

# Impact of Outsourcing to China on Hong Kong's Labor Market\*

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## **Abstract**

This paper examines the effect of outsourcing to China on the recent widening of educational and skill wage differentials in Hong Kong. An analysis of aggregate changes in the relative supplies and wages of workers by education and skill from 1976 to 1996 indicates strong and persistent growth in relative demand favoring educated and skilled workers since the early 1980s. Rapid skill upgrading within detailed industries in the manufacturing sector accounts for most of the growth in the relative demand for skilled workers, particularly since the early 1980s. The rate of skill upgrading has been greater in industries that have seen a greater degree of outsourcing to China.

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## **1. Introduction**

Many authors have investigated the extent to which increased international trade is responsible for the growing income disparities in the US. Some people have argued that a trade explanation is inadequate because most of change in relative demand for skilled workers appears to be due to relative demand shifts within industries, and not between industries. This has been extensively documented by Bound and Johnson (1992), Berman, Bound and Griliches (1994), and most recently by Autor, Katz, and Krueger (1998). The shift in the relative demand for skilled workers within industries can not be due to import competition from the Stolper-Samuelson theorem, because if import competition reduces the relative wage of unskilled workers, then all industries should substitute *towards* unskilled workers.<sup>1</sup> Thus, both the shift away from unskilled workers and their reduced relative wage must be due to another cause, and many people have argued that this cause is most likely biased technological change.

To resuscitate a trade-based explanation, Feenstra and Hanson (1996) argued that trade could be responsible for the fall in the relative wage and employment of unskilled workers in a model which allows for trade in intermediate inputs as well as trade in final goods. When trade in intermediate inputs is possible, then the outsourcing of the least skill-intensive processes within each manufacturing industries to developing countries could result in the kind of skill upgrading that we observe within each industry. Therefore, a decomposition of shifts in relative demand into shifts between and within industries does not allow us to distinguish between biased-technological change and international trade as explanations of the adverse trends for unskilled workers. Nevertheless, Berman, Bound, and Griliches (1994) and Krugman and Lawrence (1993) have argued that the magnitude of outsourcing from the US is too small to account for the observed wage and employment changes. In response, Feenstra and Hanson (1996) show that when they use a broader definition of outsourcing to include goods produced from offshore assembly plants and purchased from subcontractors, they find that outsourcing can explain 15-30 percent of skill upgrading in the 1980s. Autor, Katz, and Krueger

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<sup>1</sup> This argument was first made by Lawrence and Slaughter (1993).

(1998), however, show that Feenstra and Hanson's (1996) measure of outsourcing becomes insignificant once a control for computer investment is introduced.

A possible reason for these conflicting results is that the sheer size of the US economy makes it very difficult to tease out the effect of outsourcing on US labor markets. While outsourcing from the US has become more important over the last few decades, any impact it may have had on relative wages is probably swamped by broader economic forces such as biased technological change. If our goal is to understand the impact of outsourcing, we may learn more from examining an economy such as Hong Kong where there has been a large relocation of industrial production to Southern China due to economic reforms in China. These reforms were due to political forces within China and clearly exogenous to Hong Kong's economy. Therefore, we can be reasonably certain that outsourcing to China was not an endogenous response to forces originating in Hong Kong. In addition, since the extent of outsourcing from Hong Kong is probably larger than in any other economy in the world, if outsourcing has any effect on relative wages, we should see it in Hong Kong.

Therefore, for the same reason why Willie Sutton robbed banks, we examine the impact of outsourcing to China on the relative demand for skilled workers in Hong Kong. We start by documenting the extent of outsourcing to China from Hong Kong and by analyzing the aggregate trends in the relative supply and wages of skilled workers in Hong Kong over the last two decades. This analysis indicates that there has been a sharp increase in outsourcing to China and persistent shifts in the relative demand for skilled workers since the early 1980s. After sketching a theoretical model which illustrates how outsourcing can result in skill-upgrading within each industry, the paper turns to the manufacturing sector and shows that rapid skill upgrading within detailed manufacturing industries account for most of the growth in the relative demand for skilled workers. Finally, we show the relative wage of skilled workers and the rate of skill upgrading have been greater in industries that have seen a greater degree of outsourcing to China. We thus conclude that the adverse trends for less-skilled workers in Hong Kong since the early 1980s may be due to outsourcing to China.

## **2. Outsourcing, Relative Wage, and Employment Trends in Hong Kong**

Hong Kong's has always had extensive trade links with the Chinese mainland. However, until the late 1970s, its imports from China were limited to food products. This changed dramatically when China opened its economy to foreign investors in the late 1970s and early 1980s by establishing a number of export processing zones, particularly in the Guangdong Province. Due to their cultural and geographical proximity to the Guangdong Province (most people in Hong Kong are native Cantonese speakers and trace their origins to the Guangdong Province), Hong Kong entrepreneurs were the first to take advantage of these policy reforms. The result has been an explosion of outsourcing of manufacturing activities from Hong Kong. Figure 1 plots Hong Kong's domestic exports and re-exports of Chinese origin. It clearly shows that re-exports of Chinese origin were insignificant in the 1970s, but started to increase in the early 1980s and really took in 1986. At the same time, domestic exports have fallen as a fraction of GDP.

Table 1 puts together a slightly different measure of outsourcing for the manufacturing sector. It presents the share of imports from China as a fraction of domestic shipments plus imports from China. Imports from China include goods that are used as intermediate inputs and goods that are being re-exported. This data shows that the Chinese share of inputs increased from 8 percent in 1976 to 16 percent in 1986, and then exploded to 61 percent by 1996. To provide some sense of the magnitude, Feenstra and Hanson's (1996) figures show that outsourcing from the US increased by an average of 0.43 percentage points a year in the 1980s. Using a similar measure of outsourcing, Table 1 shows that outsourcing from Hong Kong increased by an average of 4.6 percentage points a year from 1986 to 1996, which is more than ten times larger than that in the US.

