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Working Paper Series

Centre for Public Policy Studies

No. 140 (7/03) CPPS

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June 2003

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Structural Change and the Narrowing Gender Gap in Wages: Theory and Evidence from Hong Kong^{*}

C. Simon Fan^{**} and Hon-Kwong Lui⁺

June 2003

(Forthcoming, *Labour Economics*)

Abstract: This paper offers a theoretical and empirical analysis on the sources of the narrowing gender gap in wages. Based on some existing literature, the model posits that the narrowing gender gap may be related to women's changing comparative advantage and the gender gap is smaller in occupations in which physical labor is less intensively used. The model implies that when an economy transforms from a manufacturing-oriented economy to service-oriented economy, a woman's productivity relative to a man's will generally increase so that the gender gap narrows. The implications of the theoretical analysis are then tested based on one percent random sub-samples of two population censuses. The empirical results support the predictions of the model.

^{*}We are grateful to Dan Black (the Editor) and two anonymous referees for insightful comments and suggestions that improved the quality of our paper significantly.

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I. Introduction

The phenomenon of narrowing gender gap in wages has been observed in many developed countries in the past few decades (e.g. Goldin, 1990; Blau and Kahn, 1992; 1996; Wellington 1993). Recently, there has been a growing interest in explaining why this phenomenon occurred.¹ Based on two census data sets in Hong Kong, this paper tries to complement the existing literature by providing a theoretical analysis and an empirical study on the sources of the narrowing gender gap in wages.

The economic literature on gender inequality is largely based on various theories of gender discrimination.² For example, Becker (1957) posits a model in which men and women are perfect substitute in the labor market. Suppose that employers prefer to hire men over women, due to their “taste discrimination”. Then, in equilibrium, men’s wage rate is higher than that of women, and the difference between male and female wage rate is the “discrimination coefficient”. So, narrowing gender gap is explained as resulting from the decrease of “discrimination coefficient.” Moreover, Arrow (1972), Phelps (1972), and Aigner and Cain (1977) develop a theory of “statistical discrimination.” According to this theory, given the impossibility of measuring individual productivity in advance, employers may discriminate against a whole class of workers (e.g. women) based on their perceptions of their average productivity. Based on this framework, it is explained that narrowing gender gap results from the continuous corrections of employers’ perception of women’s average productivity.

This paper first offers a theoretical explanation of the narrowing gender gap from a different perspective by relating the narrowing gender gap to the changing women’s comparative

¹For example, see Forsythe, Korzeniewicz, and Durrant (2000), Rodgers (1998), Lantican, Gladwin, and Seale (1996), O’Neil and Polachek (1993), Sorensen (1991), and Fields and Wolff (1991).

²See Forsythe, Korzeniewicz, and Durrant (2000) and Lantican, Gladwin, and Seale (1996) for excellent reviews of other explanations in sociological as well as economic literature.

advantage. It is based on the important contributions by Polachek (1981) and Galor and Weil (1996). Polachek (1981) provides a model in which the gender inequality in earnings comes from different kinds of human capital accumulated by men and women. Specifically, Polachek argues that due to the gender difference in the periods of work intermittency, the kinds of human capital accumulated by men and women have different “atrophy rates”, and hence different rates of return in a competitive labor market. Thus, he suggests that men and women have different comparative advantages, which result in occupational self-selection and gender inequality. Galor and Weil (1996, 1999) argue that as an economy develops, it is more likely to reward the attributes in which women have a comparative advantage. In particular, they assume that men and women are equally endowed with mental labor, but men possess more physical labor than women. Also, they assume that capital is complementary to mental labor, but substitutable to physical labor. Thus, capital deepening, which leads to economic growth, also reduces the gender gap.

This model extends the existing literature by considering that structural change as another driving force of narrowing gender gap. Our model argues that when an economy transforms from a manufacturing to a service oriented economy, women’s productivity relative to men’s will increase. For example, a man may be more productive than a woman when working in a factory because he is physically stronger. However, a man’s physical strength will not give him any advantage if working as a real estate agent or bank teller. Thus, structural change is in favor of women’s comparative advantage.

In our model, there are two sectors of production — manufacturing and services. The manufacturing sector is physical labor intensive, while the services sector is mental labor (or human capital) intensive. The model implies that the gender gap is smaller in occupations in which physical labor is less intensively used. So, the gender gap is smaller in the services sector. It also implies that moving from a manufacturing economy to a service economy, which is

usually associated with economic development, will result in smaller gender gap.

The implications of our model are tested by empirical analysis. Data sets used in this paper are two one-percent random sub-samples of 1981 and 1991 Hong Kong population censuses. The data are good for testing our theory for two reasons. First, between 1981 and 1991, Hong Kong had experienced very dramatic structural change, which turned Hong Kong from a manufacturing economy into a service economy (e.g. Suen, 1995).³ Second, there was no sex discrimination legislation until 1999, so Hong Kong data sets provide useful framework, which is free from any explicit policy intervention.

