects of trade on changes in employment structure by calculating the "implicit supply of labor" of net imports. Murphy and Welch (1991) and Borjas, Freeman, and Katz (1992) propose methodologies similar to that developed by Katz and Murphy to estimate the effects of trade on employment.

Di Nardo, Fortin, and Lemieux (1996) propose a method to decompose changes in inequality based on applying kernel density methods to appropriately weighted samples. The authors construct counterfactual densities to impose some of the labor conditions prevailing in 1979 on the 1988 labor market. The counterfactual densities are constructed by reweighting the sample to reflect the conditions of the counterfactual labor market. The authors integrate Bound and Johnson (1992) and Katz and Murphy (1992) with their methodology to analyze the effects of changes in the supply and demand of labor. The authors find that de-unionization and supply and demand shocks are important factors explaining the increase in wage inequality in the United States. They conclude that labor market institutions—such as the minimum wage—are as important as supply and demand considerations in explaining the change in wage inequality.

As noted, this paper uses a methodology based on Juhn, Murphy, and Pierce (1993) to decompose changes in male wage inequality in Mexico. The paper also looks at changes in employment and wages to see the changes in demand for different types of workers across economic sectors.

The evolution of wage inequality in Mexico

Many studies conclude that trade liberalization was the main cause of the growing skill and wage gap observed in many Latin American countries in the 1990s. Two main arguments explain trade's effect on the demand for skilled and unskilled labor. The first, based on the Stolper-Samuelson theorem, argues that competition with low-wage countries (such as China) has reduced the demand for unskilled workers, causing their wages to fall relative to those of skilled workers. The second argument postulates that trade liberalization has allowed for innovation in production processes and that imports of capital goods have created a trade-induced, skill-biased technological change across industries. The adoption of these new technologies has increased the demand for and wages of skilled workers.

Different explanations have been given for the increase in wage inequality in Mexico: Alarcón (1994) suggests that the stabilization process controlled the wages of unskilled workers, allowing those of skilled workers to rise. Feenstra and Hanson (1997) argue that foreign investment has increased the demand for skilled workers. Meza (1997), using employment surveys for 1988-93, finds that the increase in wage inequality is mainly due to skill-biased technological change induced by trade or by domestic factors. Cragg and Epelbaum (1996) support the idea of skill-biased technical change driven by global factors. Feliciano (1994) argues that trade liberalization has benefited more skilled workers than unskilled. Hanson and Harrison (1999a, 1999b) find that rising returns to skilled labor are associated with Stolper-Samuelson effects, arguing that protection mainly benefited low-skill wages. Finally, Ros (1999) supports the argument for a drop in returns to unskilled labor due to strong import penetration driven by trade reform and the appreciation of the peso at the end of the 1980s.

The next few sections of this paper focus on the changes in returns after liberalization by education level, sector, region, and import-export orientation using household survey data from 1984 and 1994.

Wage inequality, education inequality, and sector wages in Mexico, 1984-94

Various measures of inequality show that wage inequality rose substantially for Mexican males between 1984 and 1994 (table 1). Inequality increased 24 percent according to the Gini coefficient, 51 percent according to the mean log deviation, 64 percent according to the Theil

index, and 99 percent according to the transformed coefficient of variation. The severe increase in the transformed coefficient of variation indicates strong increases in inequality among high-wage earners.

The distribution of hourly wages by income decile confirms the big increase among high-wage earners indicated by the aggregate inequality measures (table 2). While the average hourly wage of the first 8 deciles of the distribution fell between 1 percent (decile 8) and 13 percent (decile 4), the two highest deciles increased their average wage by 14 percent (decile 9) and 51 percent (decile 10). The biggest drops in average income were concentrated in the middle deciles (from decile 3 to decile 6).

Table 1
Mexican male wage inequality, 1984 and 1994

			Change	
	1984	**1994**	**Points**	**Percent**
Gini coefficient	42.34	52.64	10.31	24.34
Mean log deviation E(0)	32.28	48.72	16.44	50.94
Theil index E(1)	34.54	56.59	22.05	63.84
Transformed coefficient of variation E(2)	61.15	121.53	60.39	98.76

Source: Author's calculations based on household surveys.

Table 2
Mean hourly wages by income decile, 1984 and 1994
(Pesos of 1994)

Decile	**1984**	**1994**	**Percentage change**
1	1.09	1.02	-6.28
2	2.08	1.90	-8.35
3	2.78	2.48	-10.86
4	3.47	3.03	-12.82
5	4.16	3.64	-12.43
6	4.86	4.35	-10.47
7	5.77	5.36	-7.08

8	7.11	7.03	-1.15
9	9.68	11.06	14.25
10	18.99	28.73	51.28

Source: Author's calculations based on household surveys.

Lorenz curves for hourly wages in 1984 and 1994 are shown in figure 1. The lines in these curves do not cross and clearly show the increase in inequality between the two years. Mean wages by percentile also show the gain in income of the highest percentiles (figure 2). Workers above the 75th percentile gained in average wages, while workers below that percentile saw their wages fell.

Other studies using employment surveys find the same trend. Using employment surveys from 1988-93, Meza (1997) finds a 20 percent increase in the premium for workers with college education versus workers with primary school education.

Insert FIGURE 1

Insert FIGURE 2

Table 3
Static decompositions of male wage inequality, 1984-94
(percent)

	1984				1994				(F) – (C)
	Total inequality	Between-group inequality (A)	Within-group inequality (B)	(A)/(B)*100 (C)	Total inequality	Between-group inequality (D)	Within-group inequality (E)	(D)/(E)*100 (F)	
Decomposition by education category									
Mean log deviation E(0)	32.28	8.94	23.33	27.71	48.72	20.71	28.01	42.50	14.79
Theil index E(1)	34.54	10.26	24.28	29.70	56.59	24.64	31.95	43.54	13.85
Transformed coefficient of variation E(2)	61.15	12.86	48.29	21.03	121.53	34.09	87.44	28.05	7.02
Decomposition by sector of employment									
Mean log deviation E(0)	32.28	9.29	22.99	28.78	48.72	12.39	36.34	25.42	-3.36
Theil index E(1)	34.54	9.40	25.14	27.22	56.59	11.67	44.92	20.61	-6.60
Transformed coefficient of variation E(2)	61.15	11.85	49.30	19.38	121.53	12.43	109.10	10.23	-9.15

Source: Author's calculations based on household surveys.

How much of this increase in inequality can be explained by the change in returns by education level and employment sector? A first approximation can be done using traditional static decompositions of inequality. Table 3 presents this decomposition for between-group and within-group inequality by education and sector group. In 1984 between-group inequality for education accounted for 21-30 percent of total inequality, depending on the inequality measure used (Column (C)). This share increased substantially by 1994 (Column (D), rising 15 percentage points for the mean log deviation, 14 points for the Theil index, and 7 points for the transformed coefficient of variation. This increase is consistent with the increase in education premiums for highly educated workers over this period.

Sector group inequality fell between 1984 and 1994. In 1984 between-group inequality by sector accounted for 29 percent of total inequality using the mean log deviation, 27 percent using the Theil index, and 19 percent using the transformed coefficient of variation (see table 3, column (F)). By 1994 the share of between-group inequality by sector had fallen 3 percentage points for the mean log deviation, 7 points for the Theil index, and 9 points for the transformed coefficient of variation. This drop in the contribution of between-group inequality by sector is explained by the drop in sector premium returns observed (see below). The rest of this section describes changes in the structure of education and sector employment by income decile.

Table 4 shows the education levels of male wage workers by decile for 1984 and 1994, along with the change between those years. The share of workers with primary education or less fell from 59 percent in 1984 to 48 percent in 1994. The share of workers with more than primary education but with preparatory education or less increased from 30 percent in 1984 to 38 percent in 1994. Workers with more than preparatory education increased their participation from 11 percent in 1984 to 14 percent in 1994.

As expected, less-educated workers were more active in the lowest income deciles. In 1984, 81 of the workers in the lowest decile had primary education or less. In the highest decile just 16 percent of workers had primary education or less. Workers with more than primary education but with preparatory education or less accounted for 19 percent of the lowest decile in 1984. Workers with more than preparatory education accounted for less than 1 percent of the lowest

decile. In the highest decile, workers with more than primary education but with preparatory education or less accounted for 32 percent of the total, and workers with more than preparatory education accounted for 52 percent.

Table 4
Education levels of male wage workers by income decile, 1984-94 (percent)

	Decile										
1984	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**Total**
Primary or less	81.2	76.2	75.3	71.5	63.1	67.8	56.4	50.4	28.7	16.2	58.7
Preparatory or less	18.5	22.3	21.9	27.6	35.1	27.7	34.5	40.8	43.9	31.9	30.4
More than preparatory	0.2	1.5	2.8	0.8	1.8	4.5	9.1	8.8	27.4	52.0	10.9
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1994	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**Total**
Primary or less	76.6	69.2	57.1	61.0	61.2	49.8	44.6	37.0	19.7	6.4	48.2
Preparatory or less	23.4	30.1	42.1	37.6	35.7	44.5	48.2	47.8	45.9	26.9	38.2
More than preparatory	0.1	0.7	0.8	1.5	3.1	5.7	7.2	15.3	34.4	66.8	13.5
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Change in participation, 1984–94	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**Total**
Primary or less	-4.7	-7.0	-18.2	-10.6	-1.9	-18.1	-11.8	-13.5	-9.0	-9.8	-10.4
Preparatory or less	4.8	7.8	20.2	9.9	0.6	16.8	13.7	7.0	2.0	-5.0	7.8
More than preparatory	-0.2	-0.8	-2.0	0.6	1.3	1.2	-1.9	6.5	7.0	14.8	2.7
Preparatory	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Source: Author's calculations based on household surveys.

