Gender earning gap among different majors

In Hong Kong

BY

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Abstract This paper explores the relationship between gender earning gap and fields of study among college students in Hong Kong. The aim is to see how gender earning gaps vary from different fields of study, furthermore to predict the possible influence the action of major choice may have on economics. The results reveal that the major choice consideration does not vary significantly from female to male. Popularity of the majors has universality among all students. The popularity of field of study is partially negatively correlated with earnings. And the earnings have certain correlation with gender earning gaps in some fields of study. For example, the fields of study such as “Medical Science” “Finance” yield high monthly earnings also results higher gender earning gaps.

Introduction
From the website of Census and Statistics Department of Hong Kong¹, we can see that nominal wage in Hong Kong has been rising continuously for the past two years, and the fluctuation of real wage differs from industries². Past works on gendering earning differences showed that the wage of male and female increases at a different rate, the wage of female increases at a higher rate than that of male³, and that the gender earning gap is narrowing down⁴. How does the increase in wage in different industries differ from genders? Does field of study affect the gender-earning gap in Hong Kong? In this paper, I will explore the effects of college majors on gendering earning differences.

According to the human capital theory, individual will continue to invest in human capital as long as the marginal benefit is greater than the margin cost. Empirical evidences show that higher schooling will result high future earnings. While when facing the choice of college majors, male and female have different

see in appendix 1
considerations. For instance, women, with more anticipations in future family obligations, will have less occupational chances thus invest less in human capital. It is sensible to assume that woman will choose schooling that demand less continuous human capital investment. While men, having the privilege of sex advantages will choose schooling with higher occupational yields in the future and requiring higher human capital investment. Past works have shown that the difference in preference of college majors and occupational choice together accounts for one or two third of the gendering earning gap. This finding indicates that the difference in gender earning might be a self-fulfilling phenomenon. In other words, young woman, with anticipation of less occupational commitment choose the college major that yields less in human capital. If this is the case, when studying the true loss of gender discrimination, economists shall eliminate the fields of study differences in order to get more accurate results.

In the vertical dimension of human capital investment, the higher the degree achieved the higher it will yields in future earnings. In this paper, I will explore the yields of human capital investments at a horizontal level and its influence on gender earning differences. That is, the gender earning gap among different college majors in Hong Kong.

Literature Review

Hong Kong enacted a Sex Discrimination Ordinance in the year 1996, which prohibits discrimination on the grounds of sex, marital status or pregnancy.

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8 Job Preferences, College Major, and the Gender Gap in Earnings, Daymont, Thomas N; Andrisani, Paul J. The Journal of Human Resources19. 3 408.(Summer 1984)
9 Gender Equality and social institution in Hong Kong, China by Development center OECD, :
While people acknowledge gender discrimination still exists\(^\text{10}\), according to a survey by the US Department of State, almost 80 per cent of female workers in Hong Kong, China believe that they are discriminated against, that they have lower salaries than men and that they have fewer promotion opportunities.\(^\text{11}\) According to Sharon’s study in the year 2006\(^\text{12}\), women perceive more personal gender discrimination than men in Hong Kong. However, the awareness of gender discrimination brings more benefits to women than to men.

The natural of gender discrimination can be explained by the Becker’s model: Assume the employer’s goal is to maximize its profit \(\pi\). Let \(w\) and \(w_f\) denotes the wages of male and female respectively, and \(N\) and \(N_f\) denote their corresponding employment levels. Employer utility is given by:

\[
U = U(\pi, w, \delta_e) = \pi - \delta_e (w_f N_f)
\]

Where \(\delta_e\) is the coefficient of employer discrimination. The equation shows that the utility of the employer increases as the profits increased while decreases as additional female employee is employed, by \(\delta_e\) amount. Intuitively, the cost to the employer of hiring an additional male worker is \(w\) whereas that of hiring an additional female worker is \(w_f (1+\delta_e)\).

Let \(\omega\) denotes the earning gap between male and female workers:

\[
\omega = (w - w_f) / w_f
\]

According to the Becker’s Model of Employer Discrimination\(^\text{13}\), the employer will exclusively employs female workers if the earning gap is bigger than the coefficient of employee discrimination, \(\omega > \delta_e\), and male workers if the coefficient is less than the earning gap coefficient, \(\omega < \delta_e\). When the two coefficients are equal there will be no difference for the employer to hire male or female workers.