The empirical results are strongly supportive of the predictions of our model. For example, we observed larger gender gaps in those occupations which are more physical labor intensive. In particular, gender gaps were much larger in primary and manufacturing sectors than those in service sectors. Meanwhile, interestingly, we find that the gender gap in any specific occupation did not decrease from 1981 to 1991, which implies that the narrowing gender gap in aggregate was due to the changes in distribution of workers in different occupations. Thus, the paper suggests that sectoral shifts is one of the major factors in explaining the narrowing gender gap experienced in Hong Kong.

In what follows, Section 2 sets up a simple model that guides the empirical analysis; Section 3 describes the data; Sections 4 to 6 present the empirical results; Section 7 concludes our discussions.

³ The structural change in Hong Kong had been due to the outsourcing of production from Hong Kong to Mainland China that mainly took place in the 1980s. Since China initiated the "reform and open door" policy in 1978, Hong Kong has been the dominant supplier of foreign direct investment in China due to its geographical proximity and cultural ties with Southern China. For example, by 1990, 3 to 5 million workers in Mainland China are reportedly working directly or indirectly for Hong Kong, compared with the total work force of about 3 million in the territory itself (e.g. Tsang and Cheng, 1997).

II. An Empirical Model

This section develops a simple model that provides a framework for our empirical analysis. In particular, it tries to achieve the following: (1) examining the relative gender gaps in different occupations for individuals with different endowments in both physical labor and mental skills (i.e. educational attainment); (2) investigating how individuals may choose or change their occupations in response to their comparative advantages.

We assume that there are two sectors of production in an economy: a manufacturing sector and a services sector. There are two factors of production: physical labor and mental labor. For the purpose of this paper, the manufacturing sector and the services sector differ in that the manufacturing sector is more physical labor intensive than that of the services sector. Formally, we assume that the per worker production function in the two sectors is described as follows:

$$E_{ij} = p_j A_j (h_i)^{\alpha_j} (l_i)^{1-\alpha_j} \quad (1)$$

where “ E ” denotes output per worker; “ h ”, “ l ” denote the mental labor input and the physical labor input of a worker respectively; “ p ” and “ A ” denote the price of the output and a positive parameter respectively; the subscript “ i ” denotes a worker’s type; the subscript “ j ” denotes the sector of production (“ j ” takes either of the two notations: “ $j=M$ ” denotes “Manufacturing” sector; “ $j=S$ ” denotes “Services” sector.)

The property that the manufacturing sector is more physical labor intensive than the services sector is captured by the following assumption,

$$\alpha_M < \alpha_S$$

There are two types of workers: male (“ $i=m$ ”) and female (“ $i=f$ ”). A worker’s mental labor is determined by her/his education attainment, while physical labor is determined by one’s gender. We assume that female and male workers are endowed with “ l ” and “ $l+a$ ” units of physical

labor respectively and “ a ” is a positive parameter, which captures the assumption that men are more endowed in physical labor than women.

Because labor is the only factor of production in this model, a worker’s output is her/his earnings in a competitive economy. So, based on the above discussion, the gender gap in each sector of production can be described as follows.

$$\ln(E_{mj}) = \ln(E_{fj}) + (1 - \alpha_j)a \quad (2)$$

namely

$$\ln(E_{mj}/E_{fj}) = (1 - \alpha_j)a$$

Because

$$\alpha_M < \alpha_S$$

we have,

$$(1 - \alpha_M)a > (1 - \alpha_S)a$$

Thus

$$\ln(E_{mM}/E_{fM}) > \ln(E_{mS}/E_{fS})$$

In summary, we have the following hypothesis.

Hypothesis 1: *The gender gap in terms of earnings is smaller in the services sector than in the manufacturing sector. More generally, the gender gap is smaller in sector or occupation in which physical labor is less intensively used.*

Next, we examine individuals’ occupational choices. A worker’s utility function is assumed to take the following form:

$$U^k = \ln(E^k) + v^k$$

where subscript “ k ” denotes an individual worker, v^k , which is a random variable, measures an individual’s idiosyncratic taste for working in the manufacturing sector and the services sector.

Depending on her/his occupational choice, E^k and v^k only take two values. So, we can write an individual’s utility as follows:

$$U_j^k = \ln(E_j^k) + v_j^k \quad (3)$$

where “ $j = M \text{ or } S$ ” (i.e *Manufacturing* or *Service*)).

Clearly, an individual will choose to work in the services sector if and only if

$$G^k \equiv U_S^k - U_M^k \geq 0$$

From (1) & (3), we have

$$G^k = \ln(p_S A_S / p_M A_M) + (\alpha_S - \alpha_M) \ln(h^k) - (\alpha_S - \alpha_M) \ln(l^k) + v_S^k - v_M^k \quad (4)$$

Now, we define

$$\Delta v^k \equiv v_S^k - v_M^k$$

Then, from (4), an individual will choose to work in the services sector if and only if

$$\Delta v^k > -\ln(p_S A_S / p_M A_M) - (\alpha_S - \alpha_M) \ln(h^k) + (\alpha_S - \alpha_M) \ln(l^k) \quad (5)$$