Demand for skills by sector: evidence from household surveys

Household surveys show that Mexican wages experienced a transformation between 1984 and 1994. As measured by years of schooling, the skill premium increased substantially, as did the share of skilled workers in total employment (table 5). Across education categories, average wages increased 16 percent, while employment rose 57 percent. But the increase in wages and employment was not uniform for all education levels. Wages rose for workers with at least a preparatory education but fell for less-educated workers. Employment increased for workers with at least a secondary education but fell for others.

These uneven increases suggest a big jump in the demand for workers with at least a preparatory education. The number of workers with an incomplete preparatory education or a secondary education increased, resulting in an increase in employment shares but a decrease in wages. Finally, workers with less than a secondary education experienced a drop in demand, resulting in lower wages and employment shares.

Table 5
Changes in wages and employment by education level, 1984-94
(in percentages)

Education level	Change in wages	Change in employment share
No instruction	-15.9	-11.1
Primary incomplete	-9.3	-27.9
Primary	-14.6	-9.1
Secondary incomplete	-12.0	-1.6
Secondary	-12.5	32.7
Preparatory incomplete	-18.0	31.6
Preparatory	23.9	40.0
Superior incomplete	47.4	29.5
Superior	53.9	18.5
Graduate studies	39.8	72.9
Total	16.2	57.1

Source: Author's calculations based on household surveys.

The drop in wages and employment among less-educated workers is consistent with the hypothesis that protection in Mexico was biased toward low-skilled workers (Hanson and Harrison, 1999b; Revenga, 1994). But the increase in wages and employment among better-educated workers also supports the hypothesis of a skill-biased technical change induced by

trade, a skill-biased technical change induced by domestic factors (Meza, 1997; Cragg and Epelbaum, 1996), or a big increase in exports intensive in skilled labor.

Skill premiums and skill employment across sectors

Important sectoral changes occurred in Mexico between 1984 and 1994. The share in GDP of agriculture and of manufacturing and mining fell (especially mining), while the share of services increased (see table A.1). Exports changed substantially, with the share of mining falling from 65 percent in 1984 to 11 percent in 1994. Clothing and textiles increased their share of exports from 1 to 5 percent, and machinery and equipment increased their share from 9 to 58 percent. Among imports, agriculture saw its share fall from 16 to 4 percent. Imports of clothing and textiles increased from 1 to 5 percent, while machinery and equipment rose from 46 to 56 percent.

Tables 6 and 7 explore the increase in skilled workers' employment levels and wage premiums across sectors . Employment levels and wage premiums are measured as the ratio of employment or wages between workers with more than preparatory education and workers with primary education or less. Skilled employment rose in most secondary and tertiary sectors except wood products, nonmetallic minerals, basic metal, and real estate (information is not available for other industries). Skilled labor ratios increased in agriculture but decreased in mining and oil extraction. In addition, wage premiums for skilled workers rose in all sectors except major retail, financial services, and real estate (information is not available for silviculture and forestry, fishing, or other industries).

Table 6
Employment ratios between wage earners with more than preparatory education and those with primary school or less, 1984 and 1994

Sector	1984	1994	Change (percent)
Agriculture and livestock	0.001	0.007	569.22
Silviculture and forestry	0.047	0.000	-100.00
Fishing	0.191	0.000	-100.00
Mining and oil extraction	0.784	0.281	-64.12
Food, beverages, and tobacco	0.085	0.186	119.22
Clothing and footwear	0.079	0.146	83.90

Wood products	0.101	0.049	-51.06
Printing	0.226	0.371	64.23
Chemical, petroleum products, rubber and plastics	0.397	0.434	9.52
Nonmetallic minerals except oil	0.055	0.047	-14.87
Basic metal industries	0.230	0.128	-44.20
Metal products, machinery and equipment	0.368	0.434	18.05
Electricity, gas, and water	0.415	0.642	54.95
Construction	0.066	0.094	41.95
Minor retail	0.344	0.545	58.12
Major retail	0.140	0.221	57.66
Restaurants and hotels	0.119	0.203	70.80
Transportation and communications	0.135	0.314	132.63
Financial services	0.901	15.643	1,635.69
Real estate	2.678	0.489	-81.73
Defense and public administration	0.338	0.664	96.22
Health and education	2.148	3.380	57.33
Other services	0.205	0.380	85.02

Source: Author's calculations based on household surveys.

Table 7
Wage ratios between earners with more than preparatory education and those with primary school or less, 1984 and 1994

Sector	1984	1994	Change (percent)
Agriculture and livestock	5.80	7.53	29.78
Silviculture and forestry	2.50	n.a.	n.a.
Fishing	1.52	n.a.	n.a.
Mining and oil extraction	1.74	4.70	169.86
Food, beverages, and tobacco	2.69	4.74	76.51
Clothing and footwear	2.36	3.81	61.16
Wood products	1.49	5.82	289.39
Printing	1.08	3.40	213.79
Chemical, petroleum products, rubber and plastics	1.51	3.01	100.09
Nonmetallic minerals except oil	2.49	4.79	92.84
Basic metal industries	2.53	5.71	125.69
Metal products, machinery and equipment	2.12	5.04	137.72
Other industries	n.a.	n.a.	n.a.
Electricity, gas, and water	1.44	2.46	70.18
Construction	3.05	5.87	92.61
Minor retail	2.11	2.25	6.74
Major retail	2.97	2.85	-4.13
Restaurants and hotels	2.17	4.33	99.34
Transportation and communications	2.24	6.11	172.48
Financial services	2.11	1.69	-20.14
Real estate	16.59	2.92	-82.37
Defense and public administration	2.68	3.79	41.37
Health and education	1.72	3.90	127.07
Other services	3.15	4.70	49.19

Source: Author's calculations based on household surveys.

Hanson and Harrison (1999a), using data on 2,354 medium-size and large Mexican manufacturing plants for 1984-90 from the Secretariat of Trade and Industrial Promotion and data for 1965-88 from the Mexican industrial census, show no change in the relative demand for skilled and unskilled workers. The authors define skilled workers as white-collar workers and unskilled workers as blue-collar workers. The secretariat's data show no change in the ratio of white- to blue-collar workers. Industry-level data show the same trend. Data from the industrial census show a slight decrease in the ratio of white- to blue-collar workers. At the industry level, seven of nine industries showed a decline in white-collar employment.

This simultaneous no change or slight decrease in skilled labor and increase in the skill premium is puzzling. Hanson and Harrison argue that it can be explained by a reduction in the supply of skilled workers due to shifts to other sectors or migration abroad; even though, from Borjas, Freeman and Katz (1992), they conclude that most Mexican workers who migrated abroad were unskilled. They also find little evidence of a shift in employment: the share of manufacturing in the labor force rose from 17 percent in 1980 to 20 percent in 1988.

As we have seen, results using household surveys and education attainment as a measure of skill contradict Hanson and Harrison's results. That could be for two reasons. First, because the household surveys compare 1984 with 1994, they include the effects on manufacturing of the strong appreciation of the peso between 1987 and 1994. That appreciation could have had a big effect on manufacturing industries intensive in low-skilled labor that compete with imports (see Ros, 1999). Second, if there was a change in the education levels of white- and blue-collar workers, the results of Hanson and Harrison are not comparable with the results of household surveys. The share of male wage workers with secondary, incomplete preparatory, or complete preparatory education rose substantially between 1984 and 1994 (see table 5). The ratio of wage earners with more than preparatory education to those with primary school or less rose in five of eight manufacturing industries (see table 6). If the blue-collar category includes workers with secondary, incomplete preparatory, or preparatory education, the absolute increase in blue-collar employment is consistent with the household survey findings.

Sectors that became more open (as measured by their share of exports and imports in GDP) also experienced an increase in their share of skilled workers. Clothing and footwear increased by 83.9 percent their ratio of workers with more than preparatory education to workers with primary school or less (see table 6). This increase is higher than the average even though the industry is less intensive in skilled labor. The sector's share in GDP fell during the period. Metal products and machinery and equipment, which are more skill intensive, experienced a below-average increase in skilled employment (18 percent). Three manufacturing sectors—wood products, nonmetallic minerals, and basic metal industries—saw decreases in their ratios of skilled employment. Wood products and basic metal industries also saw lower shares of GDP.

The three sectors increased their shares in exports, while import shares increased for wood products and nonmetallic minerals (see table A.1).

What role did skill-biased technical change play in these changes in skilled and unskilled wages and employment? There is some evidence on the direct effect of technology on skill premiums in developing countries. Tan and Batra (1997) argue that technology (investment in research and development, foreign technology, worker training, exporting, and know-how) plays a crucial role in explaining the interfirm structure of wages in developing countries. Using data for 5,072 firms in Mexico, 500 in Colombia, and 8,408 in Taiwan (China), the authors find large technology wage premiums for skilled workers—and small or no premiums for unskilled workers. In Mexico the technology wage premium for skilled workers was 54 percent, while the premium for unskilled workers was just 11 percent.

