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TOPIC 1: Trade, Growth, Inequality and Poverty

1.2 Trade and Wage Inequality

Aim

Examine the empirical relationship between trade openness and inequality and examine if the standard predictions of trade theory are supported by the empirical evidence.

Outline

1. Basic theoretical framework
2. Empirical evidence (East Asia compared to Latin America, Mexico)

Reading

*Agenor, P.-R. ,2004, pp. 555-563.

*Hanson, G..and A. Harrison , 1999, 'Trade Liberalization and Wage Inequality in Mexico', *Industrial & Labor Relations Review*, 52(2), pp. 271-288.

*Wood, A., 1999, Openness and Inequality in Developing Countries: The Latin American Challenge to East Asian Conventional Wisdom, *World Bank Economic Review*, Vol. 11(1), pp.33-57.

Arbache .S., Dickerson A. and F. Green ,2004,, Trade Liberalisation and Wages in Developing Countries, *Economic Journal*, 2004, 114 ,pp. F73-F9

Goldberg, N. and N. Pavcnik ,2007, Distributional Effects of Globalization in Developing Countries, *Journal of Economic Literature*, 45(1), pp. 39-82.

1. The Heckscher-Ohlin-Samuelson model (Wood 1999, Agenor 2004)

- The Heckscher-Ohlin trade theory predicts that trade openness in developing countries should reduce wage inequality.

  Because developing countries tend to be abundant in unskilled workers, openness should raise the relative demand for unskilled workers and lower the wage gap between skilled and unskilled workers.

- As we have already seen, the model predicts the patterns of trade across countries based on the countries' relative factor endowments.

Assume two countries, two goods and two factors of production.
Developed country (DC) is relative abundant in skilled labour and the developing country (LDC) is relative abundant in unskilled labour. Then, with free trade, country DC will export

the good which is skilled-labour intensive (say, skill-intensive machinery M) and country LDC exports the good which is unskilled-labour intensive (say, clothing C).

In autarky and because of its relative scarcity, unskilled labour is relatively more expensive than skilled labour in country DC and vice versa in country LDC. When trade opens, the international price lies in between the autarky price of each country and compared to autarky, DC produces more M relative to C than in autarky; LDC produces more C relative to M.

Hence:
unskilled wages relative to skilled wages in LDC increases
skilled wages relative to skilled wages in LDC increases
Therefore, free trade tends to equalise income distribution within each country.

Stolper-Samuelson Theorem (links good prices and factor prices): Assuming constant returns to scale, perfect factor mobility within the country and incomplete specialisation, a relative increase in the price of a commodity will increase the real return to the factor used intensively in that industry and reduce the real return to the other factor.

Factor price equalisation:
Under constant returns to scale production technology and in the absence of specialisation, free trade will bring about equalisation in the relative (e.g. wage unskilled/wage skilled) and absolute returns (real wages of skilled and unskilled workers) to homogenous factors across countries.

Free trade implies producers in the two countries face the same price for each of the two products. To this single price ratio corresponds the same unskilled/skilled wage ratio in both countries. Hence, relative factor prices are equalised.

Note: When DC increases the production of M, its relative demand for skilled labour increases so $(w_u/w_s)_{DC}\downarrow$. Similarly LDC increases the production C, its relative demand of labour increases so $(w_u/w_s)_{LDC}\uparrow$.

Equalisation of *absolute factor prices* mean that free trade also equalises the real wages of unskilled labour and the real wage of skilled labour in the two countries.

Since both countries have access to the same technology (by assumption), the prices and marginal products are the same in both countries then value marginal products must also be the same, hence wages will be equalised.

SS prediction: If there are barriers to trade, this will increase the domestic price of the protected good, the production of the protected good and hence, the real price of the factor used relatively intensive in the production of that good.

If barriers to trade (transport costs and tariffs etc.) exist, the price of clothing is lower in LDC than in DC and the price of machinery is lower in DC than in LDC. A reduction in barriers brings the prices to the free world market level and thus raises the price of clothing and lowers the price of machinery in the developing country.

LDC now produces more of C (exports some) and imports M. As the export sector expands, the demand for the abundant factor rises in each country. In turn the demand for the scarce factors falls, as these goods can now be imported more cheaply.

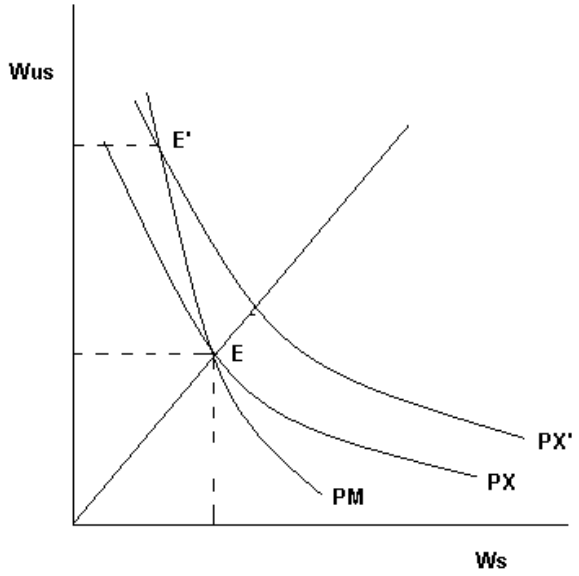
In developing countries, where generally unskilled labour is abundant – trade openness should raise the wages of unskilled workers and lower wages of skilled workers. Income inequality is predicted to fall!

Stolper-Samuelson
Assume an LDC produces an export good (X) which is more unskilled-labour intensive than importable good (M).

Iso-price curves PX and PM show combinations of wages consistent with zero profit. They are convex to the origin because the skilled to unskilled labour ratio in each sector is an increasing function of the unskilled to skilled wage ratio.

The intersection point of PX and PM is the Walrasian equilibrium (zero profit condition). This point E determines equilibrium wages – the LDC produces both goods.

Suppose export price increases, LDC starts trading. PX curve shifts outward by same amount as price change. But import price does not change – so PM curve does not move. New equilibrium E' where the increase in unskilled wages is larger than the increase in the price of the exportable. Wages of unskilled labour (Wus) have risen and wages of skilled labour (Ws) fallen.



The theory would also predict that a reduction in the price of a good due to a fall in tariff would lower the return to the factor used intensively in the production of the good. That is, if LDC has tariffs on M, then lowering tariffs will result in a decrease in skilled wages relative to unskilled wages in the M industry. In the DC, exporter of M, the effects would be opposite.