There is some suggestive evidence from aggregate trends of relative wages and employment that outsourcing to China has caused a large increase in the relative demand for skilled workers. Table 2 presents two different measures of relative employment and wages of skilled workers. The first panel presents the employment and wage of workers who have attended senior high school relative to that of non-high school educated

workers. We see that the relative employment of high school-educated workers has increased steadily since 1976, rising from 29 percent to 59 percent of the labor force. However, this increase was accompanied by a very sharply fall in relative wages for skilled workers from 1976 to 1981, and a sharp increase over the next fifteen years.<sup>2</sup> Since outsourcing to China started to take off in the early 1980s, the timing suggests that the reversal of the relative wage trends in Hong Kong in the early 1980s may have related to outsourcing.

Panel B presents the employment and wages of nonproduction workers relative to that of production workers. We can clearly see that there has been a dramatic increase in the relative employment of nonproduction workers in the manufacturing sector, rising from 13 percent of total employment in 1981 to 47 percent by 1996. This was accompanied by smaller increase in relative wages of nonproduction workers, by only 3 percent over the same time period. Nonetheless, this translates into an average increase in the wage-bill share of nonproduction workers of 2.5 percentage points a year, which is almost *seven* times larger than the increase in the relative wage-bill of nonproduction workers in the US over a similar time period.<sup>3</sup>

As further confirmation of these relative wages trends, Figure 2 presents estimates of the return to education in Hong Kong.<sup>4</sup> It can be clearly seen that the returns to education in the manufacturing sector and in the aggregate economy fell in the 1970s, but has steadily increased since 1981. Again, the timing of this turning point of the relative wage trend is consistent with an outsourcing based story. Nevertheless, while these aggregate trends are suggestive, we must turn to a more systematic analysis to isolate the contribution of outsourcing from that of other economic forces. Before we do this, however, we first sketch a simple model that shows how trade could be responsible for relative demand shifts within specific industries in a framework that allows for trade in intermediate inputs as well as trade in final output goods.

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<sup>2</sup> The fall in the relative wage of skilled workers from 1976 to 1981 is largely due to a large increase in the relative supply of skilled workers in Hong Kong over this time period.

<sup>3</sup> According to figures provided by Autor, Katz, and Krueger (1998), the relative wage-bill share of non-production workers in the US increased at an average rate of 0.375 percentage points a year from 1979 to 1989.

### 3. A Model of Outsourcing and Relative Demand for Skilled Workers

To see how outsourcing could have been the driving force behind the sharp increase in relative labor demand favoring skilled workers, this section sketches a simple model by Kumar (1998) in which we can analyze the impact of outsourcing on relative wages and employment. The model is a two-country extension of Dixit and Grossman's (1982) model of multi-stage production.<sup>5</sup>

We will consider a model with two economies, which we will call Hong Kong (h) and China (c) that produce two goods, manufactures (m) and food (f). There are three factors of production: skilled workers ( $L_s$ ), unskilled workers ( $L_u$ ), and land (T). We will assume that relative factor endowments are sufficiently different such that factor price equalization does not hold. In addition, we will assume that relative factor endowments are such that the relative wage of skilled workers in Hong Kong is lower than that in China, or  $w_s^h / w_u^h < w_s^c / w_u^c$ . This is eminently sensible, since the relative number of unskilled workers in China is larger than that in Hong Kong.

Food is produced with a standard technology from unskilled labor and land. On the other hand, manufactured goods are assembled from a continuum of intermediate inputs indexed by  $z \in [0, 1]$ . We will assume a Leontief production function for each intermediate input where the unit skilled labor requirement for input  $z$  is  $a_s(z)$  and the unit unskilled labor requirement is  $a_u(z)$ .<sup>6</sup> These inputs can be ordered by their factor requirements. We arrange intermediate inputs such that the relative skilled labor requirement is increasing in  $z$ :

$$(1) \quad \frac{\partial [a_s(z)/a_u(z)]}{\partial z} > 0$$

Thus, inputs with low  $z$ 's are unskilled labor intensive goods and inputs with high  $z$ 's are skilled-labor intensive goods. With this production function, the minimum unit cost of producing each intermediate input is the sum of the wage of skilled workers multiplied by

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<sup>4</sup> The numbers presented in figure 2 are the coefficients on years of education from a standard wage regression for each year.

<sup>5</sup> The model is similar to one presented by Feenstra and Hanson (1996). However, while Feenstra and Hanson assume only one output good, the model we sketch out in this section assumes two final output goods and thus allows us to examine relative output prices changes.

the unit skilled labor requirement and the unskilled worker wage multiplied by the unskilled labor requirement, divided the Hicks-Neutral productivity differential between the two countries:

$$(2) \quad \frac{w_u^i a_u(z) + w_s^i a_s(z)}{A^i} \quad i = h, c$$

where  $A^c$  and  $A^h$  is an index of Hicks-neutral technology in China and Hong Kong in the manufacturing sector.