Mexico's service sectors (excluding financial services and real estate) experienced higher increases in the ratio of skilled employment than did manufacturing sectors (73 percent compared with 23 percent). But wage premiums increased more in manufacturing than in services, though both sectors saw a substantial increase (137 percent and 73 percent). The increase in skilled employment and skill premiums in nontradable sectors in the context of increasing costs for skilled labor is evidence of increasing demand for skilled employment in those sectors. Increasing demand could be related to skill-biased technical change induced by trade and to skill-biased technical change induced by domestic factors.

Some manufacturing sectors showed a big jump in demand for skilled labor (as indicated by higher employment and wage premium), but others showed drops in skilled employment. These effects are not related to changes in trade shares, as seen above. Though a better conclusion can be reached with firm-level data, the observed aggregate results could arise from a combination of Stolper-Samuelson effects and skill-biased technical change induced by trade or domestic factors.

Methodology

The rest of this paper traces the effects of changes in skill premiums, sector premiums, and other returns and endowments on the distribution of wages using a decomposition methodology based on earning regressions. The methodology was proposed by Bourguignon, Fournier, and Gurgand (1998)—based on Juhn, Murphy, and Pierce (1993)—to trace changes in the wage distribution at the household level based on complete regressions of the labor market. This paper applies the decomposition methodology to Mexican male wage earners, incorporating sector premiums in the analysis.

The methodology proceeds in three steps. First, a regression model for wage earnings is estimated for 1984 and 1994. Second, new vectors of wages are computed for each year using the regression coefficients of the other year and the error terms of the other year. Finally, the change in the distribution of wages is decomposed into return effects, error term effects, and endowment effects by comparing inequality measures obtained with the observed vectors of wages and the new vectors of wages calculated for the simulation. The return effects measure the change in inequality due to changes in the coefficients of the regression. The error term effects measure the contribution to inequality of changes in unobservable variables. Finally, the endowment effects, calculated as a residual, measure the contribution to inequality of changes in the independent variables in the regression.[1]

Regression estimation

Let us assume that the wage of individual i can be represented by the following function:

$$(1) \qquad w_i = f(\Omega, X_i, Y_i, \varepsilon_i),$$

where w_i represents the wage, Ω is a vector of returns to education, experience, and other individual characteristics (common to all workers but with different returns for different sectors), X_i is a vector with the personal characteristics of worker i (education and experience),

[1] Calculating the endowment effect as a residual instead of as the error term may seem counterintuitive. The endowment effect could be measured exactly with survey panel data, which are not available here. By the nature of the decomposition, the estimated endowment effect includes unaccounted changes in the distribution of the error term that are assumed to be small. The decomposition into endowment effect and error term effect is explained in more detail below.

Y_i is a vector with the characteristics of the firm where worker *i* is employed, and ε_i is a residual term.

Assuming that the wage function in equation 1 is log linear, the following wage regression is estimated for Mexican data in 1984 and 1994:

$$(2) \qquad \log w_i = \beta_0 + \sum_k \alpha_k D_k + \beta_1 X_1 + \beta_2 X_1^2 + \beta_3 X_2 + \beta_4 X_2^{\,2} + \beta_5 Y_1 + \beta_6 Y_2 + \sum_j^n SD_j(\gamma_0 + \gamma_{1j} X_1 + \gamma_{2j} X_1^{\,2}) + \varepsilon_i ,$$

where D_k is a set of dummies for the location of the firm where the worker is employed (border region, southern region, or capital of the country), whether the firm is in an urban or rural zone, and whether she works part time or full time. X_1 stands for years of schooling, while X_2 stands for years of experience. Y_1 stands for the export orientation of the sector where the worker is employed, while Y_2 stands for the import orientation. *j* stands for the sector of activity where the worker is employed, while SD_j stands for a dummy according to each worker's sector of employment. D_k and SD_j are components of vector Y_i, while *a*, β, and γ are components of vector Ω in equation 1.

Simulation methodology

Equation 2 can be simplified as follows:

$$(3) \qquad \log w_t = Z_t \Omega_t + \varepsilon_t ,$$

where $X, Y \subset Z$. Under this specification the return effect is calculated by comparing the initial vector of wages observed in year *t* with the following vector of wages:

$$(4) \qquad \log w^{\Omega} = Z_t \Omega_{t+1} + \varepsilon_t$$

The error term effect is calculated by comparing the initial vector of wages observed in year *t* with the following vector of wages:

$$(5) \qquad \log w^{\varepsilon} = Z_t \Omega_t + \frac{\sigma_{t+1}}{\sigma_t} \varepsilon_t$$

Finally, the endowment effect is calculated as a residual by comparing the vector of wages observed in year *t+1* with the following vector of wages:

$$(6) \qquad \log w^{\Omega,\varepsilon} = Z_t \Omega_{t+1} + \frac{\sigma_{t+1}}{\sigma_t} \varepsilon_t$$

This methodology simplifies the procedure followed by Juhn, Murphy, and Pierce (1993) in that it assumes that the main changes in the error term distribution between years *t* and *t+1* are given by changes in the variance of the regression residuals. Other changes in the distribution of the regression error term, which are assumed to be small, are included in the endowment effect by the construction of the simulation. The endowment effect is estimated as a residual by comparing the simulated inequality of wages due to changes in the return effect and the error term effect with the observed inequality of the other year.

Regression results

Regression results show the increasing returns to education for male wage earners in Mexico between 1984 and 1994 (table 8; figure 3). This result is consistent with other studies for Mexico and other Latin American countries (Legovini, Bouillon, and Lustig, 2000; Ferreira and Paes de Barros, 1999; Velez, Kugler, and Bouillon, 2000).

Returns to schooling increased for workers with more than 13 years of schooling and decreased for those with less (see figure 3). For example, returns to schooling for workers with college degrees increased 34 percent. The coefficients of years of experience remained almost unchanged, becoming somewhat more convex.

The estimated coefficients for sector fixed effects, sector years of schooling, and sector years of schooling squared are shown in tables A.2A, A.2B, and A.2C. The importance of sector fixed effects fell during the period: the mean of fixed effect dummy coefficients dropped from 0.459 to 0.116, and the standard deviation fell from 0.504 to 0.286. The importance of the interaction between sector dummies and years of schooling also fell: the mean of the coefficients of sector years of schooling fell from –0.90 to –0.017, and the standard deviation fell from 0.138 to 0.057. The mean and standard deviation of the coefficients of sector years of schooling squared also fell (from 0.0051 to 0.0007 and from 0.0090 to 0.0038).

Table 8
Regression results for log real hourly wage, 1984 and 1994

			1984			**1994**
Number of observations			2,817			8,607
F statistic			40.31			114.81
Prob > F			0.00			0.00
R-squared			51.69			54.12
Root MSE			0.5483			0.6099
	Regression coefficients, 1984			**Regression coefficients, 1994**		
	Coefficient	**t**	**P>|t|**	**Coefficient**	**t**	**P>|t|**
Years of schooling	0.1247	3.7060	0.0000	0.0504	2.2330	0.0260
Years of schooling squared	-0.0013	-0.6370	0.5240	0.0041	2.9810	0.0030
Experience	0.0587	21.4540	0.0000	0.0509	30.8710	0.0000
Experience squared	-0.0008	-16.6710	0.0000	-0.0007	-22.4420	0.0000
Location dummies						
Border region	-0.0065	-0.2830	0.7770	0.0527	2.8620	0.0040
Southern region	-0.1379	-4.5210	0.0000	-0.2068	-11.4650	0.0000
Capital	0.1263	3.5850	0.0000	0.1522	6.9410	0.0000
Urban region	0.1624	5.3260	0.0000	0.1717	10.1950	0.0000
Part-time dummy	0.2419	6.0980	0.0000	0.3238	13.4490	0.0000
Trade dummies						
Export index	-0.0190	-0.7180	0.4730	0.0064	0.3790	0.7050
Import index	0.0391	2.0400	0.0410	0.0091	0.5180	0.6050
Constant	-0.1606	-1.0850	0.2780	-0.0081	-0.0860	0.9310

For location dummies, returns to working in border regions became significant in 1994 (see table 8), reflecting the effects of the North American Free Trade Agreement (NAFTA) and trade

liberalization on export firms located near the United States. The dummy for workers in the south became more negative, reflecting deteriorating conditions in that region (see Bouillon, Legovini, and Lustig, 1999). The dummy for the capital region increased slightly, as did the dummy for workers in urban areas. Dummies for part-time workers also indicate an increase in their wage premium during the period.

Insert FIGURE 3

Finally, dummies for workers in sectors with high exports or imports (relative to output) became less significant in 1994. Premiums for workers in sectors with high exports became positive in 1994, while premiums for workers in sectors with high imports fell significantly.

Decomposition results

Table 9 summarizes the decomposition results of the change in inequality for male wage earners in Mexico between 1984 and 1994. As in previous sections, inequality rose considerably, with the Gini coefficient moving from 42 to 53. The increase is robust for other measures of inequality: the mean log deviation, Theil index, and transformed coefficient of variation rose as well.