If DC has a tariff on C, a reduction in tariffs will reduce the domestic price of clothing and lead to a fall in the real wage of unskilled workers employed in the clothing industry relative to wages of skilled workers. In LDC, exporter of cloth, the effects would be opposite.

see Agenor p. 559

Wood (1999) explains the changes in wage inequality brought about by trade openness with the use of the diagram below:

- dd is the demand curve for unskilled labor with no trade. Wages are determined by the intersection with a supply curve (for simplicity completely inelastic). Position of the supply curve depends on relative abundance of skilled to unskilled workers. With an abundance of unskilled workers (*S*2), relative wage is low at w_0.

- With trade – the demand curve is DD. However, at point B, even an open county would not trade.

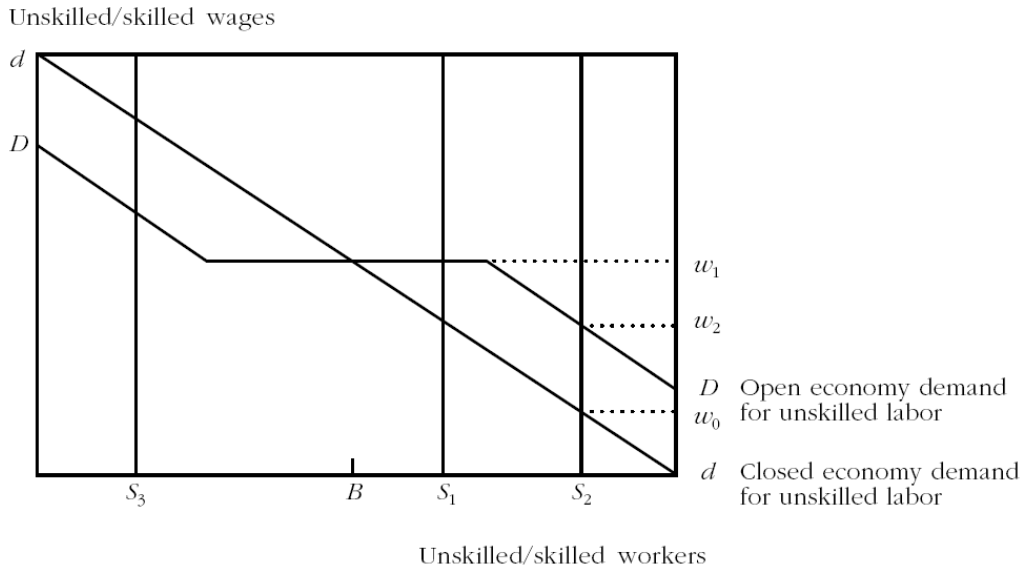
  LDC lies to the right of B and DC to the left.

  For LDC, opening to trade shifts demand curve in favour of unskilled labour – and with a supply ratio of S2, unskilled wages rise to w_2. The unskilled-skilled wage gap narrows.

The flat segment of the DD curve: range of skill supplies in which a trading economy would be diversified ((produces both goods, C and M but in different proprotions than in autarky). Eg. At S_1 for LDC.

With a high proportion of unskilled workers, as at S_2, LDC would specialise entirely in clothing.

Therefore, changes in supply of unskilled/skilled labour are met by changes in wages given that technology is assumed fixed in the H-O model.



Source: Wood (1999) - adapted from Leamer (1995).

2. Empirical Evidence

2.1. Latin America and East Asia

Wood (1999) compares the developments in wage distribution in Asian countries, which opened up in the 1960a and 1970s to developments in Latin American countries, which opened up in the 1980s and 1990s. He describes the evidence on wage inequality from two types of studies.

1) Factor content studies – earlier literature

- Calculate the amounts of skilled and unskilled labour used to produce exports. Compare these with the amounts of skilled and unskilled labour required to produce domestically the goods that the country imports. If the ratio of skilled to unskilled labour is lower for exports than for imports, then openness should lead to a rise in the relative demand for unskilled workers.
- Table 1 shows results from study by Krueger et al. (1981): Factor content of trade in broadly defined manufactures in developing countries in the early 1970s. The figures relate to the ratio of average skill intensity in exporting sectors to that in import-competing sectors. The ratio is always less than 1 - exporting sectors are less skill-intensive than import-competing sectors. Later studies had similar findings.
- The fact that exports of developing countries tend to be less skill-intensive than imports, was thought to imply that trade openness would benefit unskilled workers.

Table 1. *Skill Intensity of Trade in Manufactures in Selected Countries*

Country	Year	Ratio of average skill intensity of exporting sectors to that of import-competing sectors: Numbers measure[a]	Ratio of average skill intensity of exporting sectors to that of import-competing sectors: Wages measure[b]
Brazil	1971–72	—	0.92[c]
Chile[d]	1966–68	—	0.26[e]
Colombia	1973	0.53[c]	0.60[f]
Côte d'Ivoire[d]	1972	0.62[c]	—
Hong Kong[d]	1973	0.51[c]	—
Indonesia	1971	0.55[c]	0.45[e]
Tunisia	1972	Less than 1[c]	0.65[c]
Uruguay	1968	0.49[f]	—
Unweighted average		0.54	0.58

— Not available.

a. Based on the ratio of skilled to unskilled employment. Skilled workers are white-collar, unskilled blue-collar, except in Hong Kong (where skilled workers are defined as professional) and Côte d'Ivoire and Tunisia (where some blue-collar workers are in the skilled category). For Tunisia, the source does not give the precise number of skilled workers.

b. Based on the average wage per worker; the precise nature of the calculation varies among the country studies.

c. Trade with all partners.

d. Includes home (nontraded) goods' indirect labor use.

e. Trade with industrial countries only.

f. Exports to industrial countries only, imports from all partners.

Source: Krueger and others (1981), Krueger (1983); for further details, see Wood (1994: table 3.2).

Source: Wood (1999)

2) "Time series" studies

- Problems with examining changes in skill wage gaps over time:

- The white-collar and blue-collar division is inaccurate - the skill composition within groups changes over time.
- Examining wages by level of education better – may not always be available.
- Problems with measuring openness (information on tariffs and non-tariff barriers is often inadequate).
- Also need to control for domestic determinants of wage changes (institutions and wage flexibility, relative supply of skilled and unskilled labour).