Thus, gender earning gap “\(\omega\)” can be a good indicator of employee discrimination \(\delta_e\). In this paper, I will look at the gender earning gap in order to find insights of

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\(10\) Students’ choices of college majors that are gender traditional and nontraditional, Anne Childers Lackland; De Lisi, Richard. Journal of College Student Development, 42. 1 Jan/Feb 2001.


\(12\) Antecedents and Consequences of Perceived Personal Gender Discrimination: A Study of Solicitors in Hong Kong ORIGINAL ARTICLE Sharon Foley & Hang-yue Ngo & Raymond Loi.

\(13\) The economics of discrimination by Gary S. Becker
sex discrimination. In Hong Kong, according to the general household survey, the female-male median earning ratio is 0.67 in 1986 and 0.73 in 1991\textsuperscript{14}. In other words, the earning gap $\omega$ in 1986 is 49.25\% while in 1991 is 40.84\%. The decrease in the number shows the decrease in the coefficient of employer discrimination $\delta_e$. Evidences show that the gender-earning gap has been narrowing down in the past few decades\textsuperscript{15}. A recent study shows that education expansion for female students can be the reason for the narrowing down gender earning gap in Hong Kong, but only to a limit\textsuperscript{16}. With the disadvantage of woman's attribute prices, the gender discrimination will persist.

Past works has been done to analysis the relationships between the college major and the gender-earning gap. Polacheck's work in 1955 and 1973 indicate that individuals choose their college major based on the expectation of lifetime labor-force commitment, regardless of the sex. However, strong sex differences in the choice of major remained after adjustments have been made\textsuperscript{17}. Woman predominately majored in education and humanity, while men in business; and there is an increase in the percentage of students majored in social science. Then Polacheck came to the conclusion that the implied link between sex differences in different college major is important for both research and policy making\textsuperscript{18}.

Woman, with more obligations in the future family, tends to invest less in their human capital, which in turn reduce their occupational chances\textsuperscript{19}. Polacheck's work indicate that female with less labor market commitment prefer fields which demand less investment in human capital compared to male\textsuperscript{20}. Thus, the degree of gender earning gap is expected to drop when the difference in human capital endowment reduced.

\textsuperscript{15} Gender earnings differentials in Hong Kong: The effect of the state, education, and employment Yue-Ping Chung
\textsuperscript{16} Industrial dualism, income, and gender inequality in Hong Kong William Keng Mun Lee. Asian Affairs, an American Review24. 1 : 15-33, Spring 1997
\textsuperscript{17} College major choice and changes in the gender wage gap Eide, Eric. Contemporary Economic Policy12. 2 : 55,.Apr 1994
\textsuperscript{19} Becker, G. S. A treatise on the family (enlarged ed.). Cambridge MA: Hardvard University Press.1991
Past works has been done in Europe, and the outcome showed that Mathematics, Engineering and Medical Sciences graduates usually has the highest wages. And the gender earning gap is large in these areas while less obvious in the fields with fewer incomes. In other words, the study field that yields less income usually has less obvious gender discrimination. However Hong Kong is different from Europe in the almost every democratic aspect, when female in Hong Kong decide to make their choice of study, future family obligations might not be as strong an assumption as in Europe\(^{21}\).

Certainly, the choice of study field vary greatly due to personal preferences, female and male students have different interests and work inclinations\(^{22}\). So it is more reasonable to exclude all those variables in order to get the direct effects of the fields of study on gender earning gap. However, personal preference or family background is not for consideration in this paper, due to the limitation of survey credibility. Though industry factors are considered in this paper, the following regression analysis mostly based on the graduates from the same industry. The mean analysis doesn’t take different industries into consideration; thus, the results might be different from the regression method and the mean average method. This is partly due to the job preference in human resource theory, basically it address the possibility that a person is not work according to his study\(^{23}\).