Figure 3 plots the loci of minimum unit costs for all the intermediate inputs for the two economies. If the inputs are produced in both countries, then the locus of minimum unit cost for Hong Kong (HH) must lie below the locus of minimum unit cost for China (CC) at high levels of  $z$ . Similarly, HH must lie above CC at low levels of  $z$ . The marginal intermediate input  $z^*$  is defined as the input at which the unit cost of producing the input are the same in both countries:

$$(3) \quad \frac{w_u^h a_u(z^*) + w_s^h a_s(z^*)}{A^h} = \frac{w_u^c a_u(z^*) + w_s^c a_s(z^*)}{A^c}$$

In equilibrium, the most unskilled labor intensive inputs ( $z < z^*$ ) are produced in China and most skilled labor intensive inputs ( $z > z^*$ ) are produced in Hong Kong.

We will model China's opening as an exogenous Hicks-Neutral shift in China's technology. By doing comparative statics exercises, we can show that an improvement in China's technology increases  $z^*$ , which means that China will produce a larger range of intermediate inputs. In figure 3, we can see this as a downward shift in the locus of minimum unit costs for China, or a downward shift in CC. This can be thought of as increased outsourcing to China. Hong Kong sheds the most unskilled labor intensive of its manufacturing stages, so its manufacturing sector becomes more skill intensive. Meanwhile, as China expands the number of intermediate inputs it produces, the new inputs are more skill intensive than the average of the inputs it previously produced, so the relative demand for skilled labor also rises in China.

Since we have two goods in this model, the net impact on relative wages in the two countries depends on the change in the relative price of the two goods. However, it can be shown that if China and Hong Kong face an elastic world relative demand curve, then

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<sup>6</sup> We can allow for substitution between skilled and unskilled labor in the production of intermediates, but

we can unambiguously assert that relative wages of skilled workers rise due to outsourcing in both China and Hong Kong. When the food sector is small enough, we get the following simple expression for the impact of economic reforms in China on relative wages in Hong Kong:

$$(4) \quad \frac{d \ln(w_s^h / w_u^h)}{d \ln(A^c)} = \frac{L_u^h(z^*)}{L_s^h} \cdot \left( \frac{L_s^h}{L_u^h} - \frac{a_s(z^*)}{a_u(z^*)} \right) \cdot \frac{dz^*}{d \ln A^c} > 0$$

Since the marginal intermediate input in Hong Kong is the least skilled-labor intensive, or  $L_s^h / L_u^h > a_s(z^*) / a_u(z^*)$ , the relative wage of skilled workers in Hong Kong increases when this marginal intermediate input is outsourced to China.

If we drop the assumption of an elastic world demand curve, then we can show that the relative price of manufactures falls due to Chinese economic reforms and as long as the relative price does not fall by too much, the relative wage of skilled workers will still increase in both economies.

#### **4. Decomposition of Relative Demand Shifts**

The model we have sketched out suggests that outsourcing to China will result in skill upgrading within each manufacturing sector in Hong Kong. Similarly, skilled-biased technical change is also likely to result in an increase in the relative utilization of skilled workers within detailed manufacturing sectors. In contrast, explanations based on the Stolper-Samuelson theorem from international trade are likely to involve shifts in the derived demand for labor between industries from those that are intensive in less-skilled workers to those intensive in skilled workers. Therefore, a decomposition of the change in the skilled-worker share of the wage bill and employment can help illustrate the potential importance of these different channels.

A standard decomposition of the change in the aggregate share of payments (or employment) of skilled workers into a term reflecting the reallocation of labor across industries and another term reflecting changes in the employment share of skilled workers within industries is as follows:

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the results do not hinge on this assumption.



$$(5) \quad \Delta P_{jt} = \sum_k (\Delta E_{kt} \gamma_{jk}) + \sum_k (\Delta \gamma_{jkt} E_k) = \Delta P_{jt}^b + \Delta P_{jt}^w,$$

where  $k$  indexes industries,  $E_{jkt}$  is the employment of group  $j$  in industry  $k$  in year  $t$  as a share of aggregate employment in year  $t$ ,  $E_{kt}$  is total employment in industry  $k$  in year  $t$ ,  $\gamma_{jkt} \equiv E_{jkt}/E_{kt}$  is group  $j$ 's share of employment in industry  $k$  in year  $t$ ,  $E_k$  is the average total employment in industry  $k$ , and  $\gamma_{jk}$  is group  $j$ 's average share of employment in industry  $k$ . The first term in equation 5 ( $\Delta P_{jt}^b$ ) reflects the change in the aggregate proportion of skilled workers due to changes in employment shares *between industries* that utilize skilled workers in different intensities. The second term ( $\Delta P_{jt}^w$ ) reflects *within-industry* skill upgrading.

Based on this accounting framework, Table 3a present a decomposition of the increase in the share of non-production workers in total employment and wage-bill into between and within industry shifts. As previously mentioned, the employment and wage-bill share of nonproduction workers in the manufacturing sector sharply accelerated in the 1980s. Table 3a shows that most of this relative demand shift can be explained by within-industry demand shifts. The rate of within-industry skill upgrading was particularly high between 1986 and 1996; the relative employment of non-production workers grew at a annual rate of 2.75 percentage points between 1986 and 1996, which is more than eight times the rate at which it increased from 1976 to 1981. Table 3a also indicates that in contrast to the manufacturing sector, between industry shifts account for a significant share of the relative demand shift in the service sector. However, this is not inconsistent with an explanation that relies on outsourcing since this between shift is largely due to a relative increase in the size of the service industries that are inputs in the production, financing, and distribution of manufactured goods such as export and import trades and finance and banking.

Table 3b decomposes the change in the employment and wage-bill share of skilled workers using an alternative definition of skilled and unskilled workers. Specifically, we define a skilled worker as someone who has attained at least high school education (known as O-Level education in Hong Kong's British educational system). This decomposition yields a similar result: within-industry demand shifts account for the bulk

of the relative demand shifts in the manufacturing sector, and smaller share of the shift in the service sector.