- Need to control for changes in the relative supply to isolate the effects of openness on wages. Note in the diagram above, the impact on wages depends on (relative) demand and (relative) supply for labour. A change in wages will not measure the impact of increased openness if it coincides with a shift in (relative) labour supply

Types of tests performed to isolate the effects of supply shifts (Robbins, 1995):

- Inner test: If relative employment move opposite to relative wages, then (relative labour) supply shifts dominate; but if it is the same direction, then (relative labour) demand shifts dominate.
- Estimate time series of implied shifts in the relative demand for skilled and unskilled labour

$$\ln\left(\frac{d_{sl}}{d_{ul}}\right) = \sigma \ln\left(\frac{w_{sl}}{w_{ul}}\right) + \ln\left(\frac{s_{sl}}{s_{ul}}\right)$$

where d is demand, s is supply and σ is the elasticity of the relative demand curve. This is an identity but it can be used to estimate if assumptions are made about σ but it becomes complicated if σ might change as a result of more trade openness.

East Asia

- The time-series evidence from this region relates mainly to Hong Kong, the Republic of Korea, Singapore, and Taiwan.
- Generally confirms that openness raises relative demand for unskilled workers.
- However, according to Wood evidence is not so clear-cut due to data deficiencies and little control of internal influences on the movement of relative wages.
- According to studies, in three of the four countries, the wage gap narrowed during the decade examined - the 1960s in Korea and Taiwan, the 1970s in Singapore.
- Might also be explained by rise in post-basic education.
- After the initial period of export-oriented industrialisation, expansion of higher education further reduced wage gap.
- Less evidence for other countries in East Asia. E.g. persistence decline in wage differentials in Malaysia 1973-89 particularly between university educated and less-educated workers. Skilled and semiskilled blue collar workers gaining relative to other groups. This is explained by labour supply side shifts dominating labour demand shifts (increase in number of highly educated workers and discrimination against Malays) but also to labour demand shifts in favour of less skilled workers (expansion of export-oriented labour intensive activities in manufactures and textiles).

Latin America

- Evidence is conflicting. It suggests that when openness increased, skill wage gap widened. Happened from the mid-1970s to mid 1980s in Argentina and Chile, between the mid-1980s and the mid-1990s in Colombia, Costa Rica, and Uruguay and from mid 1980s in Mexico.
- In almost all cases – a rise in relative the demand for skilled workers.
- In some cases, liberalisation of labour market institutions might explain the widening of the skill wage gap. Although some studies have found no correlation between changes in wages and changes in minimum wages, the decrease in trade union power (labour market under military rule) has widened the wage gap (e.g. Argentina, Chile)
- In some countries and periods, increased openness has reduced the skill wage gap; but in others were the wage gap has increased (see table below) the relative demand for skilled workers has increased.
- The evidence for Latin America in the 1980s and 1990s (widened skill wage gap) contradicts the evidence for East Asia in the 1960s and 1970s (narrowed wage skill gap)

Table 3. *Effects of Increased Openness in Five Latin American Countries*

Country and years	*Changes in trade regime*	*Skill differentials in wages*	*Predominant influence (inner product test)*	*Relative demand for skill (time series)*
Argentina (Buenos Aires)				
1976–82	Barrier reduction with appreciation	Widened	Demand	Rising
1989–93	Barrier reduction with appreciation	Narrowed	Supply	Falling
Chile (Santiago)				
1974–79	Barrier reduction with devaluation	Widened	Demand	Rising
1984–92	Devaluation	Fluctuated	Demand	Rising
Colombia (seven cities) 1985–94	Devaluation to 1989, barrier reduction in 1990–92	Widened	Demand	Rising
Costa Rica 1985–93	Barrier reduction and devaluation	Widened	Supply, except in 1988–90	Rising
Uruguay (Montevideo) 1990–95	Barrier reduction	Widened	Demand	Rising

Source: For Argentina, Robbins, Gonzales, and Menendez (1995); for Chile, Robbins (1995a); for Colombia, Robbins (1996a); for Costa Rica, Robbins and Gindling (1997); for Uruguay and various other countries, Robbins (1995b, 1996b).

Source: Wood (1999)

What could explain the differences between East Asia and Latin America?

- **Country-specific?**

According to Wood:

- Faster growth in labour supply of skilled labour in East Asia compared to Latin America; more regulated labour markets in Latin America than in Asia.
- Natural Resource Endowments:
- Latin America is better endowed with natural resources than East Asia. If Latin America has a comparative advantage in primary products (including processed products), perhaps skilled and natural resources are complementary inputs. But, this is only the case on mining and oil (small share of total employment and requires a highly skilled force) but

not on primary products like agriculture (large number of workers with low skilled/unskilled ratio).

- Differences in trade policy instruments:

  In East Asia – export promotion involved increasing incentives for exporters, but still fairly high levels of protection against imports in most sectors.

  In Latin America opening to trade involved mainly large reductions in barriers to imports.

Wood, however thinks that other factors provide more plausible explanations that the two above and focuses on changes that occurred at the world-wide level.

- **World changed?**

1) Entry of Large Low-Income Exporters in world markets in the 1980s

- Half the world's population lives in five low-income Asian countries: Bangladesh, China, India, Indonesia, and Pakistan.
- In the 1960s and 1970s, these countries had highly protective trade regimes.
- But, by mid-1980s they started opening up and manufactured exports grew rapidly.
- This means that comparative advantage of middle-income countries may have changed – their skilled-to-unskilled worker ratio is above the average of low-income countries, but below the developed country average.
- The comparative advantage of middle-income countries may have shifted to goods which require **intermediate skills.**
- Therefore, in Middle-income countries like the Latin American countries, greater openness may have led to a contraction of high-skill intensity sectors (replaced by imports from developed countries) and also of low-skill intensity sectors (replaced by imports from low-income countries).
- It is possible that the gap between skilled and unskilled wages rose.
- An increase in the relative world supply of unskilled labour lowers the relative world market price of unskilled-labour-intensive goods.
- The rise in exports from low-income Asian countries could explain widening skill wage gap in Latin America.
- Figure 5 below shows that the world price of unskilled-labor-intensive goods fell relative to that of more skill-intensive goods. This coincides with the expansion of exports in low-income countries.
- Also anecdotal evidence that Latin American labour-intensive manufacturing sector struggled with competition from Asian imports in both domestic and foreign markets.
- Open middle-income countries producing both unskilled-labour-intensive and skill-intensive goods should have experienced a rise in wage gap.
- One way to test if the wage gap widened in Latin American countries that opened up to trade due to expansion of exports from low-income Asia, is to analyses if skill wage gaps also widened in other, already open, middle-income countries during the same time period.
- Time series studies show mixed results: In Hong Kong, wage gap grew in 1980s, in Taiwan and Singapore, grew in early 1980s but shrank in late 1980s, in Korea and Malaysia, shrank throughout 1980s, in Chile, fluctuated.
- Further research required on the hypothesis of entry of low-income Asian countries. Larger sample of countries and also examine what happened to wage gaps in opening low-income countries.