Table 9
Decomposition of changes in inequality, 1984-94
(percentage of total change in inequality measure)

	Gini	E(0)	E(1)	E(2)*
1. ***Return effect***	30.14	29.34	29.34	25.15
1a. Average return and sector effects	25.39	24.80	24.38	19.25
Average education returns	50.11	55.26	58.74	27.14
Sector effects	-24.71	-30.46	-34.37	-7.98
Fixed effects	-18.84	-21.76	-26.47	-1.52
Education	-5.88	-8.71	-7.89	-6.46
1b. Age coefficient	-2.35	-3.08	-1.52	-0.08
1c. Regional, border, and zone effects	2.88	3.82	2.82	3.11
Regional effects	2.39	3.00	2.11	2.01
Border effects	0.01	0.18	0.29	0.71
Zone effects	0.52	0.70	0.46	0.41
1d. Part-time dummy effect	2.44	2.15	1.83	0.98
1e. Export-import orientation	2.76	2.30	2.32	2.22

1f. Interaction	-2.74	1.65	1.84	1.88
2. ***Error term effect***	21.89	26.72	25.79	34.22
3. Remainder	0.20	-0.28	-0.83	-4.21
4. ***Endowment effect***	47.78	44.22	45.70	44.84
Total (1 + 2 + 3 + 4)	100.00	100.00	100.00	100.00

* Decomposition for E(2) between average education returns and sector effects uses only 1994 base year results due to sampling problems in 1984.

Table 9 decomposes the observed increase in inequality into a return effect, error term effect, and endowment effect.[2] As noted, the return effect measures the change in inequality due to changes in the coefficients of the regression. This effect measures the contribution to the change in inequality of changes in premiums associated with education, sector, region, import-export orientation, part-time work, and region, border, and zone fixed effects. The error term effect measures the contribution to inequality of changes in unobservable variables. Finally, the endowment effect, which is calculated as a residual, measures the contribution to inequality of changes in the independent variables in the regression. This effect captures changes in inequality due to changes in human capital, location, sector of employment, and part-time work decisions.

Using the Gini coefficient, changes in returns account for 30 percent of the increase in inequality (see table 9). Changes in the error term account for 22 percent. The rest (48 percent) is accounted for by changes in endowments. The main contributor to the increase in inequality across returns is the change in returns to education and sector effects.

More convex returns to education, as measured by the change in the coefficient of years of schooling in the regression, had one of the most important inequality-increasing effects of the period. Average education returns contributed about half of the increase in inequality—even more than the change in endowments.

This finding is consistent with other results that highlight the role of skill premiums in increasing earnings inequality in Mexico and elsewhere in the region. Figure 4 shows the change in wages due to changes in education returns and the constant term. Most workers

[2] Table 9 presents the average contributions of each component to inequality. Because the decomposition is path dependent, the table presents the average of the decomposition using 1984 endowments and 1994 endowments. The inputs for table 9 are presented in tables A.3, A.4, and A.5.

below the 80th percentile in wages lost income due to the change in education returns. Only highly educated workers in the top two wage deciles gained from changes in returns to education.

Insert Figure 4
Insert Figure 5
Insert Figure 6
Insert Figure 7

The change in sector premiums had an equalizing effect during the period, contributing -25 percent to the increase in inequality. This is a result of the decrease in sector wage premiums after trade liberalization. The regression results show the decrease in fixed sector premiums (the mean of the estimated fixed sector premiums decreased from 0.459 to 0.116; the standard deviation also decreased) as well as the reduction in education sector premiums. This could be the effect of reducing protection in certain sectors and of the appreciating exchange rate. Figure 5 presents the change in hourly wages by percentile due to changes in sector returns. The figure, along with the estimated decomposition, indicates that after liberalization workers in the highest wage percentiles were the most affected by the decrease in sector premiums. Most workers below the 37th percentile experienced 5-10 percent drops in mean wages. Most workers between the 38th and 87th percentiles experienced 10-15 percent drops in wages. Workers above the 88th percentile experienced 20 percent drops in wages.

Experience had a small equalizing effect, consistent with the fact that the experience coefficient did not vary much between 1984 and 1994. Regional, border, and zone effects increased inequality by a small amount. Regional effects accounted for almost all the location effects (about 2.4 percent). This result reflects the contribution of deteriorating conditions in the south, shown in the increased negativity of the dummy for this region. Even though the dummy coefficient for workers in border regions increased in 1994, this had no effect on inequality (see table 9). The increase in urban premiums also had no effect on the increase in inequality. Figure 6 shows region, border, and zone effects on mean wages.

The increase in returns to part-time work contributed 2.4 percent of the increase in inequality. Figure 6 shows the changes in mean wages by percentile due to changes in part-time work dummies. The slight increase in premiums to workers in sectors with higher shares of exports and the reduction in premiums to workers in sectors with higher shares of imports tend to increase inequality (see table 9). Figure 6 helps explain why. Workers at the middle of the income distribution were more affected by the decrease in import premiums, and did not benefit from the increase in export premiums. The opposite was true for high- and low-income wage earners, but the increase in wages for workers at the bottom of the distribution was not enough to compensate for the decrease for middle-income workers—resulting in a small increase in inequality.

The error term effect is inequality increasing. This result reflects the effects of variables not explicitly included in the regression. One unaccounted factor that could explain this result is the worker's profession. According to Cragg and Epelbaum (1996), certain professions (such as managers) substantially increased their premiums between 1984 and 1994. The results indicate that unobserved capabilities were more rewarded in 1994 than in 1984. Figure 7 presents the effects on mean wages of changes in the variance of the error term. The increase in mean wages is positively correlated with the worker's percentile. Workers in the lowest percentile experienced a 10 percent drop in wages, while workers in the highest percentile experienced an 8 percent increase.

Finally, the endowment effect is highly inequality increasing. The education effect could have increased inequality even though the education levels of male wage workers became slightly less unequal. (The Gini of years of schooling for these workers fell from 34.99 to 34.15 between 1984 and 1994; see Bouillon, Legovini, and Lustig, 2000, for more evidence on this effect.) The increase in mean years of schooling, combined with the convexity of returns to education in 1984 and 1994, resulted in a strong inequality-increasing effect of the change in education endowments. The endowment effect of years of experience is also likely to have increased inequality during the period. The stock of years of experience fell 2.4 percent during the period, and the Gini of years of experience increased slightly (from 40.46 to 40.93). This increase in the

inequality of the experience endowment caused an increase in the inequality of wages if the returns to experience were linear or slightly concave.

Conclusion

Wage inequality rose substantially among male workers in Mexico after trade liberalization in the mid-1980s. This increase was associated with higher returns to skilled labor, which many studies view as a direct result of trade liberalization and peso appreciation at the end of the 1980s. This paper confirms the impressive increase in education returns experienced by Mexican male wage workers between 1984 and 1994. According to the decomposition exercise used here, the rise in returns to schooling is the most important factor explaining the increase in inequality—accounting for about half of it.

Some studies suggest that the reform affected low-skilled workers in sectors that compete with imports. This paper found that the drop in sector premiums over the period caused the most harm to workers with the highest wages. Moreover, the effect of changes in sector returns was equalizing during the period. This suggests that before the reform, a large portion of uneducated workers had high wages because they were employed in protected sectors.

What do the results of the paper can tell us about policy recommendations to decrease labor inequality in Mexico? Since Education is found to play a pivotal role in the determination of changes in income inequality. Because returns to education have fallen for most education levels, the paper recommends addressing private incentives for investing in education as well as the quality and availability of educational services (such as it is done in programs like Progresa in Mexico and the revamped PRAF in Honduras).

Appendix

Table A.1
Changes in GDP and trade shares by sector 1984-94

Sector of activity	GDP Share		Export Share		Index of Export Orientation		Import Share		Index of Import Orientation	
	1984	1994	1984	1994	1984	1994	1984	1994	1984	1994
Agriculture, silviculture and fishing	6.422	5.492	6.042	4.425	0.941	0.806	15.524	4.309	2.417	0.785
Mining	5.125	1.225	65.069	10.944	12.696	8.931	1.602	0.560	0.313	0.457
Food, beverages and tobacco	4.282	4.682	3.399	3.133	0.794	0.669	4.129	5.099	0.964	1.089
Clothing and footwear	2.181	1.448	1.137	5.380	0.521	3.716	0.818	5.326	0.375	3.679
Wood products	0.746	0.529	0.405	0.968	0.543	1.830	0.306	0.888	0.410	1.679
Printing	0.939	0.887	0.401	0.929	0.427	1.046	3.113	3.884	3.314	4.378
Chemicals, oil products, rubber and plastic	3.053	2.693	9.205	7.668	3.015	2.847	18.918	15.113	6.197	5.611
Non metallic minerals except oil	1.309	1.344	1.195	2.007	0.913	1.494	0.603	1.291	0.461	0.961
Basic metal industries	1.365	0.784	3.672	4.329	2.689	5.520	8.299	6.552	6.078	8.356
Metal products, machinery and equipment	4.129	4.321	9.164	58.363	2.219	13.507	46.367	55.589	11.230	12.865
Other manufacturing industries	0.509	0.525	0.310	1.855	0.609	3.532	0.322	1.388	0.633	2.642
Construction	4.074	4.858	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Electricity, Gas and water	0.918	1.347	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Retail, restaurants and hotels	24.809	19.368	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Transportation and communication	7.997	8.770	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Financial services and real state	9.041	14.859	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Non financial services	16.971	21.852	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Fuente: INEGI