## **5. Outsourcing and Within-Industry Relative Demand Shifts**

The previous section documents that within-industry demand changes account for most of the aggregate relative demand shifts, particularly for the manufacturing sector. To directly assess whether the relative demand shifts within specific industries is due to outsourcing, we adopt Feenstra and Hanson's (1996) adaptation of Berman, Bound, and Griliches' (1994) framework. This framework explains the change in the share of the wage-bill of skilled workers as a function of various industry variables including a measure of the change in outsourcing from a particular industry. Table 4 presents the summary statistics for variables we use in our regression analysis. The first two rows show that the share of payments to skilled workers dramatically increased in the 1980s. The change in the degree of outsourcing also sharply increased in the mid-1980s, from 0.80 percentage points a year (1976-1981) to 3.09 percentage points a year (1981-1996). The last striking fact we glean from this table is that the average value-added in the manufacturing sector has fallen since the early 1980s, and sharply accelerated after 1986 reflecting the wholesale relocation of industrial production to China.

Table 5 presents estimates of the relationship between changes in outsourcing and changes in the wage-bill share of non-production workers. In most of the regressions, outsourcing appears to be significantly and positively correlated with within-industry skill upgrading. The effect of outsourcing is even higher once we leave out the time-period controls since there has been a sharp secular increase in outsourcing for most industries in Hong Kong. The point estimates of the outsourcing coefficients in columns (1) and (3) indicate that outsourcing accounts for roughly one-third of within-industry skill upgrading.

Table 6 presents similar estimates using the change in the share of the wage-bill of high-school educated workers as the dependent variable. The coefficient on the outsourcing variable across the different specifications presented in Table 6 is remarkably consistent and provide further evidence that outsourcing is linked to within-industry

relative demand shifts. It is interesting to note that the effect of capital intensity is typically negative and significant no. This suggests that there is little capital-skill complementarity in Hong Kong and rules out capital accumulation as an explanation for skill upgrading in Hong Kong.

## **6. Outsourcing and Returns to Education, Skill, and Experience**

This section presents an alternative method to assess the extent to which outsourcing is responsible for relative demand shifts in Hong Kong's labor market by examining whether returns to skill have increased in sectors that have seen a greater degree of outsourcing. To do this, we estimate several Mincerian wage models in we add in an additional variable that interacts our measure of outsourcing (share of imports from China) with different measures of skill.

We start by examining the impact of outsourcing on returns to education in Hong Kong. The first two columns in Table 7 present estimates of the returns to education from standard wage regressions. A comparison of the estimates in these two columns indicates that the estimated return to education does not change once a control for outsourcing is introduced. The third column introduces a variable interacting years of education and our measure of outsourcing. The coefficient on this variable is positive and highly significant, which suggests that the returns to education have increased by more in industries that have seen a greater degree of outsourcing. Since the average share of imports from China increased by roughly 50 percentage points from 1976 to 1996 (see Table 1), the point estimates from the model in column 3 indicate that outsourcing accounts for a 2.25 percentage point increase in the returns to education over this time period. This is roughly 42 percent of the 5.4 percentage increase in the returns to education in Hong Kong over this time period.

A possible problem with these estimates is that the degree of outsourcing to China may be an endogenous response to forces that originate in Hong Kong. To convince ourselves that this was not the case, we estimate the same equation using the share of imports from China in US imports as an instrument for our measure of outsourcing from Hong Kong. The idea is that the Chinese share of US imports are affected by same forces

that are behind outsourcing from Hong Kong (economic reforms in China), but are arguably independent of economic forces that originate in Hong Kong. Column 4 presents our instrumental variable estimate of the impact of outsourcing on returns to education. As can be seen, the estimated effect of outsourcing on returns to education is virtually unchanged.

The next set of estimates (Table 8) examine whether the relative wage of non-production workers is affected by the extent of outsourcing. The first two columns indicate that without controlling for education, the wage of nonproduction workers is roughly 50 percent higher than that of production workers.<sup>7</sup> The next set of estimates (Column 3) presents the estimates of the effect of outsourcing on relative wages of nonproduction workers. Again, taking a 50 percentage point increase in outsourcing as our baseline, the coefficients in Column 3 indicate that outsourcing has increased the relative wage of nonproduction workers by 15 percent over the last two decades. The effect of outsourcing on relative wages is lower once we instrument for outsourcing from Hong Kong (see Column 4), but the coefficient estimate is still large and significantly different from zero.

Finally, we examine the impact of outsourcing on older workers by looking at changes in age-income profiles in Hong Kong. Table 9 presents estimates of the impact of outsourcing on the returns to experience. As can be seen, the coefficient estimates indicate that the return to experience has fallen in industries that have seen a greater degree of outsourcing. According to the coefficient estimates in column 2, a 50 percentage point increase in the degree of outsourcing lowers the return to experience by 0.3 percent a year.<sup>8</sup> In sum, in addition to harming less-skilled workers, there is evidence that outsourcing to China has adversely affected older workers in Hong Kong.