Figure 5. *Price of Developing-Country Manufactured Exports, Relative to Developed-Country Exports of Machinery, Transport Equipment, and Services, 1975–95*
(index: 1980 = 100)

Note: Manufactured export prices are unit value indexes from U.N. trade data. Service price index refers to the United Kingdom only and has a weight of 0.27 in the combined developed-country index.
Source: Update of Minford, Riley, and Nowell (1995: figure 6).

Source: Wood (1999)

2) Skill-Biased Technical Progress

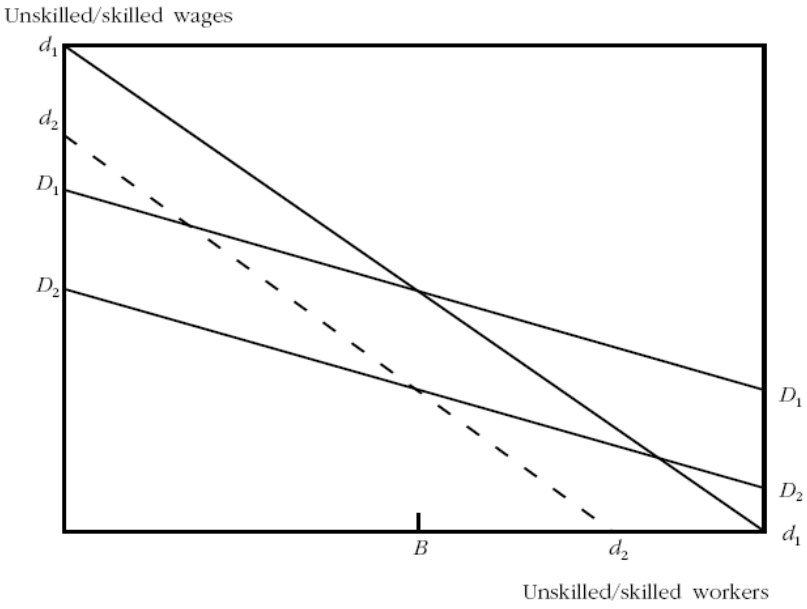
- Another potential reason for why the effects of trade on wage inequality were different in 1980s and 1990s from those of 1960s and 1970s is technological progress.
- World technology may have changed so that relative demand for skilled labour rose.
- Robbins calls this phenomenon "skill-enhancing trade."
- Trade openness changes both
    - Sectoral composition of production (H-O theory) and
    - Production technology available - increased imports of advanced capital goods, learning from foreign buyers etc.
- The adoption of new production technology or meeting the needs of customers may require more skilled workers and could raise the demand for skilled workers.
- Net impact depends on size of the two effects and the difference between domestic and world technology.
- However, the net effect on wages can contradict the implications of the H-O model, which assumes that all countries always have access to the same technology and no technology reversals.

- Figure below shows the skilled enhancing trade effect:
    - Demand curves: d1d1 and D1D1 - use of 1960s technology, d2d2 and D2D2 – use of 1980s technology.
    - Assume technology has changed so that a lower ratio of unskilled to skilled labour is required
    - New technology available only to open economies.
    - Trade openness will lead to different effect on wage gap in 1980s than in 1960s. In 1980s, openness still reduces wage gap, but technology effect dominates

- Therefore, it may be that technical progress in 1980s and 1990s became biased towards skilled workers.

Again, further research required to assess whether open-economy demand curve has shifted down over time – would support both technological bias and the entry of low-income Asian countries hypotheses -and which hypothesis is closer to truth

Figure 6. *Effects of Openness and Technology Transfer*



Note: d_1d_1 and d_2d_2 are the closed economy demand curves for unskilled labor based on 1960s and 1980s technology, respectively. D_1D_1 and D_2D_2 are the open economy demand curves for unskilled labor based on 1960s and 1980s technology, respectively.

Source: Wood (1999)

More on technological progress:

Arbache et al. (2004) show evidence for Brazil, which supports the technological progress argument i.e. trade liberalisation increases competition and technical innovation that is complementary to skilled labour.

- They use household survey data for Brazil for 1981-1999 and examine hourly wages of employed individuals between 18-65 years old.
- Their education variable is given by the number of years of completed education and they classify workers into 6 categories:
    - Level 1: Basically illiterate (less than one year of study);
    - Level 2:Some elementary education;
    - Level 3:Completed elementary, no or some primary;
    - Level 4:Completed primary, no or some secondary;
    - Level 5:Completed secondary, no or some college;
    - Level 6: Completed college education.

- They regress log real wages on a number of personal characteristics, and indicators of broad industrial sector of worker and trade liberalisation (Mincer earning function).
- Use both: a postliberalisation dummy, which takes a value of 1 for the period after liberalisation (1992) and zero otherwise (table 3a) and examination of wage structure before and after trade liberalisation (table 3b).

Main findings:

- Table 3a: Similar regression as 3b except that it includes: traded, interactions (traded x post liberalisation) and (nontraded x post liberalisation). Wages in the traded sector fell after liberalisation, which is consistent with increased degree of competition in traded industries and fall in rents. Wages also fell in the non-traded sector (but less) – either spill-over effect or effects of other changes such as privatisation or deregulation. However, because education levels rose, the average economy-wide wage changed little over the period examined.
- Table 3b: Who are the winners and losers after the trade reform accoding to education levels? Trade liberalisation had different effects depending on level of education and sector.
    - Returns to education compared to level 1 are lower in the post lib period. This is consitent with an increase in the supply of more educated workers.
    - The ***marginal return*** to education (comparison of each education level with the previous education level) were lower in post-liberalisation than the pre-liberalisation period, with the exception of college-educated workers once the number of years it takes to gain each qualification is taken into account. This is consistent with trade the trade skill enhancing hypothesis.
    - The return to education is larger in the traded than in the non trade sector before and after liberalization.
- Table 4: Improve the measure of the timing of liberalisation:
  $Open_{jt} = \exp(-e_{jt})$ where j refers to industry, t to time and e to the effective rate of protection. Hence, smaller open, larger tariffs. Analysis then is restricted to the traded sector
    - Trade reform was associated with lower wages except for the two highest education levels.
- The authors conclude that their findings support the hypothesis the technological progress associated with trade reform (channeled mainly via capital imports and FDI) was skill-biased, which would in turn explain why wage gap between unskilled and skilled workers did not fall as predicted by H-O model.