We assume that the cumulative distribution function of the random variable, Δv^k , is denoted by “ $F(.)$ ” with the support $(-\infty, \infty)$. Then, from (5), the probability of working in the services sector is

$$P(G^k > 0) = P(\Delta v^k > -\ln(p_S A_S / p_M A_M) - (\alpha_S - \alpha_M) \ln(h^k) + (\alpha_S - \alpha_M) \ln(l^k))$$

namely

$$P(G^k > 0) = 1 - F[-\ln(p_S A_S / p_M A_M) - (\alpha_S - \alpha_M) \ln(h^k) + (\alpha_S - \alpha_M) \ln(l^k)] \quad (6)$$

We denote the probability density function of Δv^k by “ $f()$ ”, then, from (6), we have,

$$\partial P(G^k > 0) / \partial h^k = f(\cdot)(\alpha_S - \alpha_M) / (h^k) \geq 0 \quad (7)$$

and

$$\partial P(G^k > 0) / \partial l^k = -f(\cdot)(\alpha_S - \alpha_M) / (l^k) \leq 0 \quad (8)$$

Recall the assumptions that $\alpha_S > \alpha_M$ and that a man is endowed with more physical labor than a woman. Then, from (7) & (8), we have the following hypothesis:

Hypothesis 2:

- (a) An individual with higher education attainment is more likely to choose to work in the services sector.*
- (b) Ceteris paribus, men are more likely to choose to work in the manufacturing sector than women.*

The essence of this hypothesis is that an individual will choose the occupation in which he/she enjoys a comparative advantage. Better educated individuals are more likely to choose to work in the services sector, because they have higher mental skills and the services sector is more mental labor intensive. Men are more likely to choose to work in the manufacturing sector than women, because they are more abundant in physical labor, and the manufacturing sector is more physical labor intensive. In particular, this hypothesis implies that well educated women are more likely to work in occupations which are mental labor whereas less educated men will choose more physical labor intensive occupations.

Moreover, it is often observed that women have a greater preference for social interaction, and these opportunities are more prevalent in the services sector. Thus, it is one of the additional factors that may result in more women working in the services sector. Further, if only better educated men work in the services sector while women generally work in the services sector, women will receive a lower relative average wage in the services sector.

Finally, the model provides an explanation for the structural change in Hong Kong. From (6), it is easy to see that more individuals are likely choose to work in the services sector if p_S increases or p_M decreases. Since China launched its “Reform and Open Door” policy in 1978, in the context of the Greater China, which includes both Hong Kong and Mainland China, the output of the manufacturing sector has increased rapidly and continuously. The industrial development in Southern China greatly increases the demand for services (marketing, international trade, finance, etc.) from Hong Kong (see, for example, Sung 1991). Thus, the price of services in Hong Kong has increased significantly, while that of manufactured goods has decreased. This provides a theoretical explanation for the drastic structural change that happened in Hong Kong, particularly in the 1980s.

III. The Data Sets

The data sets used in this study are the one percent random sub-samples of the 1981 and 1991 Hong Kong Population Censuses. Since we are interested in the behaviour of the working population, only individuals that meet the following conditions are included in our analysis: (i) those aged 15 or above; (ii) those with positive main employment income; and (iii) those born in Hong Kong or in Mainland China. Based on the above selection criteria, there are 21,265 and 23,312 individual observations in the 1981 and 1991 one percent random sub-samples respectively.

Insert Table 1 here

Table 1 presents the summary statistics of the two one percent random sub-samples. From the table, we can see that on average male workers were older and have more working experience than female workers. Men were more likely to be born in Mainland China and more likely to be employers or self-employed. One seemingly puzzling fact is related to the average educational attainment. In 1981, men received 1.18 more years of schooling than that of women. However,

this pattern was reversed as women workers, on average, spent 0.25 more years at school than that of men in 1991. One highly possible explanation to this phenomenon is that (i) females benefited more than males when the government expand the provision of elementary education; and (ii) unskilled and/or uneducated women are more likely to quit the labor market than men. Most men, once join will not leave the labor market until they reach retirement age. This can be reflected by the high male labor force participation rate in Hong Kong and throughout the world. On the contrary, female labor force participation rate varied considerably across different age group. Socio-cultural division of labor also plays a part in explaining the relatively low female labor force participation rate. From Table 1, the female labor force participation rates for both 1981 and 1991 census years were the same (49.5%).

IV. Empirical Evidence from Hong Kong

In the literature, there are a variety of ways to measure the gender gap. For example, simple female-male earnings ratio and difference in mean log income have been reported extensively. However, these methods take no account of the heterogeneity of workers. In order to control for variation in individual characteristics, we follow the widely used earnings regression to estimate the gender earnings gap. Mincer (1974) proposes that one's earnings is related to one's schooling and other socio-economic characteristics such that:

$$\ln Y = \alpha + \beta_1 S + \beta_2 S^2 + \beta_3 E + \beta_4 E^2 + \gamma D + \varepsilon$$

where Y is main employment income, S is years of schooling, E is years of work experience, D is a vector of other relevant socio-economic variables and ε is an error term. Work experience is defined as (Age – Schooling – 6). But considering that this definition may overestimate the work experience of female workers, we may include an interaction term of experience with marital status to adjust for the reduced experience and increase home time for married women.⁴

⁴ We thank an anonymous referee for suggesting this method to us.