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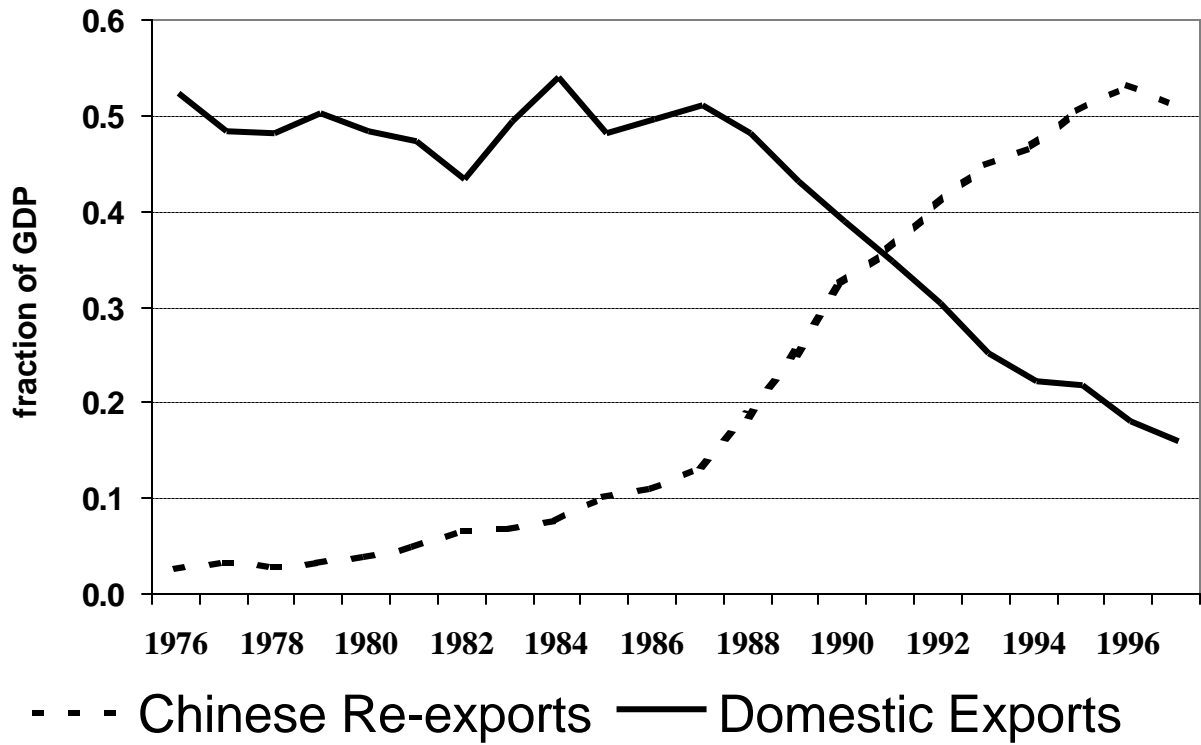
<sup>7</sup> The estimates presented in first column of Table 8 shows that the relative wage of nonproduction workers fall by roughly one-half once controls for education are introduced.

<sup>8</sup> Without taking outsourcing into account, the returns to experience in the manufacturing sector has actually increased over the last two decades, from 1.7 percent a year in 1976 to 2.8 percent a year in 1996.

## **7. Conclusion**

This paper documents the extent of outsourcing from Hong Kong into China and the aggregate trends in relative wages and employment of skilled workers in Hong Kong over the last two decades. We find evidence of strong and persistent relative demand shifts favoring skilled workers in Hong Kong since the early 1980s, which is when outsourcing to China started to take off. In addition, we find that these relative demand shifts have been stronger in industries that have seen a greater degree of outsourcing to China. Finally, we find strong evidence that the return to education and the relative wage of nonproduction workers have increased by more in the industries that have shifted a larger share of their production to China.

**Figure 1: Hong Kong's Domestic Exports and Re-exports from China**



Sources: Annual issues of Annual Review of Hong Kong External Trade and Hong Kong Trade Statistics.