Table A.2A
Regression coefficients for sector dummies, 1984 and 1994

Fixed sector dummies

	1984			1994		
	Coef.	**t**	**P>|t|**	**Coef.**	**t**	**P>|t|**
Agriculture and livestock	-0.277	-2.159	0.031	-0.285	-3.175	0.002
Silviculture and forestry	-0.216	-0.624	0.533	-0.864	-2.183	0.029
Fishing	1.898	1.699	0.089	-0.194	-0.395	0.693
Clothing and footwear	0.300	1.379	0.168	0.297	1.810	0.070
Wood products	1.092	2.256	0.024	0.322	1.632	0.103
Printing	0.279	0.651	0.515	0.476	1.997	0.046
Chemical, petroleum products, rubber and plastics	0.948	2.717	0.007	0.229	0.879	0.379
Nonmetallic minerals except oil	0.288	1.601	0.109	0.241	2.159	0.031
Basic metal industries	0.384	2.455	0.014	0.325	2.091	0.037
Other industries	1.023	2.337	0.020	0.078	0.140	0.888
Electricity, gas, and water	0.532	1.604	0.109	0.295	1.910	0.056
Construction	0.153	0.999	0.318	0.115	1.177	0.239
Minor retail	0.287	1.398	0.162	0.179	1.387	0.165
Major retail	0.039	0.189	0.850	-0.027	-0.196	0.844
Restaurants and hotels	0.502	2.106	0.035	0.201	1.099	0.272
Transportation and communications	0.491	2.811	0.005	0.332	2.061	0.039
Financial services	0.724	2.482	0.013	0.112	0.162	0.871
Real estate	0.885	4.719	0.000	0.105	0.455	0.649
Defense and public administration	0.240	1.377	0.169	0.121	0.904	0.366
Health and education	0.092	0.291	0.771	0.104	0.628	0.530
Other services	-0.018	-0.097	0.922	0.276	2.396	0.017
Mean	0.459			0.116		
Standard deviation of coefficients	0.504			0.286		

Table A.2B
Regression coefficients for sector dummies, 1984 and 1994

Years of schooling sector dummies

	1984			1994		
	Coef.	**t**	**P>|t|**	**Coef.**	**t**	**P>|t|**
Agriculture and livestock	-0.054	-1.035	0.301	-0.020	-0.781	0.435
Silviculture and forestry	0.080	0.682	0.495	0.069	0.322	0.747
Fishing	-0.410	-1.107	0.268	0.064	0.367	0.713
Mining and oil extraction	0.118	1.545	0.123	0.031	0.839	0.402
Clothing and footwear	-0.050	-0.869	0.385	-0.063	-1.575	0.115
Wood products	-0.281	-2.414	0.016	-0.070	-1.261	0.207
Printing	-0.032	-0.283	0.777	-0.124	-2.288	0.022
Chemical, petroleum products, rubber and plastics	-0.179	-2.157	0.031	-0.009	-0.157	0.875
Nonmetallic minerals except oil	-0.080	-1.439	0.150	-0.065	-1.923	0.055
Basic metal industries	-0.070	-1.528	0.127	-0.089	-2.183	0.029
Metal products, machinery and equipment	-0.062	-1.255	0.209	-0.030	-0.873	0.383
Other industries	-0.383	-2.349	0.019	-0.085	-0.459	0.646
Electricity, gas, and water	0.039	0.527	0.599	0.025	0.566	0.571
Construction	-0.047	-1.144	0.253	-0.019	-0.733	0.464
Minor retail	-0.062	-1.201	0.230	-0.030	-0.941	0.347
Major retail	-0.032	-0.621	0.535	0.003	0.096	0.924
Restaurants and hotels	-0.112	-1.984	0.047	-0.002	-0.042	0.967
Transportation and communications	-0.090	-1.995	0.046	-0.061	-1.536	0.125
Financial services	-0.034	-0.571	0.568	0.105	0.922	0.357
Real estate	-0.323	-4.006	0.000	0.017	0.267	0.789
Defense and public administration	-0.018	-0.415	0.678	0.005	0.158	0.875
Health and education	0.034	0.537	0.591	0.033	0.939	0.348
Other services	-0.024	-0.538	0.591	-0.081	-2.842	0.004
Mean	-0.090			-0.017		
Standard deviation of coefficients	0.138			0.057		

Table A.2C
Regression coefficients for sector dummies, 1984 and 1994

Years of schooling squared sector dummies

	1984			1994		
	Coef.	**t**	**P>|t|**	**Coef.**	**t**	**P>|t|**
Agriculture and livestock	0.0041	0.8220	0.4110	0.0004	0.2310	0.8170
Silviculture and forestry	-0.0038	-0.6110	0.5410	0.0033	0.1330	0.8940
Fishing	0.0190	0.9060	0.3650	-0.0082	-0.5560	0.5780
Mining and oil extraction	-0.0054	-1.4130	0.1580	-0.0013	-0.6220	0.5340
Clothing and footwear	0.0040	1.1600	0.2460	0.0028	1.2630	0.2070
Wood products	0.0141	2.2870	0.0220	0.0034	0.8150	0.4150
Printing	-0.0023	-0.3380	0.7350	0.0065	2.1650	0.0300
Chemical, petroleum products, rubber and plastics	0.0075	1.7820	0.0750	0.0000	0.0120	0.9910
Nonmetallic minerals except oil	0.0043	1.2570	0.2090	0.0037	1.6490	0.0990
Basic metal industries	0.0034	1.2510	0.2110	0.0054	2.0850	0.0370
Metal products, machinery and equipment	0.0036	1.2960	0.1950	0.0017	0.8600	0.3900
Other industries	0.0331	2.5370	0.0110	0.0070	0.4890	0.6250
Electricity, gas, and water	-0.0042	-1.1210	0.2620	-0.0034	-1.3240	0.1850
Construction	0.0023	0.9110	0.3620	0.0000	0.0280	0.9770
Minor retail	0.0031	1.0330	0.3020	0.0020	1.0470	0.2950
Major retail	0.0018	0.5890	0.5560	-0.0015	-0.7580	0.4490
Restaurants and hotels	0.0064	1.9650	0.0500	-0.0010	-0.3640	0.7160
Transportation and communications	0.0046	1.5990	0.1100	0.0024	1.0240	0.3060
Financial services	0.0006	0.1760	0.8600	-0.0058	-1.2120	0.2250
Real estate	0.0212	4.4680	0.0000	-0.0022	-0.5850	0.5590
Defense and public administration	0.0003	0.1270	0.8990	-0.0012	-0.6410	0.5210
Health and education	-0.0018	-0.5910	0.5540	-0.0025	-1.3900	0.1640
Other services	0.0018	0.6360	0.5250	0.0043	2.5540	0.0110
Mean	0.0051			0.0007		
Standard deviation of coefficients	0.0090			0.0038		

Table A.3
Decomposition of changes in inequality, 1984-94

Using 1984 endowments	Gini	% Share	E(0)	% Share	E(1)	% Share	E(2)	% Share
Observed 1984 wages	42.34		32.28		34.54		61.15	
Simulated wages with 1994 returns								
Return and error term effects	47.19	47.07	39.88	46.25	43.59	41.06	79.58	30.52
Return effect	45.18	27.58	35.97	22.46	38.87	19.64	64.81	6.07
Education returns and sector effects	44.43	20.33	34.90	15.94	37.26	12.32	60.21	-1.55
Experience	42.17	-1.63	31.96	-1.90	34.46	-0.37	62.06	1.51
Regional, border, and zone effects	42.61	2.68	32.76	2.91	35.08	2.47	62.67	2.53
Regional effects	42.60	2.55	32.71	2.62	34.95	1.85	61.88	1.22
Border effects	42.32	-0.20	32.25	-0.15	34.62	0.38	61.83	1.13
Zone effects	42.38	0.41	32.36	0.50	34.61	0.31	61.28	0.23
Interaction		-0.08		-0.06		-0.07		-0.05
Part-time dummy effect	42.70	3.51	32.75	2.88	35.25	3.24	63.31	3.59
Export-import orientation	42.70	5.51	33.06	4.74	35.48	4.27	63.25	3.49
Interaction		-6.33		2.63		1.98		-0.01
Error term effect	44.52	21.19	36.21	23.94	39.50	22.49	77.65	27.34
Interaction		-1.69		-0.15		-1.08		-2.88
Endowment effect		52.93		53.75		58.94		69.48

Using 1994 endowments	Gini	% Share	E(0)	% Share	E(1)	% Share	E(2)	% Share
1994 wages	52.64		48.72		56.59		121.53	
Simulated wages with 1984 returns								
Return and error term effects	46.73	57.37	37.98	65.31	41.70	67.54	73.35	79.79
Return effect	49.27	32.70	42.77	36.22	47.98	39.04	94.83	44.22
Education returns and sector effects	49.50	30.46	43.18	33.67	48.56	36.43	97.35	40.05
Experience	52.96	-3.07	49.42	-4.26	57.18	-2.68	122.54	-1.66
Regional, border, and zone effects	52.33	3.08	47.94	4.73	55.89	3.17	119.30	3.69
Regional effects	52.41	2.23	48.16	3.39	56.07	2.38	119.84	2.81
Border effects	52.62	0.23	48.64	0.51	56.55	0.19	121.37	0.28
Zone effects	52.58	0.63	48.57	0.90	56.45	0.61	121.18	0.59
Interaction		-0.02		-0.06		-0.01		0.02
Part-time dummy effect	52.50	1.38	48.49	1.41	56.49	0.43	122.52	-1.63
Export-import orientation	52.64	0.02	48.74	-0.14	56.51	0.38	120.96	0.95
Interaction		0.85		0.66		1.69		3.77
Error term effect	50.32	22.58	43.87	29.50	50.18	29.09	96.72	41.10
Interaction effect		2.08		-0.40		-0.59		-5.54
Endowment effect		42.63		34.69		32.46		20.21