If we include a female dummy in vector D , the coefficient of the female dummy can be interpreted as the unexplained gender gap.

Insert Table 2A here

Table 2A shows the results of the multiple regression. The first and third columns refer to the earning regressions without an interaction term for experience with marital status. From the table, we can see that with or without the interaction term, the explanatory power and coefficient estimates are broadly the same. The earnings regressions for 1981 captured 30% of the variance in log income. The explanatory power of the earnings equation raised to 42% for 1991. These results are comparable to most earnings regressions done elsewhere. From the table, the coefficient estimate for the female dummy for 1981 is -0.400 which means that women earn 33% (i.e. $1 - e^{-0.400}$) less than that of men, *ceteris paribus*. The earnings disadvantage reduced to 24% (i.e. $1 - e^{-0.279}$) in 1991. In short, the unexplained gender gap narrowed by 9 percentage points in a decade.

Insert Table 2B here

Alternatively, instead of grouping men and women together, we also ran separate earnings regression for men and women and present the results in Table 2B. Those coefficient estimates for men and women are largely comparable with each other. However, the estimates for the marital status dummies differ markedly. Married or divorced or widowed women were at a disadvantage position when compared with single women or male counterparts. This differential can be explained by the fact that women once married will spend more time on household production than men.

(A) Gender Gap by Sector

The model we discussed in Section II implies that the gender gap is larger in industries which require more physical inputs than those demand higher mental inputs. A straightforward test for this hypothesis is to divide the one percent random sub-samples into major industrial sectors and compare the female-male earnings ratio. If the implication of our model is correct, we should observe larger earnings gap in primary and manufacturing sectors than those in service industries. The first two columns of Table 3 show the difference in mean log income of male and female workers for 1981 and 1991 respectively. As expected, primary and manufacturing sectors recorded the highest income differentials in both years. In 1981, female workers employed in manufacturing industries received the lowest income relative to their male counterparts. The difference in mean log income stood at -0.528 . The gender gap of those engaged in primary sector ranked second and the difference in mean log income was -0.514 .⁵ Although the gender gap was large and significant in all sectors, the female-male income ratios in service sectors were substantially below those of primary and manufacturing sectors. The difference in mean log income only varied within a relatively narrow range from -0.200 to -0.357 . As for 1991, the overall pattern was broadly similar to that of 1981. The gender gap was much larger in primary and manufacturing sectors than those in service sectors. Hence, the empirical evidence supports the prediction of our model.

Insert Table 3 here

One may argue, however, the previous method is too crude as it does not account for variation in individual characteristics. So, we make use of the earnings discussed earlier in this section. Firstly, we divide the data set into different industrial sectors. We then run the earning regressions and compare the coefficient estimates of the female dummy. Columns 3 and 4 of Table 3 summarise the earnings regressions' results. In order not to over-burden readers with

⁵ In Hong Kong, there were no female worked in mining and quarrying industries in both census years.

coefficient estimates, Table 3 only presents the coefficient estimates of the female dummy.⁶ Although not shown in the table, all independent variables are statistically significant and have the predicted signs. The coefficient estimate of the female dummy can be regarded as the unexplained gender gap after controlling for individual differences.

As expected, the coefficient estimate and the difference in mean log income for all sectors are in the same order of magnitude. Results of the multiple regressions tell essentially the same story — the gender gap is larger in primary and manufacturing sectors than those in other service sectors. Among all services, women workers in financing, insurance, real estate and business service (sector 8), which demands the least physical inputs, enjoyed the highest female-male earnings ratio. On the contrary, male workers in agriculture, forestry and fishing (sector 1) received the highest income relatively to females. Obviously sector 1 requires the highest physical input among all industrial sectors and it recorded the highest earnings differential. Moreover, the manufacturing sector recorded the second largest gender gap for both years.⁷ In short, evidence from Hong Kong is consistent with our hypothesis.

One puzzling fact appear from Table 3. The gender gap in the manufacturing sector narrowed whereas the wage differential widened in several service sectors. This in fact can be partly attributable to the fact that there were mental labor intensive positions (e.g. accountants and company secretaries) within the manufacturing sector. Those female workers who chose to stay in the manufacturing sector were more likely to receive higher wages than those who left the sector. Hence, the earnings gap narrowed over the decade. On the other hand, when the supply of female workers to a particular service sector increased, their average wage rate would decrease

⁶ Full regression results can be obtained from the authors.

⁷ The proportion of female workers in manufacturing dropped from 46.5% in 1981 to 42.1% in 1991. When the manufacturing base move north, labor intensive jobs were the first to be cut. Those remained in the manufacturing sectors provided support to their production plants in Mainland China. As a result, women workers in manufacturing were less likely to be production workers in 1991 than that in 1981. Our model predict, *cetera peribus*, the gender gap should be improved.

due to supply side effect. As a result, the earnings differential might widen within a particular service sector.