Figure 2: Returns to Education in Hong Kong, 1976-1996

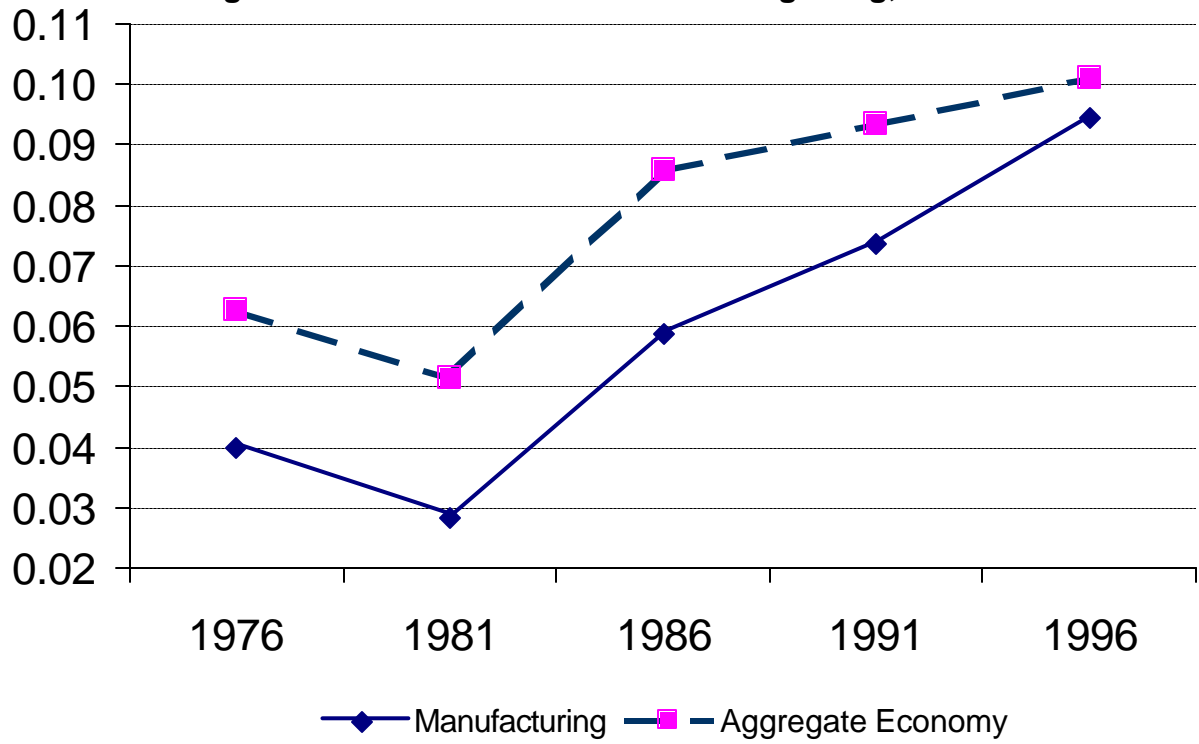
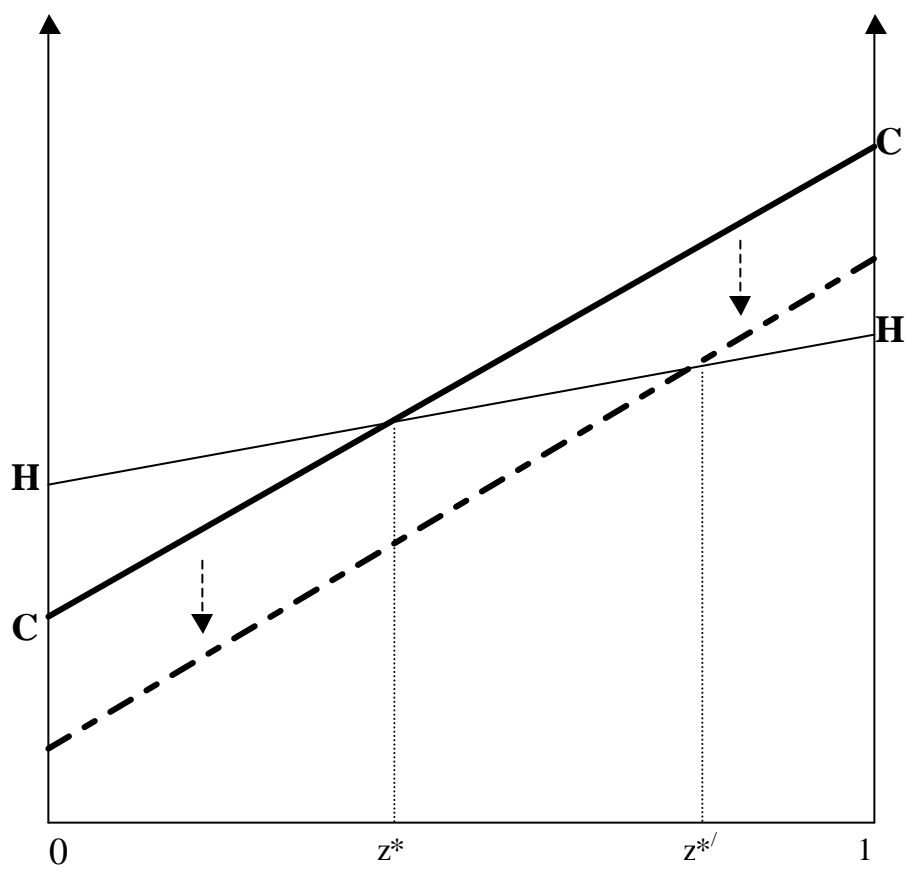


Figure 3:  
Locus of Unit Cost for Each Intermediate Input





**Table 1: Outsourcing to China from Hong Kong:  
Imports from China/(Shipments + Imports from China)**

<b><i>Industry</i></b>	1976	1981	1986	1991	1996
Food, beverages, and tobacco	0.434	0.422	0.415	0.338	0.473
Textiles	0.097	0.216	0.284	0.380	0.541
Apparel (except footwear)	0.027	0.108	0.079	0.445	0.695
Footwear and leather products	0.144	0.281	0.398	0.792	0.968
Wood and wood products	0.142	0.108	0.142	0.376	0.887
Paper products, printing and publishing	0.084	0.062	0.065	0.058	0.126
Chemicals, petroleum and coal products	0.323	0.365	0.462	0.549	0.575
Rubber and plastic products	0.004	0.011	0.017	0.151	0.684
Basic metal and metal products (except machinery)	0.049	0.128	0.095	0.254	0.493
Machinery and electronic products	0.033	0.055	0.095	0.531	0.708
Professional, scientific equipment and photographic, optical goods	0.010	0.039	0.044	0.310	0.667
other manufacturing	0.268	0.305	0.371	0.652	0.844
<b><i>weighted average</i></b>	0.079	0.130	0.155	0.394	0.610

Sources: Statistics Canada's World Trade database (from NBER), Hong Kong Annual Review of External Trade, and Hong Kong's Report on Annual Survey of Industrial Production.

Table 2:  
Levels of Educational Composition of Employment and  
Relative Wage of Skilled Workers, 1976-1996.

	<i>1976</i>	<i>1981</i>	<i>1986</i>	<i>1991</i>	<i>1996</i>
Panel A					
<b><u>Aggregate Economy</u></b>					
High-School (O Level +) Workers/Total Employment (%)	27.5	32.9	44.1	51.4	59.1
Log high-school (O Level +)/non high-school educated wage	.535	.383	.479	.509	.518
<b><u>Manufacturing</u></b>					
High-School (O Level +) Workers/Total Employment (%)	18.7	23.1	31.6	38.3	51.0
Log high-school (O Level +)/non high-school educated wage	.374	.277	.369	.502	.512
Panel B					
<b><u>Aggregate Economy</u></b>					
Non-Production Workers/Total Employment (%)	31.9	31.9	40.1	45.0	51.8
Log Non-Production/Production wage	.507	.483	.529	.601	.659
<b><u>Manufacturing</u></b>					
Non-Production Workers/Total Employment (%)	11.0	13.2	17.5	31.8	47.0
Log Non-Production/Production wage	.706	.628	.580	.676	.658

Source: Authors' calculations from 1% subsample of Hong Kong Censuses of 1976, 1981, 1986, 1991, and 1996.