Table continues on next page

Table A.3 (*continued)*

Decomposition of changes in inequality, 1984-94

Average	Gini	% Share	E(0)	% Share	E(1)	% Share	E(2)	% Share
Return and error term effects		52.22		55.78		54.30		55.16
Return effect		30.14		29.34		29.34		25.15
Education returns and sector effects		25.39		24.80		24.38		19.25
Experience		-2.35		-3.08		-1.52		-0.08
Regional, border, and zone effects		2.88		3.82		2.82		3.11
Regional effects		2.39		3.00		2.11		2.01
Border effects		0.01		0.18		0.29		0.71
Zone effects		0.52		0.70		0.46		0.41
Interaction		-0.05		-0.06		-0.04		-0.02
Part-time dummy effect		2.44		2.15		1.83		0.98
Export-import orientation		2.76		2.30		2.32		2.22
Interaction		-2.74		1.65		1.84		1.88
Error term effect		21.89		26.72		25.79		34.22
Interaction effect		0.20		-0.28		-0.83		-4.21
Endowment effect		47.78		44.22		45.70		44.84

Table A.4
Decomposition of the contribution to the increase in inequality of average returns and sector effects, 1984 and 1994

	Gini	% Share	E(0)	% Share	E(1)	% Share	E(2)	% Share
Using 1984 endowments and 1994 returns								
Contribution of the change in:								
Average return and sector effects	44.43	100.00	34.90	100.00	37.26	100.00	60.21	100.00
Average education returns	43.37	225.42	32.65	236.46	36.12	311.66	59.33	-1870.84
Sector effects		-125.42		-136.46		-211.66		1970.84
a. Using fixed effects as the base								
Fixed effects	45.93	-198.05	37.33	-219.76	39.86	-277.95	64.59	2137.55
Education		72.63		83.30		66.29		-166.71
b. Using education as the base								
Fixed effects		-51.85		-49.99		-112.16		1486.08
Education	42.77	-73.57	31.86	-86.47	35.17	-99.50	59.04	484.76
Average (a and b)								
Fixed effects		-124.95		-134.87		-195.06		1811.81
Education		-0.47		-1.58		-16.61		159.02
Using 1994 endowments and 1984 returns								
Contribution of the change in:								
Average return and sector effects	49.50	100.00	43.18	100.00	48.56	100.00	97.35	100.00
Average education returns	46.22	169.23	37.14	209.19	42.91	170.31	87.32	141.48
Sector effects		-69.23		-109.19		-70.31		-41.48
a. Using fixed effects as the base								
Fixed effects	49.93	-61.27	44.51	-55.37	49.18	-37.66	100.85	-27.40
Education		-7.96		-53.83		-32.65		-14.08
b. Using education as the base								
Fixed effects		14.45		-25.76		-6.63		11.56
Education	48.67	-83.68	41.32	-83.44	47.23	-63.68	94.50	-53.03
Average (a and b)								
Fixed effects		-23.41		-40.56		-22.14		-7.92
Education		-45.82		-68.63		-48.16		-33.56
Average								
Contribution of the change in:								
Average return and sector effects	100.00		100.00		100.00		100.00	

Average education returns	197.33	222.83	240.98	-864.68
Sector effects	-97.33	-122.83	-140.98	964.68
a. Using fixed effects as the base				
Fixed effects	-129.66	-137.56	-157.80	1055.08
Education	32.33	14.74	16.82	-90.40
b. Using education as the base				
Fixed effects	-18.70	-37.87	-59.39	748.82
Education	-78.62	-84.95	-81.59	215.86
Average (a and b)				
Fixed effects	-74.18	-87.72	-108.60	901.95
Education	-23.15	-35.11	-32.39	62.73

Table A.5

Contribution of sector components to inequality, 1984 and 1994

1984	Gini	% Share	E(0)	% Share	E(1)	% Share	E(2)	% Share
.								
Observed wage	42.34	100.00	32.28	100.00	34.54	100.00	61.15	100.00
Average returns	38.65	91.29	26.46	81.97	27.66	80.08	41.87	68.48
Total sector effects		8.71		18.03		19.92		31.52
a. Fixed sector effects	45.36	15.85	36.89	24.65	38.94	26.65	67.07	59.53
b. Education sector effects	39.59	2.23	27.93	3.48	29.41	4.13	46.11	10.00
c. Interaction effect		-9.36		-10.10		-10.86		-38.01

1994	Gini	% Share	E(0)	% Share	E(1)	% Share	E(2)	% Share
.								
Observed wage	52.64	100.00	48.72	100.00	56.59	100.00	121.53	100.00
Average returns	51.53	97.89	46.03	94.48	54.93	97.06	121.47	99.95
Total sector effects		2.11		5.52		2.94		0.05
a. Fixed sector effects	53.32	3.39	50.34	8.84	58.17	5.74	128.38	5.69
b. Education sector effects	51.36	-0.33	45.59	-0.91	54.13	-1.41	115.82	-4.64
c. Interaction effect		-0.95		-2.41		-1.40		-0.99

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Figure 1
Lorenz curves
(Hourly Wages)