Table 3(*b*)

Trade Liberalisation and the Returns to Education: 1981–99

	(1)		(2)			
			Non-traded		Traded	
	Pre-lib.	Post-lib	Pre-lib.	Post-lib	Pre-lib.	Post-lib
Age	0.086 (0.000)		0.084 (0.000)			
$Age^2 \times 10^{-3}$	−0.875 (0.004)		−0.862 (0.004)			
Female	−0.450 (0.001)		−0.470 (0.001)			
Work card	0.173 (0.001)		0.166 (0.001)			
Illiterate	–	−0.046 (0.003)	–	0.054 (0.004)	−0.225 (0.003)	−0.392 (0.004)
Some Elementary education	0.362 (0.002)	0.287 (0.003)	0.295 (0.003)	0.281 (0.004)	0.160 (0.003)	−0.025 (0.004)
Completed Elementary education	0.715 (0.002)	0.623 (0.002)	0.588 (0.003)	0.538 (0.003)	0.592 (0.003)	0.408 (0.004)
Completed Primary education	1.105 (0.003)	0.962 (0.003)	0.971 (0.003)	0.848 (0.004)	1.009 (0.005)	0.802 (0.005)
Completed Secondary education	1.624 (0.002)	1.429 (0.003)	1.497 (0.003)	1.318 (0.003)	1.529 (0.005)	1.249 (0.005)
Completed College education	2.419 (0.003)	2.291 (0.004)	2.285 (0.004)	2.173 (0.004)	2.373 (0.008)	2.134 (0.010)
constant	−2.086 (0.005)		−1.931 (0.006)			
N	2,095,639		2,095,639			
R^2	0.45		0.46			

Notes: Heteroscedastic-consistent standard errors in parentheses.
All coefficients are significant at the 1% level.

Table 4

Openness, Wages and the Returns to Education in the Traded Sector: 1987–98

	(1)	(2)	(3)	(4)
Open	−0.047 (0.091)‡	−0.238 (0.086)	−0.238 (0.087)	
Experience		0.048 (0.001)		
Experience$^2 \times 10^{-3}$		−0.549 (0.019)		
Age			0.064 (0.003)	0.064 (0.003)
Age$^2 \times 10^{-3}$			−0.617 (0.037)	−0.614 (0.037)
Female		−0.391 (0.015)	−0.398 (0.015)	−0.398 (0.015)
Work card		0.202 (0.015)	0.195 (0.015)	0.195 (0.015)
Some Elementary education		0.335 (0.008)	0.322 (0.007)	0.347 (0.033)
Completed Elementary education		0.688 (0.011)	0.629 (0.009)	0.610 (0.052)
Completed Primary education		1.074 (0.020)	0.916 (0.015)	0.805 (0.054)
Completed Secondary education		1.597 (0.026)	1.361 (0.021)	1.228 (0.062)
Completed College education		2.525 (0.030)	2.223 (0.027)	2.100 (0.063)
Illiterate × open				−0.282 (0.113)†
Some Elementary education × open				−0.315 (0.098)
Completed Elementary education × open				−0.260 (0.074)
Completed Primary education × open				−0.133 (0.071)*
Completed Secondary education × open				−0.100 (0.083)‡
Completed College education × open				−0.115 (0.103)‡
Constant	−0.221 (0.089)†	−1.230 (0.082)	−1.816 (0.109)	−1.773 (0.125)
N	337,268	337,268	337,268	337,268
R^2	0.22	0.45	0.44	0.44

Notes: Robust standard errors in parentheses are corrected for potential inter-industry/year group correlation. Industry dummies are also included.
All coefficients are significant at the 1% level unless otherwise indicated: *significant at 10%; †significant at 5%; ‡insignificantly different from zero at conventional levels.

2.2. Hanson and Harrison (1999): the case of Mexico

- In 1985, Mexico joined GATT and reduced trade barriers substantially.
- The liberalisation was matched with a dramatic increase in skilled-unskilled wage gap.
- The wages of more-educated, more-experienced workers rose relative to those of less-educated, less-experienced workers.
- Hanson and Harrison have data on 2,354 Mexican manufacturing plants for 1984-90 and Mexican Industrial Census data 1965-88. They examine if the rise in the skill wage gap could be explained by: 1) Mexico in fact was abundant in skilled and not unskilled labour, at least in comparison with China (the low-income Asian entry hypothesis). 2) During the import substitution period, industries which were relatively unskilled-labour-intensive received preferential protection and the effect of trade openness would have fallen disproportionately on these sectors.
  Harrison and Hanson conclude that: The increase in the skilled-unskilled wage gap in Mexico can not be attributed to changes in relative employment. Explanation lies on the high trade protection of low-skilled industries, trade barriers were lowered in those sectors so low skilled workers were affected more disproportionately. The exposure of Mexico to competition form China and other countries abundant in unskilled labour also contributed to increase the skilled-unskilled wage gap.
- Related literature on Mexican labour markets:
  - Feliciano (1993) and Cragg and Epelbaum (1996) find with household data that the return to schooling increased during the 1980s.

- Revenga (1997) finds using plant-level data that blue-collar wages and employment were more affected by trade reforms than white-collar wages and employment, possibly since the former were concentrated in industries with largest drops in trade barriers.
- It is also possible that foreign investment contributed to rising wage inequality. See e.g. Feenstra and Hanson (1995) – FDI changes structure of production and increases the stock of capital in developing countries.
- Also it is possible that changes in minimum wages affected employment. Bell (1997) however found that despite the substantial fall in real minimum wage during 1984-90, labour demand in manufacturing sector was not affected perhaps because the minimum wage was not binding.

- **Data**
  - Data on 2354 manufacturing plants for 1984-90 (Secretariat of Trade and Industrial Promotion)
  - Only includes medium-sized and large plants – the only available plant-level data source at the time.
  - So, also use other data source: manufacturing establishments from the Mexico Industrial Census – includes data on employment, number of establishments, and total pay-roll by state and two-digit (ISIC) manufacturing industry for 1965-88, at approx. 5-year intervals.
  - Workers in two categories: blue-collar (unskilled) and white-collar workers (skilled).
  - Earnings = average annual salary or average hourly wage for each type of worker in a given plant.
  - Substantial wage differences exist between the two groups.

- **Trade liberalisation**
  - See table below – tariffs lowered, coverage of import licenses fell, export controls removed and exchange rate devalued.
  - In 1984, average tariff ranged from 13.6% in basic metals to 47.3% in wood products and import licenses were required for over 85% of products in all two-digit industries.
  - By 1990, maximum tariff rate in was 18.4% for "other industries". Barriers to FDI were also removed.
  - Privatisation of state-owned enterprises also took place. To distinguish between trade reform and privatisation reform, authors estimated effects without basic industries (iron and steel) and petroleum products which were subject to state ownership.