**Table 3a**

Between- And Within-Industry Decomposition of the Increase in Share of Non-Production Workers in Employment, 1976-1996

**Dependent Variable: 100x (Annual Change in Non-Production Worker Employment and Wage-Bill Share)**

Period	<b>A. Wage Bill</b>								
	<i>All industries</i>			<i>Manufacturing</i>			<i>Non-manufacturing</i>		
	Between	Within	Total	Between	Within	Total	Between	Within	Total
1976-81	-0.33	0.24	-0.09	0.09	0.33	0.42	-0.64	0.20	-0.44
1981-96	0.66	0.89	1.55	0.26	2.52	2.77	0.55	0.35	0.90
1981-86	1.01	0.92	1.93	0.22	1.05	1.27	0.91	0.86	1.77
1986-96	0.51	0.94	1.45	-0.03	3.08	3.06	0.30	0.23	0.53
1976-96	0.41	0.75	1.17	0.18	1.94	2.12	0.28	0.31	0.60

Period	<b>B. Employment</b>								
	<i>All industries</i>			<i>Manufacturing</i>			<i>Non-manufacturing</i>		
	Between	Within	Total	Between	Within	Total	Between	Within	Total
1976-81	-0.09	0.19	0.09	0.08	0.36	0.44	-0.46	0.06	-0.40
1981-96	0.55	0.71	1.26	0.23	2.06	2.30	0.30	0.12	0.42
1981-86	0.74	0.87	1.61	0.08	0.91	0.99	0.66	0.85	1.51
1986-96	0.47	0.67	1.14	0.07	2.75	2.82	0.07	-0.13	-0.07
1976-96	0.38	0.58	0.97	0.14	1.69	1.83	0.29	0.07	0.36

Sources: Authors' calculations from 1% subsample of Hong Kong Censuses of 1976, 1981, 1986, 1991, and 1996.

**Table 3b**

Between- And Within-Industry Decomposition of the Increase in Share of High-School-Educated (O-Level) Workers in Employment, 1976-1991

**Dependent Variable: 100x (Annual Change in High School-Educated Worker Employment and Wage-Bill Share)**

Period	<i>All industries</i>			<b><i>A. Wage Bill</i></b>			<i>Non-manufacturing</i>		
	Between	Within	Total	<i>Manufacturing</i>			Between	Within	Total
1976-81	-0.04	0.60	0.55	0.11	0.53	0.64	-0.18	0.63	0.45
1981-96	0.66	1.23	1.89	0.29	2.05	2.34	0.56	0.96	1.52
1981-86	0.88	2.04	2.91	0.15	2.40	2.56	0.94	1.94	2.87
1986-96	0.50	0.88	1.38	-0.03	1.76	1.73	0.30	0.54	0.84
1976-96	0.48	1.08	1.55	0.24	1.67	1.92	0.37	0.88	1.25

Period	<i>All industries</i>			<b><i>B. Employment</i></b>			<i>Non-manufacturing</i>		
	Between	Within	Total	<i>Manufacturing</i>			Between	Within	Total
1976-81	0.27	0.89	1.16	0.11	0.75	0.87	0.27	0.99	1.26
1981-96	0.56	1.10	1.66	0.26	1.60	1.87	0.39	0.87	1.27
1981-86	0.54	1.78	2.32	0.07	1.79	1.86	0.60	1.83	2.43
1986-96	0.53	0.79	1.32	0.05	1.43	1.48	0.22	0.46	0.69
1976-96	0.45	1.08	1.53	0.21	1.41	1.62	0.32	0.94	1.26

Sources: Authors' calculations from 1% subsample of Hong Kong Censuses of 1976, 1981, 1986, 1991, and 1996.

**Table 4: Skill-Upgrading, Outsourcing, Output, and Capital Accumulation in Hong Kong:  
Average Annual Rates of Change, 1976-1996**

Variable	1976-81	1981-96	1986-1996	1976-96
$\Delta$ [wage-bill share of non-production workers]	0.29	3.61	4.66	2.88
$\Delta$ [wage-bill share of high-school (O level) educated workers]	0.77	2.64	2.85	2.15
$\Delta$ [Imports from China / Domestic Shipments + Imports from China]	0.80	3.09	4.32	2.52
$\Delta \ln(K/Y)$	3.59	3.96	6.59	4.26
$\Delta \ln Y$	6.05	-3.31	-7.17	-0.97

Table 5:  
Outsourcing and Skill Upgrading in Manufacturing, 1976-1996.  
Dependent Variable is Annual Change in Non-Production Worker Wage-Bill Share.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$\Delta[\text{Chinese Imports} /$ $(\text{Shipments} +$ $\text{Chinese Imports})]$	.360 (.201)	-.034 (.142)	.365 (.228)	.032 (.141)	.096 (.067)	.129 (.047)	.100 (.062)	.131 (.047)
$\Delta \ln(K/Y)$			-.007 (.071)	-.202 (.085)	-.022 (.045)	.011 (.034)		
$\Delta \ln Y$		-.254 (.057)		-.315 (.054)	-.044 (.037)		-.034 (.029)	
time period controls	no	no	no	no	yes	yes	yes	yes
$R^2$	.124	.454	.124	.538	.915	.911	.915	.911
Standard Error	.029	.023	.029	.022	.010	.010	.011	.010

Note: Sample consists of 41 observations on 2-digit manufacturing industries. Huber-White robust standard errors are reported in parenthesis. Equations are weighted by the average industry wage bill in manufacturing.