**Methodology**

Data used is the 2006 Population By-census 5\%, which was conducted in the eighteen-day period from 15 July to 1 August 2006. It was a sample enquiry on a broad range of demographic and social-economic characteristics of population. About one –tenth of all quarters in Hong Kong were sampled and all households therein were included in the enquiry\(^{24}\).

\(^{21}\) Transfer students in STEM majors: Gender differences in the socialization factors that influence academic and social adjustment by Dimitra Lynette Jackson


\(^{23}\) Gender differences in participation and earnings in Hong Kong., Chau Kiu Cheung Jounal of Contemprory Asia Vol.32 No.1 2002

\(^{24}\) 2006 Population By-census
This study targets at First degree undergraduate students from institutions in Hong Kong, including distance learning first-degree courses and other first-degree courses and Postgraduate degrees students, which including Postgraduate certificate/diploma courses in institutions in Hong Kong and Master degree course in institutions in Hong Kong. The classification of the study fields is based on the current situation in Hong Kong University System and the categories in the 5% Population by Census data. Specifically, all the fields of study are divided into 10 categories including 1 reference group, denoted as “Others”. The 9 main categories are: (1) Social Science, denoted as SocialSc in the following of the paper, including study in Humanity and studies in Social and behavioral science. (2) Science, including studies in Life science, Physical sciences Mathematics and statistics and Computing. (3) Education, including studies in Teacher training and education service. (4) Accounting, studies in Accountancy and studies in secretarial skills. (5) Finance, studies in Business administration and financial management. (6) Arts, including studies in Arts and Architecture. (7) Law (8) Medical Science, denote as MedicalSc, studies in Health. (9) Service, including studies in Transport services, Journalism and information, Social services, Personal Services and Security Services. The reference group is Others, including studies in Environment protection, Construction civil and structural engineering, Medical and marine engineering, production and industrial engineering, chemical engineering, Electrical engineering and Others programs. These areas are denoted as “Others” mainly because they are not common college majors in the 7 college institutions in Hong Kong.

Two ways to estimate the gender discrimination in this paper, the first is the gender earning gap $\omega \equiv (w-w_t)/w_t$. The other way is the Oaxaca model25. That is: assume that the true log earning function for male is:

$$\ln Y_m = b_m X_m + e_m,$$

Similarly the true log earning function for female is

$$\ln Y_f = b_f X_f + e_f.$$
Where the dependent variable is the log earning, and Xm and Xf are variables use to explain the pay structure, bm and bf are the coefficients, em and ef are the error terms. After running the regression and get the estimated bm’ and bf, if there is no gender discrimination between male and female, then it can be conducted that bm=bf. With the same endowments, the effects of the endowments, that are the coefficients, should be the same. Thus, the supposed female log earning equation with no discrimination should be:

\[ \text{LnYf}'=bmXf+ef \]

The difference between the true male earning and the no discriminated female earning is:

\[ \text{LnYm-LnYf}'=bm(Xm-Xf) \]

Similarly, the difference between the no discrimination female earning and the true female earning is:

\[ \text{LnYf}'-\text{LnYf}=Xf(bm-bf) \]

Adding up the above two equation, we can get the earning difference between male and female:

\[ \text{LnYm-LnYf}=bm(Xm-Xf)+Xf(bm-bf) \]

The gender earning difference is composite by two parts, the first part “Xm-Xf” is the difference of endowments, such as education, age, year of schooling etc. the other part is the difference in the coefficients of the endowments, “bm-bf”. This part can be an indicator of wage discrimination. In this paper, I’ll treat the ten different fields of study as endowments to see the difference of their coefficients among different college majors.

**Results of the Study**

The following table shows an overview of the population disparity among Hong Kong College students (undergraduate and postgraduate first-degree courses).