Table 1. Average Tariffs and Import-License Requirements by Two-Digit Industry, 1984–90 (Percent).

Industry		*1984*	*1985*	*1986*	*1987*	*1988*	*1989*	*1990*
31—Food Products	t	42.9	45.4	32.1	22.9	14.8	15.8	16.2
	q	100.0	80.1	62.2	33.3	20.8	20.6	16.8
32—Textiles, Apparel	t	38.6	43.2	40.4	26.6	16.8	16.6	16.7
	q	92.9	66.8	38.0	31.1	2.8	1.1	1.0
33—Wood Products	t	47.3	48.5	44.9	29.9	17.7	17.6	17.8
	q	100.0	75.6	25.7	0.0	0.0	0.0	0.0
34—Paper, Printing	t	33.7	36.5	34.8	23.7	7.7	10.1	9.9
	q	96.7	54.1	11.2	9.5	3.4	4.1	0.0
35—Chemicals	t	29.1	29.9	27.0	20.5	13.4	14.3	14.4
	q	85.7	54.0	21.1	4.8	0.0	0.0	0.0
36—Stone, Clay, Glass	t	37.1	38.5	33.8	22.4	13.8	14.3	14.3
	q	99.0	53.1	5.2	0.0	0.0	0.0	0.0
37—Basic Metals	t	13.6	16.7	18.4	13.8	7.9	11.0	11.0
	q	93.3	47.4	0.0	0.0	0.0	0.0	0.0
38—Metal Products	t	43.1	46.3	30.0	20.8	14.1	15.9	16.1
	q	90.7	74.8	54.7	51.4	42.7	44.1	44.1
39—Other Industries	t	40.9	42.9	40.5	27.5	17.1	18.1	18.4
	q	100.0	50.0	0.0	0.0	0.0	0.0	0.0

Notes: t = Production-weighted average tariff rate; q = weighted-average share of production subject to import-license requirements.
Source: Authors' calculations, SECOFI sample data.

• Wages and Employment

- Increase in white-collar-blue-collar wage inequality among manufacturing workers since 1984
- This is explained by a rise in real-wage increases for white-collar workers and-real-wage decreases for blue-collar workers:
  Between 1984 and 1990, average real hourly wages for white-collar workers increased by 13.4%, while those for blue-collar workers fell by 14%.
  Note these are averages - do not control for changes in composition of labour force in manufacturing or for changes in distribution of skill.
- Consistent with previous evidence for Mexico and contradicts H-O theory .

Table 2. Average Annual Real Wages in Manufacturing, 1984–1990. (Values in 1980 Pesos)

	White-Collar		*Blue-Collar*		*White-Collar/Blue-Collar*	
Year	*Annual Earnings*	*Hourly Wages*	*Annual Earnings*	*Hourly Wages*	*Annual Earnings*	*Hourly Wages*
1984	138,793	62.127	72,528	32.191	1.914	1.930
1985	143,692	63.856	74,952	32.783	1.917	1.948
1986	137,444	60.641	68,525	29.929	2.006	2.027
1987	134,474	59.014	67,559	29.243	1.991	2.018
1988	122,241	53.557	57,781	24.729	2.116	2.166
1989	145,487	64.278	62,755	26.809	2.318	2.398
1990	160,502	70.460	64,935	27.691	2.472	2.545

Source: Authors' calculations based on SECOFI sample data.

⇒ ***Did the composition of Mexican work-force change? Did the relative demand for skilled labour rise?***

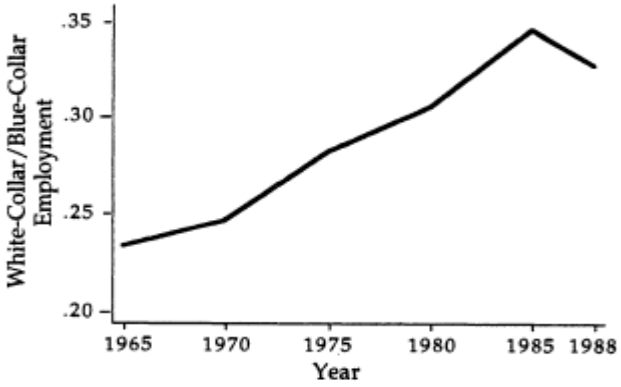
Table 3. Relative Employment, All Manufacturing, 1984–1990.

	Number of Workers			*Thousands of Hours Worked*		
Year	*White-Collar*	*Blue-Collar*	*Ratio*	*White-Collar*	*Blue-Collar*	*Ratio*
1984	234,851	545,477	0.431	524,666	1,229,016	0.427
1985	239,847	560,738	0.428	539,713	1,282,056	0.421
1986	242,189	550,963	0.440	548,925	1,261,465	0.435
1987	241,528	545,937	0.442	550,368	1,261,272	0.436
1988	243,741	549,839	0.443	556,327	1,284,741	0.433
1989	248,840	566,737	0.439	563,229	1,326,644	0.425
1990	250,066	577,405	0.433	569,629	1,353,991	0.421
Log Change, 1984–90	0.063	0.057		0.082	0.097	

Source: Authors' calculations based on SECOFI sample data.

- Little evidence of this in Table above.
- Data from the Industrial Census shows that ratio of white-collar employment to blue-collar employment fell from 0.346 in 1985 to 0.328 in 1988. Also in 7 out of 9 2-digit industries, relative white-collar employment fell.
- Did skilled labour move to other sectors or out of the country? This might explain both fall in the share of skilled employment and increase in the skilled wage. But there is no evidence that composition of Mexican emigrants changed over the 1980s. (see e.g. Borjas (1994))
- Also little evidence that skilled workers moved out of manufacturing.
- So, skill wage gap widened, but little change in the relative employment of skilled labour.

Figure 2. Ratio of White-Collar to Blue-Collar Employment in Mexico, 1965–1988.



Source: Industrial Census.

- **The H-O-S model: Prices, industry composition and wages**

⇒ ***Are relative price changes associated observed relative-wage changes (i.e relative skill intensities)? Did relative price of skill-intensive goods rise after liberalisation?***

Table 4. Relative Price Changes and Skill Intensity. (Dependent Variable: Change in Log Price, 1984–1990)

Prices	*Log Ratio of White-Collar Employment to Blue-Collar Employment*	*N*	*R-Square*
All Sectors			
Gross-Output Prices	0.039 (0.76)	125	0.006
Value-Added Prices	–0.003 (–0.02)	125	0.000
Excluding Petroleum Products, Iron, and Steel			
Gross-Output Prices	–0.011 (–0.25)	119	0.001
Value-Added Prices	–0.129 (–0.99)	119	0.010

Notes: Observations are all four-digit Mexican manufacturing industries in the SECOFI sample. All regressions are weighted by the average industry share of total manufacturing output in 1984 and 1990. T-statistics, based on heteroskedasticity-consistent standard errors, are reported in parentheses. Log relative white-collar employment is the average for 1984 and 1990. Coefficient estimates for constant terms are not shown.