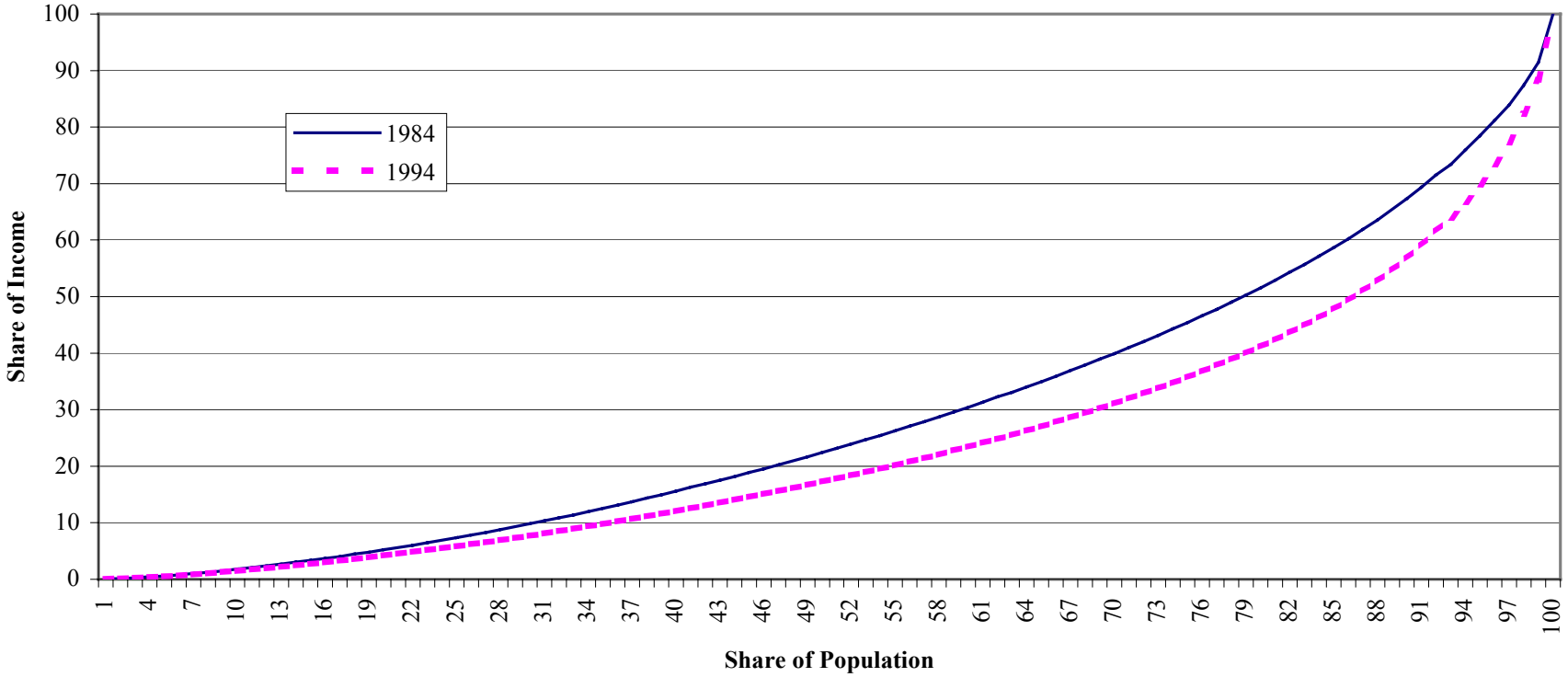

Figure 2
Mean wage by percentile

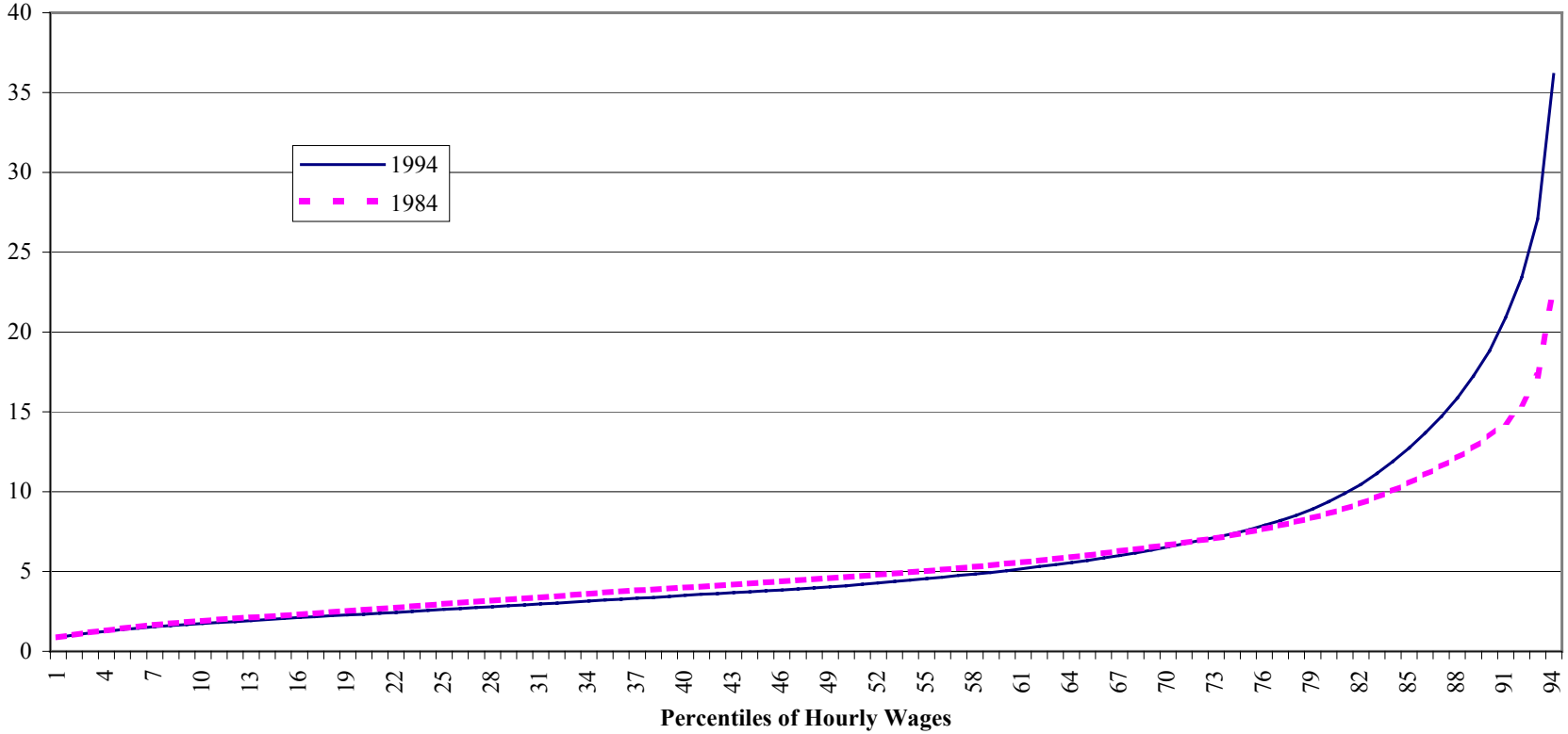

Figure 3
Estimated returns to education

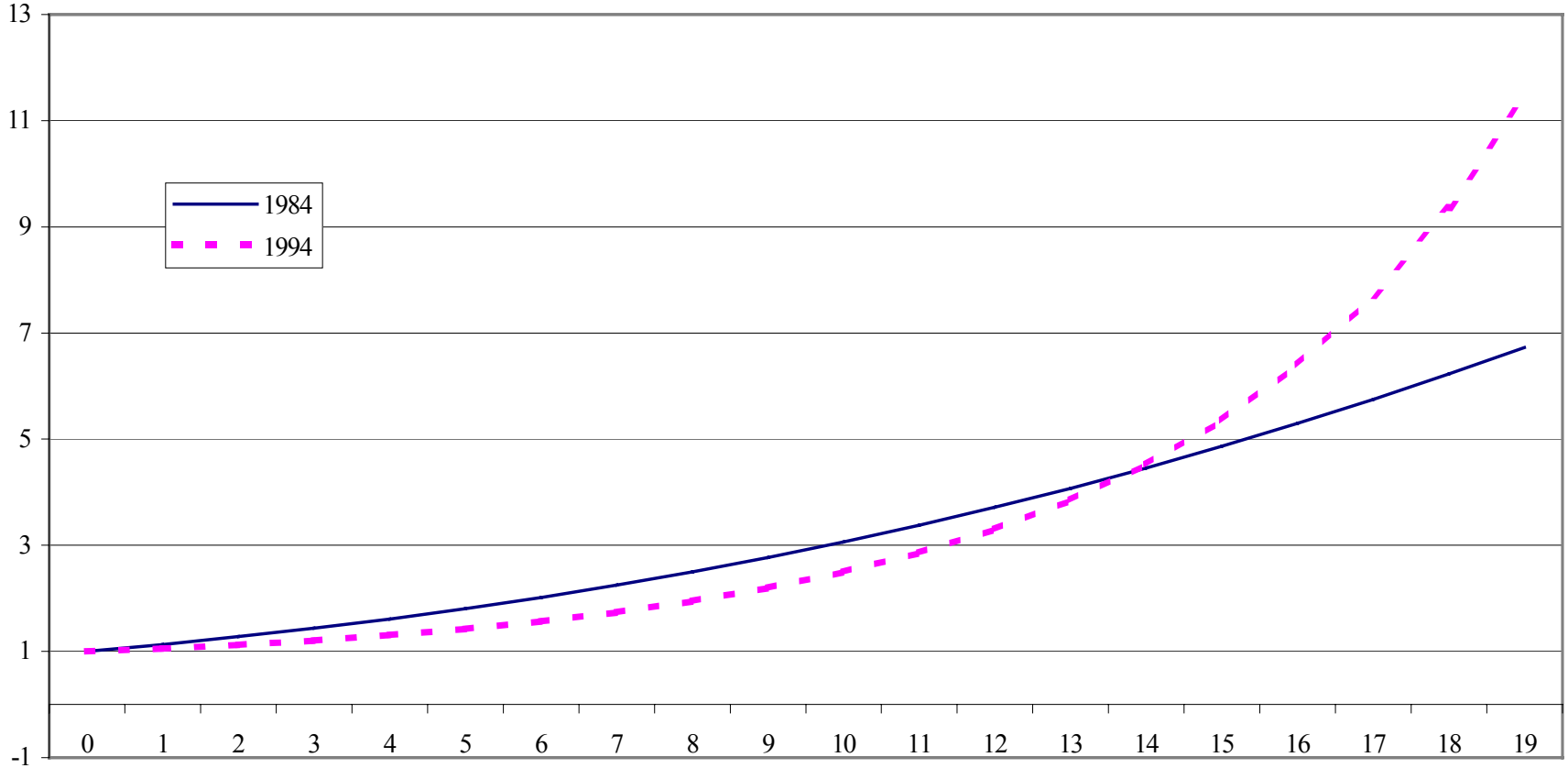

Figure 4
Percentage change in wages due to changes in average education returns and the constant
(Using 1984 data)