(B) Gender Gap by Occupation

One may argue that within manufacturing sector (or any other sectors), there is a wide variety of industries. While some manufacturing industries are labor intensive which requires more physical labor inputs, other industries are skewed towards mental labor inputs. An alternative approach to test our hypothesis is to analyse the gender gap by occupation. If our model is correct, we should observe that the female-male earnings ratio should be rather low for professionals and managerial personnel. These occupations are usually restricted to those with higher education or skill level. Whether these workers are endowed with high physical strength is immaterial for professionals and managers & administrators in determining their labor productivity. However, those engaged in elementary occupations, such as plant and machine operators, should possess higher physical strength than professionals. Our model predicts a wider gender gap for unskilled and physical labor.

Table 4 presents the gender gap by occupation. Before studying the statistical information in the table, it should be noted that the figures for 1981 are not strictly comparable with those for 1991. The two one percent random sub-samples adopted two different classification systems. In 1991, the classification follows the major groups, with local adaption, of the International Standard Classification of Occupation promulgated by the International Labor Organisation in 1988. As for 1981, the classification system was based on the international standards set in 1968. The 1988 system puts more emphasis on the differentiation of skill level and skill specialisation of jobs than the earlier method (Census & Statistics Department 1993). With this caveat in mind, we should compare the two sets of results with care.

Insert Table 4 here

From the first column of Table 4A, we can see that the differences in mean log earnings for professionals and clerks were the lowest which stood at -0.167 and -0.177 respectively in 1981. In other words, women in these two occupations received an average income of around 80% that of male counterparts. As predicted by our model, the gender gap was highest for physical labor intensive occupations, such as production and related workers. From the table, we can see that the gender gap for these workers was well below -0.5 . However, analysing the difference in mean log income cannot account for differences in individual characteristics. To control for variation in socio-economic characteristics, a better way to study the gender gap is to employ regression analysis. Column 2 of Table 4A shows the coefficient estimate of the female dummy of Mincer type of earnings regression.⁸ After controlling for individual characteristics, the earnings disadvantage for women who worked as clerks or professionals reduced to less than 10 percentage points in 1981. Nevertheless, production and related female workers still earned less than half of that of male counterparts.

If we look at Table 4B, the statistical information in 1991 tells exactly the same story. While occupations that require more mental labor inputs recorded lower gender gaps, jobs that demand substantial physical labor inputs experienced higher earnings differentials. This conclusion is consistent with our model. Moreover, it should be pointed out that researchers, for example Albelda (1986), Gunderson (1989), Brown et al (1980), also try to relate occupational segregation with gender gap.

V. Sectoral Shift and the Narrowing Gender Gap

In the literature, economists use Blinder (1973) or Oaxaca (1974) methods to decompose the gender gap. Basically, their methods separate the gender gap into two components, namely the

⁸ Although not shown in the table, all estimates of the female dummy are statistically significant with t-ratio less than -2 . Full regression results can be obtained from the authors.

coefficient effects and the endowment effects. The main difference between the two equations is the choice of base for decomposition. However, there is no established decomposition method to disentangle the relationship between sectoral shift and earnings differential. We can study the distribution of labor force by industrial sector and shed some lights of the direction of change.

Insert Table 5 here

Table 5A presents the distribution of the labor force by industrial sector. From the table, we can see that the importance of the manufacturing sector diminished substantially from 41.48% to 29.08% between 1981 to 1991. On the contrary, all service sectors experienced an increase in percentage share during the same period. The changing distribution of the labor force was a clear sign of sectoral shifts. From Table 3, we understand that the gender gap for primary and manufacturing sectors were higher than other sectors. As the labor force shifted away from manufacturing sector to service sectors, we should observe a narrowing gender gap.

Moreover, our model implies that it is to females' comparative advantage to work in the services sector than in the manufacturing sector. If more female workers move from the manufacturing sector to the services sector, we should observe a lower earnings differential, *ceteris paribus*. Table 5B shows the distribution of workers by industrial sector by gender. Comparing the distribution of male and female workers, we observed that there were proportionately more women switched from manufacturing to services. From Table 1, we notice that the female labor force participation stood at 49.5% throughout the report period whereas the rate for men dropped slightly. With this kind of composition change, our model predicts a lower gender earnings gap. Although there is no standard approach to decompose the changes in the wage gap due to sectoral shift, we can borrow the methods used by economists in analysing gender gap due to changes

occupational distribution (see, for example, Chiswick et al. 1975).⁹ Basically, we compute the difference in mean log income for men and women for 1991 by using the 1991 and 1981 sectoral distributions.

Suppose

$$G^1 = \sum_{i=0}^9 (\bar{X}_{fi} D_{fi}^1 - \bar{X}_{mi} D_{mi}^1)$$

and

$$G^0 = \sum_{i=0}^9 (\bar{X}_{fi} D_{fi}^0 - \bar{X}_{mi} D_{mi}^0),$$

where G^1 is the raw gender gap in 1991 using the 1991 sectoral distribution; G^0 is the adjusted gender gap using the sectoral distribution in 1981; $\bar{X}_{fi}$ and $\bar{X}_{mi}$ are the mean log income for women and men in sector i respectively; and D_{fi}^1 and D_{fi}^0 are the proportions of female workers in sector i in 1991 and 1981 respectively. If sectoral shift has no effect on the gender gap, G^1 and G^0 should be the same. Our hypothesis, however, predicts that $G^1 > G^0$. Table 6 presents the mean income and mean log income of men and women by industrial sector in 1991.