- Measure of skill-intensity: log ratio of white collar to blue-collar employment.
- Employment: Average annual number of workers by skill type.
- Two prices: gross output prices, and value-added prices (by industry).
- Weight all regressions by industry share of total manufacturing output
- No significant correlation between price changes and relative white-collar employment. But: a) changes in product prices may not just reflect trade reform, they might also reflect e.g. privatisation, deregulations; b) firms may alter mix of goods produced after trade reform so price changes might not only be reflecting "pure" price changes but also compositional effects.
- Alternative output price measure of changes in trade policy: tariffs. This works if Mexico is a small country. The idea is to examine if the pattern of tariffs and import licences varied across industries according to the skill intensity of the product.

Table 5. Trade Protection and Skill Intensity.

Trade Law	*Log Ratio of White-Collar to Blue-Collar Employment*	
	All Industries	*Excluding Petroleum Products, Iron, and Steel*
Tariff 1984	–0.136	–0.184**
Import License 1984	–0.006	–0.003
Tariff Change, 1984–90	0.150*	0.195**
Import License Change, 1984–90	–0.076	–0.087

Notes: The table shows raw correlations of the log ratio of white-collar to blue-collar employment averaged in 1984 and 1990, the average industry tariff in 1984, the average industry import-license coverage rate in 1984, the change in industry tariff from 1984 to 1990, and the change in industry import-license coverage rate from 1984 to 1990. Observations are for either the 125 four-digit Mexican manufacturing industries or the 119 industries excluding petroleum products, iron, and steel. Correlations are weighted by the average industry share of total manufacturing output in 1984 and 1990.

*Statistically significant at the .10 level; **at the .05 level.

- **Table 5:** correlations of industry tariffs (1984) and import-license coverage rates (1984), changes in these variables during 1984-90, and the log ratio of white-collar to blue-collar employment for four-digit manufacturing industries.
- Tariffs in 1984 (prior to reform) were lower in skill-intensive industries than in non-skill-intensive industries.
- White-collar to blue-collar employment ratio correlates negatively with 1984 tariffs.
- Tariff reductions were smaller in skill-intensive industries.
- So, **skill-intensive sectors were less protected and faced smaller tariff reductions**.
  Why protect low-skilled industries given that Mexico has comparative advantage in these industries? Puzzle.
  Similar evidence for Morocco (Currie and Harrison, 1997).
  Revenga (1994, 1995) finds that export-intensive sectors were more protected in Mexico.
- Tariffs fell less in skill-intensive industries. Interpreted within the Stolper-Samuelson framework, the wage of skilled workers relative to unskilled workers should have risen. That is, changes in trade policy are consistent with Stolper-Samuelson effect.

Are changes in product prices and trade policy correlated and consistent with Stolper Samuelson effects?

Table 6. Relative Price Changes and Trade Policy.
(Dependent Variable: Change in Log Prices, 1984–90)

Independent Variable	*All Industries*				*Excluding Petroleum Products, Iron, and Steel*			
	Dependent Variable: Gross-Output Prices (mean = 2.85)		*Dependent Variable: Value-Added Prices (mean = 2.69)*		*Dependent Variable: Gross-Output Prices (mean = 2.85)*		*Dependent Variable: Value-Added Prices (mean = 2.70)*	
Tariffs	–0.030	—	–0.085	—	–0.030	—	–0.085	—
	(–2.90)		(–2.40)		(–3.14)		(–2.46)	
Import Licenses	–0.010	—	–0.032	—	–0.009	—	–0.030	—
	(–2.27)		(–2.25)		(–2.27)		(–2.22)	
Tariffs*Licenses	0.0003	—	0.001	—	0.0003	—	0.001	—
	(2.86)		(2.46)		(3.10)		(2.51)	
Complete License Coverage	0.043	—	0.080	—	–0.042	—	–0.066	—
	(0.48)		(0.36)		(–0.58)		(–0.32)	
Change in Tariffs	—	0.009	—	0.021	—	0.009	—	0.021
		(1.58)		(1.34)		(1.65)		(1.39)
Change in Licenses	—	0.002	—	0.006	—	0.002	—	0.006
		(1.48)		(1.09)		(1.77)		(1.17)
Change in Tariffs* Licenses	—	0.0001	—	0.0002	—	–0.0001	—	–0.0002
		(–1.56)		(–1.53)		(–1.61)		(–1.52)
Eliminated Licenses	—	0.157	—	0.581	—	0.165	—	0.598
		(2.89)		(1.79)		(2.94)		(1.85)
Net Impact of Policy:								
Tariffs	–0.002	0.017	0.009	0.037	–0.002	0.017	0.008	0.037
Licenses	0.001	0.004	0.004	0.010	0.003	0.004	0.009	0.011
N	125	125	125	125	119	119	119	119
R^2	0.040	0.047	0.050	0.085	0.090	0.075	0.069	0.101

Notes: Observations are four-digit Mexican manufacturing industries. All regressions are weighted by the average industry share of total manufacturing output in 1984 and 1990. T-statistics, based on heteroskedasticity-consistent standard errors, are reported in parentheses. See text for description of tariffs and import-license coverage rates. Complete License Coverage is a dummy variable equal to one if 100% of goods in the industry were subject to import-license requirements in 1984. Eliminated Licenses is a dummy variable equal to one if the industry eliminated all import-license requirements between 1984 and 1990. The Net Impact of Policy is calculated at mean values for tariffs and import-license coverage rates, whether in levels or changes. Coefficient estimates for constant terms are not shown.

⇒ Correlations between price changes , trade policy and trade policy changes

- **Table 6** : Correlations between product price changes and commercial policy
- Interaction term between tariffs and import-license coverage rates.

The net impact for gross-output prices:

- Impact of initial tariffs on price changes is negative, suggesting that prices fell more in sectors with higher initial tariffs. With value-added prices, the effect is opposite.
- Price changes are larger in industries with higher initial tariffs.
- For import controls - net impact of initial import licenses on both price changes is positive. Relative price changes were higher in sectors with higher initial license coverage.
- Initial levels of trade protection cannot predict much of magnitude of price changes
- Correlation between price changes and changes in protection - in all regressions, price changes are positively correlated with changes in tariffs and changes in import-license coverage rates, but negatively correlated with the interaction between tariffs and import licenses.