**Figure 1**

<table>
<thead>
<tr>
<th>Variables</th>
<th># of students</th>
<th>Mean</th>
<th>Std. Dev</th>
<th>Min</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>26623</td>
<td>0.5076438</td>
<td>0.499951</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>SocialSc</td>
<td>26623</td>
<td>0.1489314</td>
<td>0.356028</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Science</td>
<td>26623</td>
<td>0.1602374</td>
<td>0.366833</td>
<td>0</td>
<td>1</td>
</tr>
</tbody>
</table>
The total number of college students suitable for this study is 26623. In this paper, the fields of studies is divided into 10 different categories, excluding “Others” which constitutes 14.30% of the total population, the average amount of population for each fields of study is 9.52%. The fields of study above this amount will be viewed as popular fields in the following part of this paper, which are Finance, Natural Science and Social Science. Students in the field of finance constitutes the most (26.03%) of the total population. Which is accordance with the fact that Hong Kong is a major financial center in Asia. Traditional fields of study as Social Science and Natural Science still constitutes considerable amount of population, with 14.89% and 16.023% respectively. And other fields of study, such as “Accounting” “Arts” and Education” are less popular among college students in Hong Kong.

Separating the ten different fields study and using SAS program to calculate the average monthly earning (denote as Monthly Income in the table), population (denote as # of graduates in the table) and the standard deviation of the monthly earnings (denote as Standard Deviation in the table), I get the following table. Female and Male college students are separated in each fields and the total earning is the average monthly earning of the whole fields. Gender Earning Gap is calculated by using the formula: $\omega = (w - w_f)/w_f$.

<table>
<thead>
<tr>
<th></th>
<th>Female</th>
<th>Male</th>
<th>Total</th>
<th>Gender Earning Gap</th>
</tr>
</thead>
<tbody>
<tr>
<td>Education</td>
<td>26623</td>
<td>0.0455621</td>
<td>0.208537</td>
<td>0</td>
</tr>
<tr>
<td>Accounting</td>
<td>26623</td>
<td>0.06716</td>
<td>0.250304</td>
<td>0</td>
</tr>
<tr>
<td>Finance</td>
<td>26623</td>
<td>0.2603388</td>
<td>0.438828</td>
<td>0</td>
</tr>
<tr>
<td>Arts</td>
<td>26623</td>
<td>0.0392893</td>
<td>0.194286</td>
<td>0</td>
</tr>
<tr>
<td>Law</td>
<td>26623</td>
<td>0.0175788</td>
<td>0.131417</td>
<td>0</td>
</tr>
<tr>
<td>MedicalSc</td>
<td>26623</td>
<td>0.0649438</td>
<td>0.246431</td>
<td>0</td>
</tr>
<tr>
<td>Service</td>
<td>26623</td>
<td>0.0529242</td>
<td>0.223886</td>
<td>0</td>
</tr>
<tr>
<td>Others</td>
<td>26623</td>
<td>0.1430342</td>
<td>0.350114</td>
<td>0</td>
</tr>
<tr>
<td>Monthly Income</td>
<td>SocialSc</td>
<td>23549.12</td>
<td>30376.96</td>
<td>26100.39</td>
</tr>
<tr>
<td># of Graduates</td>
<td>2506.00</td>
<td>1495.00</td>
<td>4001.00</td>
<td></td>
</tr>
<tr>
<td>Standard Deviation</td>
<td>20365.32</td>
<td>27920.31</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Monthly Income</td>
<td>Science</td>
<td>20923.94</td>
<td>27901.09</td>
<td>25665.33</td>
</tr>
<tr>
<td># of Graduates</td>
<td>1367.00</td>
<td>2899.00</td>
<td>4266.00</td>
<td></td>
</tr>
<tr>
<td>Standard Deviation</td>
<td>17921.44</td>
<td>23199.46</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Monthly Income</td>
<td>Education</td>
<td>23035.87</td>
<td>33840.56</td>
<td>15348.35</td>
</tr>
<tr>
<td># of Graduates</td>
<td>924.00</td>
<td>289.00</td>
<td>4266.00</td>
<td></td>
</tr>
<tr>
<td>Standard Deviation</td>
<td>16043.66</td>
<td>16624.11</td>
<td>32667.77</td>
<td></td>
</tr>
<tr>
<td>Monthly Income</td>
<td>Accounting</td>
<td>21730.73</td>
<td>35322.59</td>
<td>27127.95</td>
</tr>
<tr>
<td># of Graduates</td>
<td>1078.00</td>
<td>710.00</td>
<td>1788.00</td>
<td></td>
</tr>
<tr>
<td>Standard Deviation</td>
<td>21241.83</td>
<td>33422.02</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Monthly Income</td>
<td>Finance</td>
<td>23944.70</td>
<td>36532.00</td>
<td>29777.97</td>
</tr>
<tr>
<td># of Graduates</td>
<td>3719.00</td>
<td>3212.00</td>
<td>6931.00</td>
<td></td>
</tr>
<tr>
<td>Standard Deviation</td>
<td>21842.37</td>
<td>32672.19</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Monthly Income</td>
<td>Arts</td>
<td>21743.99</td>
<td>31541.43</td>
<td>27017.37</td>
</tr>
<tr>
<td># of Graduates</td>
<td>483.00</td>
<td>563.00</td>
<td>1046.00</td>
<td></td>
</tr>
<tr>
<td>Standard Deviation</td>
<td>18287.97</td>
<td>27060.13</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Monthly Income</td>
<td>Law</td>
<td>43306.50</td>
<td>52431.55</td>
<td>48453.96</td>
</tr>
<tr>
<td># of Graduates</td>
<td>204.00</td>
<td>264.00</td>
<td>468.00</td>
<td></td>
</tr>
</tbody>
</table>
Excluding “Others”, the average gender earning gap among all the 9 fields is 0.42. Fields with a gender earning gap higher than the average are Accounting, Medical Science, Finance, Education and Arts. Others are lower than the average. It is understandable why Medical Science yields in a high gender earning gap, because Medical Science including studies in medicine; nursing; dentistry; psychiatry; radiology; pharmacy etc. 26 Nurses, the female dominant occupation, tend to have lower wages than that of doctors. This may induce a high gender earning gap due to the low average wages of female nurses. The reason for other fields with high gender earning gaps is not clear.