Insert Table 6 here

Together with the data in Table 5B, we estimated that

$$G^1 = -0.291$$

and

$$G^0 = -0.352.$$

⁹ We thank an anonymous referee for suggesting this decomposition method and pointing this useful reference to us. However, as explained in Section 4B, the two censuses adopted different classifications of occupation making it impossible to apply the same method to analyse the changes in occupational distribution.

So, $G^1 - G^0 = 0.061$. Hence, changes in sectoral composition alone narrowed the gender gap by 6 percentage points. Using similar method, we also calculated the raw and adjusted female-male income ratio are 0.726 and 0.695 respectively. This implies that changes in sectoral distribution narrowed the raw female-male income ratio by 3 percentage points. These results confirm our conjecture that sectoral shifts is one of the key factors in explaining the narrowing gender gap experienced in Hong Kong.

VI. Demand Shifts and the Gender Gap of Educational Attainment

Various studies, for example Suen and Chan (1997), suggest that Hong Kong's labor market is highly flexible and dynamic. Labor moves from one sector to another so as to maximize one's earnings. Hypothesis 2 of our model suggests that unskilled workers stay in physical labor intensive industries whereas more educated workers move to mental labor intensive industries. To test whether our predictions are correct, we confront our model with empirical data.

Insert Table 7 here

Table 7 presents the years of schooling by gender by industrial sector. In 1981, the schooling differential between different industrial sectors was relatively small for both men and women. The small difference is partly attributable to the fact that the average schooling of both groups of workers was low.

The growth of the service sector in the 1980's increased the demand for skilled labor. This in turn raised the incentive for workers to invest in human capital.¹⁰ As shown in Table 1, the

¹⁰ In analysing the changes in wage structure in the US, Katz and Murphy (1992) suggest that the relative wage of women increased substantially in response to the secular growth in the demand for more-educated workers.

average educational attainment of all workers improved substantially from 1981 to 1991. Basic economic principles tell us that workers will choose to work in an industry in which he/she has comparative advantage. Hence educated women workers are more likely to work in mental labor intensive sector. From Table 7, we can see that the average schooling of primary and manufacturing workers was much lower than those in the mental labor intensive sectors. This piece of information is broadly consistent with our prediction. However, one may argue that there are jobs in the manufacturing sector and in the service sector which are mental labor intensive and physical labor intensive respectively. It is useful if we can take a look at schooling by occupation.

Insert Table 8 here

Table 8 compares years of schooling by gender by occupation. Looking down the two columns for both sub-tables, one can conclude that the average educational attainment of professionals was much higher than those of physical labor intensive occupations. If we study row by row carefully, we observed an important change between the two periods. The schooling differentials by occupation were larger in 1981 than those in 1991. In several occupations, the average years of schooling for women was even higher than that of men in 1991. It can be interpreted as the structural change was in favor of women's comparative advantage. Consequently, it sharpened women's incentives to accumulate human capital. Educated women workers joined mental labor professions whereas unskilled counterparts stayed in physical labor intensive positions. This kind of job distribution is consistent with the implications of our Hypothesis 2 of our model.

VII. Concluding Remarks

This paper offers a theoretical and empirical analysis on the sources of the narrowing gender gap in wages, based on two census data sets in Hong Kong. The existing economic literature on

gender inequality is generally based on the theories of gender discrimination. This paper offers a theoretical explanation of narrowing gender gap from a different perspective by relating the narrowing gender gap to the changing women's comparative advantage. The model implies that the gender gap is smaller in occupations in which physical labor is less intensively used. So, it argues that sectoral shift from a manufacturing economy to a service economy, which is usually associated with economic development, is in favor of women's comparative advantage and consequently lead to smaller gender gap.

The data we used in this paper are the one percent random sub-samples of 1981 and 1991 population censuses. Hong Kong provides a unique natural setting to test our model because it had experienced dramatic structural change and there was no explicit policy intervention. In general, the empirical results are supportive of the predictions of our model. We find that the gender gap was much larger in primary and manufacturing sectors than those in services sectors. Moreover, we observed larger gender gap for unskilled labor and the gender gap within occupational groups did not decrease during the period from 1981 to 1991. This implies that the narrowing gender gap in aggregate was largely due to shifting of women workers from occupations with larger gender gaps to those occupations with smaller gender gaps. Thus, the analysis in this paper suggests that sectoral shifts is one of the key factors in explaining the narrowing gender gap experienced in Hong Kong.