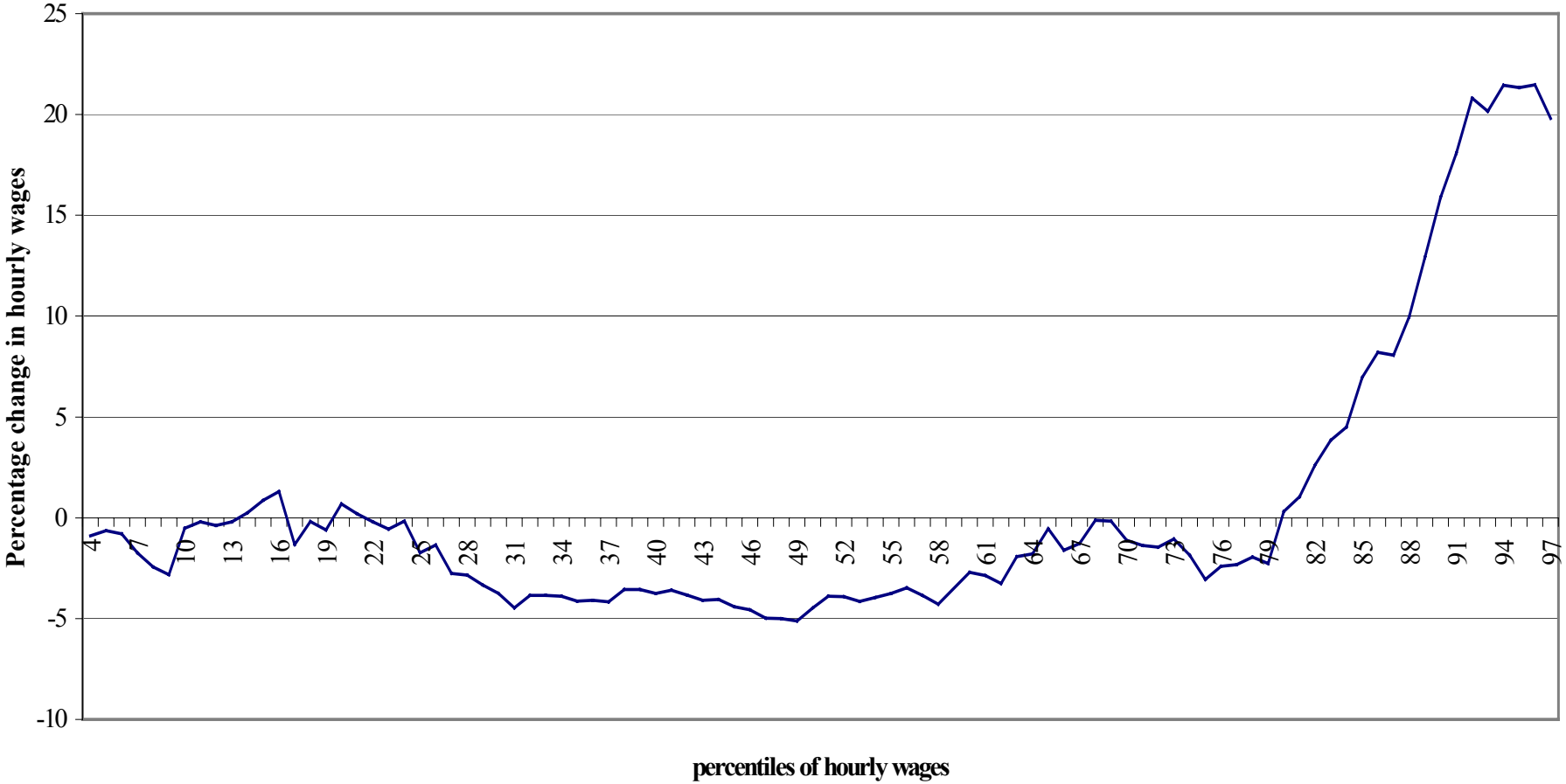

Figure 5
Percentage change in wages due to changes in fixed sectoral returns
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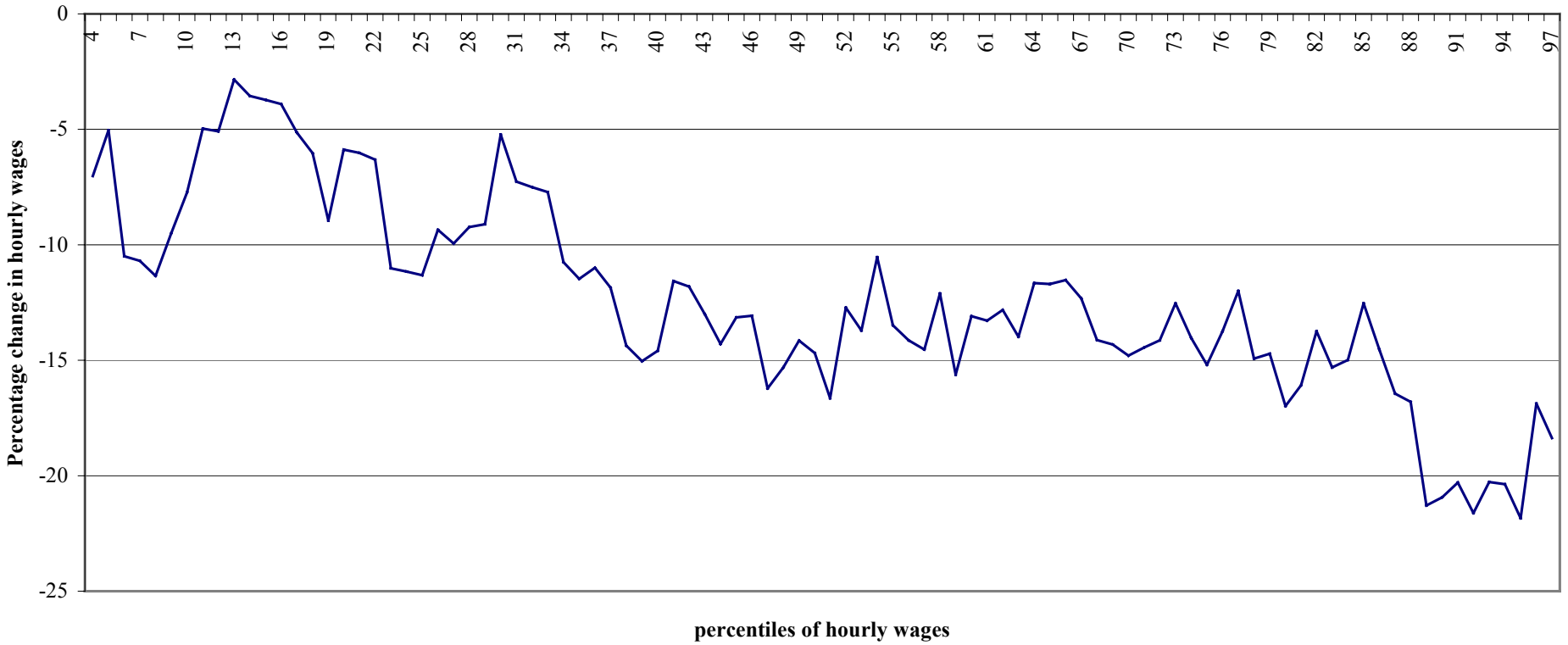

Figure 6

Percentage change in wages due to changes in location, part time and export import coefficients (Using 1984 data)

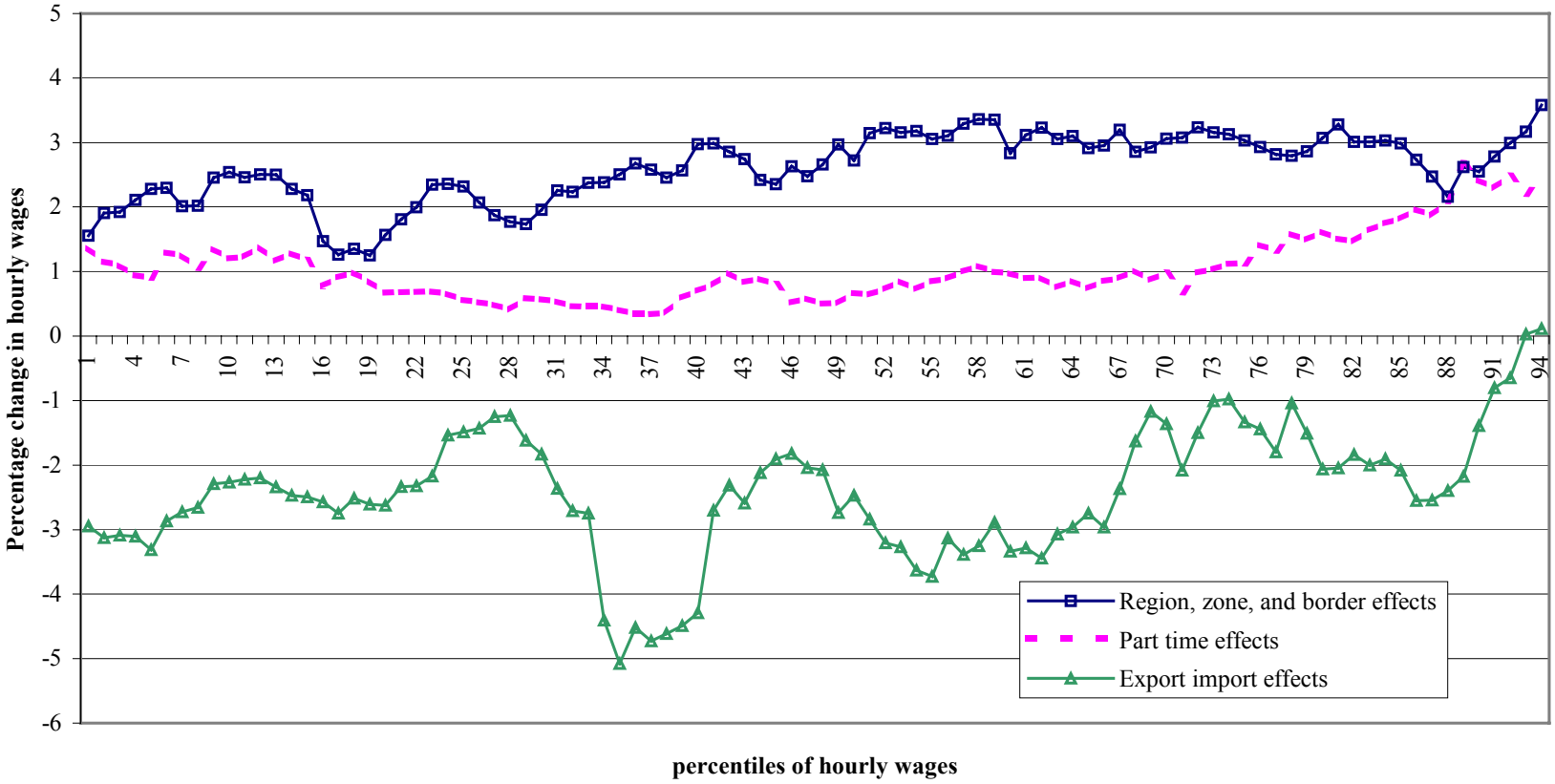

Figure 7
Percentage change in wages due to changes in the residual variance of the regression
(Using 1984 data)