- In all regressions, the net impact of either the change in tariffs or the change in import licenses on price changes is positive – so weak evidence that **relative prices** increased in sectors with smallest reductions in trade protection. But, effect not always statistically significant.
- So, relative price increases were possibly larger in industries with smaller reductions in trade barriers and that skill-intensive sectors had smallest reductions in tariffs.
- If relative price of skill-intensive goods rose, could expect labour to reallocate to such sectors. But, in reality little reallocation across industries.

⇒ Are industries with highest employment growth relatively skill-intensive?

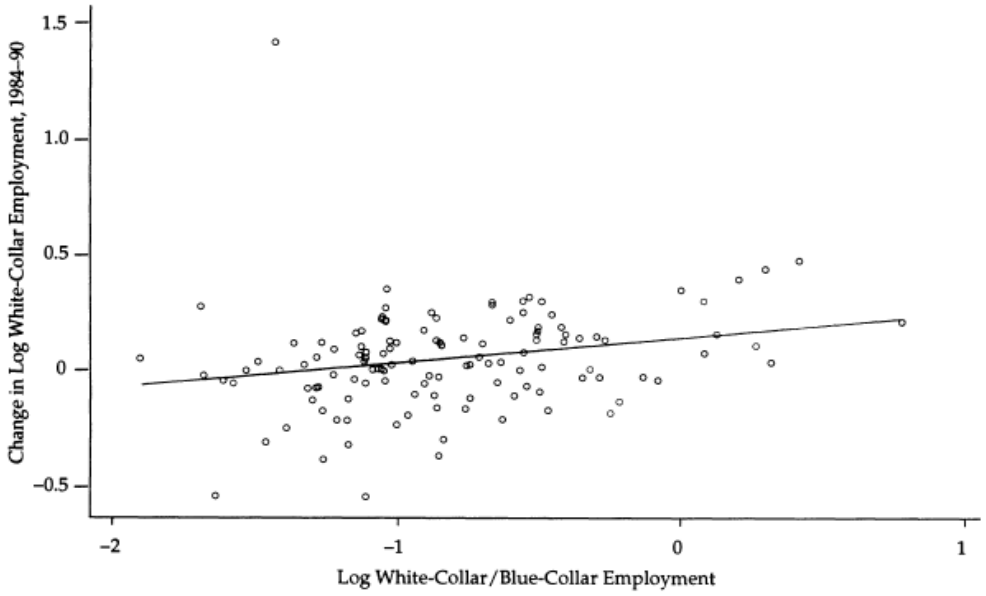
- Figure 3: change in log employment of white-collar workers between 1984 and 1990 against average log ratio of white-collar to blue-collar employment in 1984 and 1990 by four-digit industry.

- Relationship is positive and statistically significant – employment growth was higher in skill-intensive sectors.

- Figure 4 shows that there is also a positive correlation between blue-collar employment growth and skill intensity.

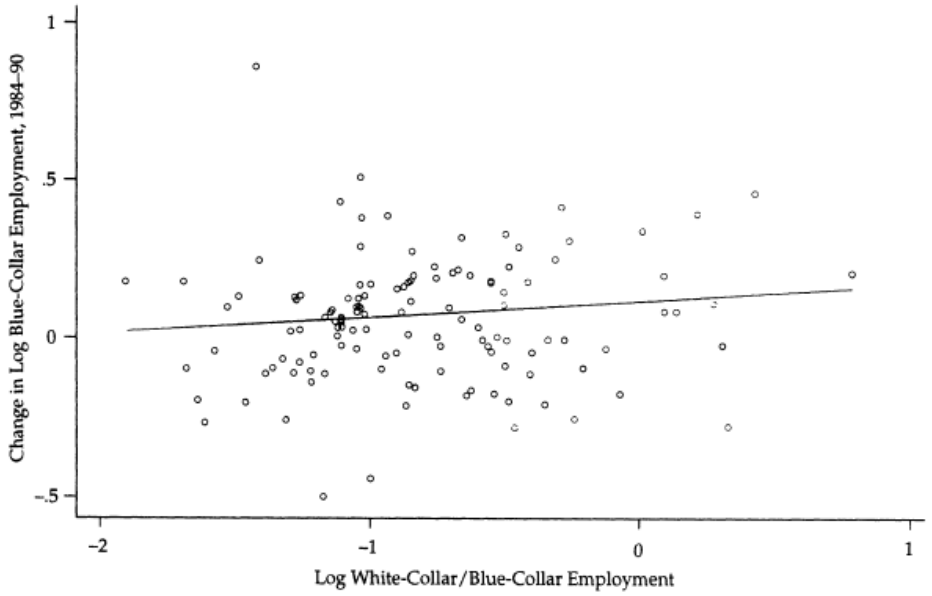
- Therefore, in general - employment growth was relatively high in skill-intensive sectors.

Figure 3. Relationship between White-Collar Employment Growth and Skill Intensity in Mexico, 1984–1990.



Source: SECOFI.

Figure 4. Relationship between Blue Collar Employment Growth and Skill Intensity in Mexico, 1984–1990.



Source: SECOFI.

- **Summary and conclusion**

- Trade liberalisation was associated with an increase in the white-collar-blue-collar wage gap.
- There was little change in the ratio of white-collar to blue-collar employment.
- Higher employment growth in skill-intensive sectors.
- No positive correlation between skill intensity and relative product price changes, but initial tariff levels and reductions in tariffs were lower in skill-intensive sectors than in low-skill-intensive sectors.
- Therefore, reduction in trade barriers had a more dramatic effect on low-skill worker wages.
- Low-skilled producers from Mexico may not have been competitive compared with Asian low-skill intensive sectors. According to the authors, the results imply that Mexico was likely to be abundant in intermediate skilled labour and would confirm the hypothesis of competition from low-income Asian countries.

3. CONCLUSION

- The H-O-S model predicts that trade liberalisation in developing countries is likely to raise demand for low-skilled workers (given that this is the abundant factor) and lead to a reduction in the wage gap between skilled and unskilled workers.
- Evidence from East Asian countries that liberalized in the 1960s and 1970s supports this evidence, but it no longer appeared to hold for Latin American countries in the 1980s and 1990s.
- The few hypotheses for which empirical support is found are: technological progress which was biased toward skilled workers and competition from low-income Asian countries.
- For the case of Mexico: no positive correlation between skilled intensity and relative product prices during the 1980s. But low-skilled industries were highly protected and trade reform had a disproportionate negative effect on the wages on low-skilled wages. This plus the entrance of low income Asian countries in global trade have contributed to lower the wages of low- skilled workers.