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Table 1
Characteristics of the Workforce by Gender

Variable	Male		Female	
	1981	1991	1981	1991
Age	36.1	37.7	32.9	34.0
Years of work experience	20.7	21.2	17.6	17.2
Born in Mainland China (%)	56.7	41.8	43.2	31.1
Years of schooling	5.05	8.95	3.87	9.2
Main employment income (HK\$)	2108	8278	1367	6013
Labor Force Participation Rate (%)	82.5	49.5	78.7	49.5
Employers (%)	5.2	7.7	0.9	2.7
Self-employed (%)	8.4	6.2	3.7	2.4

Table 2A
Earnings Regressions

Independent Variable	1981		1991	
Work Experience	0.032 (26.325)	0.033 (26.746)	0.036 (33.593)	0.037 (34.107)
Work Experience Square	-0.0007 (-31.941)	-0.0006 (-28.802)	-0.0007 (-34.468)	-0.0006 (-29.940)
Years of Schooling	-0.066 (-29.653)	-0.066 (-29.477)	-0.014 (-4.661)	-0.014 (-4.439)
Years of Schooling square	0.007 (44.835)	0.007 (44.594)	0.006 (34.965)	0.006 (34.691)
Born in Mainland China	-0.154 (-17.283)	-0.153 (-17.169)	-0.207 (-25.413)	-0.203 (-24.942)
Female	-0.400 (-48.667)	-0.401 (-48.785)	-0.279 (-38.987)	-0.281 (-39.213)
Employer	0.594 (29.162)	0.597 (29.300)	0.442 (30.467)	0.442 (30.520)
Self-employed	0.024 (1.53)	0.026 (1.682)	0.040 (2.545)	0.040 (2.565)
Married	0.109 (10.026)	0.169 (10.043)	0.139 (14.882)	0.209 (13.694)
Widowed/divorced	-0.011 (-0.461)	-0.091 (-3.103)	0.081 (3.631)	-0.0009 (-0.034)
Experience*Married		-0.004 (-4.682)		-0.005 (-5.815)
R ²	0.304	0.305	0.417	0.418
N	21,265		23,312	

T-statistics are shown in parentheses.

Table 2B
Earnings Regressions

Independent Variable	1981		1991	
	Male	Female	Male	Female
Work Experience	0.038 (27.203)	0.031 (13.401)	0.041 (29.527)	0.037 (21.130)
Work Experience Square	-0.0007 (-26.126)	-0.0006 (-15.601)	-0.0007 (-26.316)	-0.0006 (-17.170)
Years of Schooling	-0.056 (-21.764)	-0.096 (-23.615)	-0.023 (-5.783)	-0.020 (-3.990)
Years of Schooling square	0.006 (34.322)	0.010 (32.300)	0.006 (27.120)	0.007 (25.502)
Born in Mainland China	-0.124 (-12.270)	-0.204 (-12.343)	-0.206 (-20.693)	-0.201 (-14.808)
Employer	0.529 (26.660)	0.851 (12.103)	0.449 (28.017)	0.355 (10.852)
Self-employed	-0.004 (-0.225)	0.049 (1.354)	0.028 (1.596)	0.031 (0.908)
Married	0.316 (14.863)	-0.017 (-0.632)	0.305 (14.513)	0.119 (5.556)
Widowed/divorced	0.047 (1.176)	-0.277 (-6.116)	0.070 (1.863)	-0.126 (-3.416)
Experience*Married	-0.005 (-4.575)	-0.008 (-5.744)	-0.004 (-4.026)	-0.009 (-7.964)
R ²	0.282	0.233	0.393	0.445
N	13,786	7,479	14,889	8,423

T-statistics are shown in parentheses.

Table 3
Gender Gap by Industrial Sector

Industrial Sector	Difference in Mean Log Income		Coefficient of the Female Dummy*	
	1981	1991	1981	1991
1. Agriculture, forestry & fishing	-0.514	-0.646	-0.478	-0.533
2. Mining & quarrying	<i>No female workers</i>			
3. Manufacturing	-0.528	-0.469	-0.470	-0.372
4. Electricity, gas & water	-0.216	-0.390	-0.273	-0.282
5. Construction	-0.218	-0.014	-0.238	-0.174
6. Wholesale & retail trade & restaurants & hotels	-0.357	-0.298	-0.314	-0.267
7. Transport, storage & communication	-0.200	-0.143	-0.136	-0.169
8. Financing, insurance, real estate, & business service	-0.224	-0.224	-0.116	-0.136
9. Services	-0.207	-0.204	-0.197	-0.258
0. Industrial activity not classified	-0.470	-0.203	-0.483	-0.109

* We ran separate earning regressions for each industry and only coefficient estimates of the female dummy are reported here. Detailed regression results can be obtained from the authors.

Table 4
Gender Gap by Occupation

(A) 1981		
Classification of Occupation (at 2-Digit Level)	Difference in Mean Log Income	Coefficient of the Female Dummy*
11–19 Professional, technical & related workers	–0.167	–0.082
21–29 Administrative & managerial workers	–0.274	–0.209
31–39 Clerical & related workers	–0.177	–0.078
41–49 Sales workers	–0.445	–0.349
51–59 Service workers	–0.403	–0.357
61–69 Agricultural, animal husbandry & forestry workers & fishermen	–0.537	–0.454
71–79 Production & related workers, transport equipment operators & laborers	–0.555	–0.539
81–89 Production & related workers, transport equipment operators & laborers	–0.603	–0.557
91–99 Production & related workers, transport equipment operators & laborers	–0.633	–0.552
01–09 Others	–0.457	–0.441

(B) 1991		
Classification of Occupation (at 2-Digit Level)	Difference in Mean Log Income	Coefficient of the Female Dummy*
11–19 Managers & administrators	–0.162	–0.170
21–29 Professionals	–0.211	–0.094
31–39 Associate professionals	–0.130	–0.102
41–49 Clerks	–0.107	–0.078
51–59 Service workers & shop sales workers	–0.355	–0.345
71–79 Craft & related workers	–0.434	–0.414
81–89 Plant & machine operators & assemblers	–0.586	–0.567
91–99 Elementary occupations	–0.341	–0.316
01–09 Others	–0.673	–0.567

* We ran separate earning regressions for each group and only coefficient estimates of the female dummy are reported here. Detailed regression results can be obtained from the authors.