Table 6:  
Outsourcing and Skill Upgrading in Manufacturing, 1976-1996.  
Dependent Variable is Annual Change in High School (O Level +) Worker Wage-Bill Share.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$\Delta[\text{Chinese Imports} / (\text{Shipments} + \text{Chinese Imports})]$	.063 (.071)	.142 (.073)	.034 (.066)	.104 (.056)	.131 (.073)	.158 (.063)	.132 (.073)	.164 (.059)
$\Delta \ln(K/Y)$	-.085 (.040)	-.041 (.042)			-.006 (.037)	.022 (.037)		
$\Delta \ln Y$	-.066 (.018)		-.039 (.023)		-.035 (.027)		-.033 (.028)	
time-period controls	no	no	no	no	yes	yes	yes	yes
$R^2$	.223	.098	.123	.068	.478	.461	.478	.454
Standard Error	.011	.012	.011	.012	.009	.009	.009	.009

Note: Sample consists of 41 observations on 2-digit manufacturing industries. Huber-White robust standard errors are reported in parenthesis. Equations are weighted by the average industry wage bill in manufacturing.

Table 7:  
Outsourcing and Returns to Education in Manufacturing, 1976-1996.  
Dependent Variable is Log Real Wage.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
education x outsourcing			.045 (.007)	.048 (.009)	.040 (.007)	.057 (.009)	.035 (.007)
education	.058 (.006)	.058 (.006)	.032 (.005)	.030 (.006)	.034 (.005)	.042 (.006)	.034 (.005)
outsourcing		.169 (.082)	-.253 (.109)	-.217 (.145)	-.291 (.114)	-.361 (.115)	
non-production worker dummy			.232 (.016)	.263 (.022)	.243 (.017)		.243 (.014)
industry controls	yes	yes	yes	yes	no	yes	yes
IV for outsourcing	no	no	no	yes	no	no	no
R <sup>2</sup>	.440	.440	.450	.449	.444	.445	.449
Standard Error	.565	.565	.560	.560	.562	.562	.560

Note 1: Outsourcing variable is Hong Kong's imports from China as a fraction of domestic shipments. IV estimates use US import share from China as instrument for outsourcing from Hong Kong.

Note 2: Sample consists of 34,071 observations on workers in the manufacturing industry from 1976, 1981, 1986, 1991, and 1996. Regressions also include a sex dummy, experience, experience squared, and time period dummies. Standard errors (in parentheses) are robust to correlation within industries.



Table 8:  
Outsourcing and Relative Wage of Non-production Workers in Manufacturing, 1976-1996.  
Dependent Variable is Log Real Wage.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
non-production worker dummy x outsourcing			.302 (.060)	.247 (.070)	.272 (.057)	.241 (.060)	.264 (.068)
non-production worker dummy	.533 (.028)	.531 (.028)	.162 (.020)	.204 (.035)	.179 (.019)	.443 (.032)	.436 (.032)
outsourcing		.189 (.090)	.115 (.090)	.182 (.119)	.024 (.097)	.153 (.093)	
education			.042 (.004)	.042 (.004)	.044 (.005)		
industry controls	yes	yes	yes	yes	no	yes	yes
IV for outsourcing	no	no	no	yes	no	no	no
R <sup>2</sup>	.429	.430	.445	.448	.443	.431	.430
Standard Error	.570	.570	.561	.561	.563	.569	.569

Note 1: Outsourcing variable is Hong Kong's imports from China as a fraction of domestic shipments. IV estimates use US import share from China as instrument for outsourcing from Hong Kong.

Note 2: Sample consists of 34,071 observations on workers in the manufacturing industry from 1976, 1981, 1986, 1991, and 1996. Regressions also include a sex dummy, experience, experience squared, and time period dummies. Standard errors (in parentheses) are robust to correlation within industries.

Table 9:  
Outsourcing and Returns to Experience in Manufacturing, 1976-1996.  
Dependent Variable is Log Real Wage.

	(1)	(2)	(3)	(4)	(5)	(6)
experience x outsourcing		-.006 (.001)	-.011 (.002)	-.006 (.002)	-.007 (.001)	-.003 (.002)
experience	.021 (.005)	.022 (.005)	.023 (.005)	.021 (.005)	.021 (.005)	.021 (.005)
outsourcing	.161 (.086)	.292 (.098)	.494 (.136)	.193 (.083)	.335 (.093)	
education	.042 (.004)	.042 (.004)	.042 (.004)	.043 (.005)	.057 (.006)	.042 (.004)
non-production worker dummy	.276 (.018)	.267 (.018)	.273 (.019)	.273 (.020)		
industry controls	yes	yes	yes	no	yes	yes
IV for outsourcing	no	no	yes	no	no	no
R <sup>2</sup>	.447	.448	.449	.443	.441	.447
Standard Error	.561	.561	.560	.563	.564	.561

Note 1: Outsourcing variable is Hong Kong's imports from China as a fraction of domestic shipments. IV estimates use US import share from China as instrument for outsourcing from Hong Kong.

Note 2: Sample consists of 34,071 observations on workers in the manufacturing industry from 1976, 1981, 1986, 1991, and 1996. Regressions also include a sex dummy, experience squared, and time period dummies. Standard errors (in parentheses) are robust to correlation within industries.

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