Table 5A
Distribution of Workforce by Industrial Sector

Industrial Sector	1981	1991
1. Agriculture, forestry & fishing	1.74	0.78
2. Mining & quarrying	0.05	0.04
3. Manufacturing	41.48	29.08
4. Electricity, gas & water	0.64	0.69
5. Construction	8.49	7.18
6. Wholesale & retail trade & restaurants & hotels	19	22.38
7. Transport, storage & communication	7.75	10.24
8. Financing, insurance, real estate, & business service	4.9	11.24
9. Services	14.75	18.08
0. Industrial activity not classified	1.19	0.31

All figures are expressed in percentage.

Table 5B
Distribution of Workforce by Industrial Sector by Gender

Industrial Sector	1981		1991	
	Male	Female	Male	Female
1. Agriculture, forestry & fishing	2.1	1.2	1.0	0.4
2. Mining & quarrying	0.1	---	0.1	---
3. Manufacturing	34.2	54.9	26.3	33.9
4. Electricity, gas & water	0.9	0.2	0.9	0.2
5. Construction	12.3	1.4	10.7	1.0
6. Wholesale & retail trade & restaurants & hotels	20.6	16.0	20.9	24.9
7. Transport, storage & communication	10.6	2.5	13.5	4.4
8. Financing, insurance, real estate, & business service	4.3	6.0	10.4	12.6
9. Services	13.5	17.0	15.7	22.3
0. Industrial activity not classified	1.4	0.8	0.3	0.3

All figures are expressed in percentage.

Table 6
Mean Income and Mean Log Income by Industrial Sector in 1991

Industrial Sector	Log Income		Income	
	Male	Female	Male	Female
1. Agriculture, forestry & fishing	8.369	7.723	5,853	3,028
2. Mining & quarrying	8.732		6,515	
3. Manufacturing	8.656	8.187	7,218	4,397
4. Electricity, gas & water	9.043	8.653	10,752	6,069
5. Construction	8.617	8.603	6,761	7,051
6. Wholesale & retail trade & restaurants & hotels	8.745	8.447	8,063	5,564
7. Transport, storage & communication	8.713	8.570	7,116	6,007
8. Financing, insurance, real estate, & business service	9.028	8.804	12,026	7,999
9. Services	8.897	8.693	9,957	7,831
0. Industrial activity not classified	8.391	8.594	8,473	7,675

Table 7
Years of Schooling by Gender by Industrial Sector

Industrial Sector	Years of Schooling of Male		Years of Schooling of Female	
	1981	1991	1981	1991
1. Agriculture, forestry & fishing	3.042	5.273	1.568	3.419
2. Mining & quarrying	4.182	6.000	<i>No female workers</i>	
3. Manufacturing	5.186	8.550	4.151	7.675
4. Electricity, gas & water	5.661	10.035	1.056	11.421
5. Construction	4.997	7.612	2.595	9.928
6. Wholesale & retail trade & restaurants & hotels	4.715	8.763	2.931	8.827
7. Transport, storage & communication	4.677	8.501	3.141	10.805
8. Financing, insurance, real estate, & business service	5.422	11.280	3.733	11.707
9. Services	5.682	9.804	4.321	10.211
0. Industrial activity not classified	5.237	8.563	2.879	10.417

Table 8
Years of Schooling by Gender by Occupation

(A) 1981		
Classification of Occupation (at 2-Digit Level)	Male	Female
11–19 Professional, technical & related workers	9.580	7.702
21–29 Administrative & managerial workers	7.326	6.088
31–39 Clerical & related workers	4.399	2.694
41–49 Sales workers	4.679	3.349
51–59 Service workers	4.460	2.559
61–69 Agricultural, animal husbandry & forestry workers & fishermen	3.289	1.618
71–79 Production & related workers, transport equipment operators & laborers	5.034	4.772
81–89 Production & related workers, transport equipment operators & laborers	5.260	4.137
91–99 Production & related workers, transport equipment operators & laborers	4.662	3.362
01–09 Others	5.211	3.500

(B) 1991		
Classification of Occupation (at 2-Digit Level)	Male	Female
11–19 Managers & administrators	11.216	11.575
21–29 Professionals	15.263	15.226
31–39 Associate professionals	12.584	12.626
41–49 Clerks	10.846	11.107
51–59 Service workers & shop sales workers	8.530	8.470
71–79 Craft & related workers	7.858	6.918
81–89 Plant & machine operators & assemblers	7.466	6.682
91–99 Elementary occupations	6.105	4.363
01–09 Others	5.058	3.321