To see the relationship between gender earning gap and the monthly earnings more clearly, the above table is transformed into the following chart. The blue

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26 2006 Population By-census Sample Dataset
bar represents Female and red represents male. Gender earning gap is amplified by 10000 times to match the units of monthly earnings.

Figure 3

In the above chart, gender-earning gap is in its descending order and the field of “Others” is not in the chart.

Excluding the field with the highest gender earning gap, that is accounting, and the field with the lowest gender earning gap, that is Law, it can be seen from the chart that as gender earning gap decreases, the total average monthly earning decreases (with fluctuations) as well. To see whether the fields of study have a significant influence on the monthly earnings, other influencing factors have to be excluded from the model.

The earnings of an individual is generally believed to be influenced by factors such as, gender, experience, marital status, and whether he or she is a
postgraduate or not in the case of this research. Apart from the above factors, I also include industrial factors in the model. All the industries are divided into 7 different areas in this paper, which are “Manufacturing” (the reference group), “Public Utility” (denote as “PubUtility” in the following table), “Construction”, “Wholesale”, “Transport”, “Financial Management” (denote as “Financial” in the following table) and “Services”.

In sum, the model is to use variables Male, Experience, Experience Square, Marital Status, Postgraduate, the 9 different fields (reference group “Others”) and 6 different industries (reference group “Manufacturing”) to explain Log (Monthly Earning).

The following table is get from the SAS program using the above factors.

**Figure 4**

<table>
<thead>
<tr>
<th>The REG Procedure</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Model:</strong></td>
<td>Log Earning Model</td>
</tr>
<tr>
<td><strong>Dependent Variable:</strong></td>
<td>Log Earning</td>
</tr>
<tr>
<td><strong>Number of Observations</strong></td>
<td>Read 26582</td>
</tr>
<tr>
<td><strong>Number of Observations</strong></td>
<td>Used 26582</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Analysis of Variance</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Source</strong></td>
<td><strong>DF</strong></td>
</tr>
<tr>
<td>Model</td>
<td>20</td>
</tr>
<tr>
<td>Error</td>
<td>26561</td>
</tr>
<tr>
<td>Corrected Total</td>
<td>26581</td>
</tr>
<tr>
<td>Root MSE</td>
<td>0.71299</td>
</tr>
<tr>
<td>Dependent Mean</td>
<td>9.9149</td>
</tr>
<tr>
<td>Coeff Var</td>
<td>7.19112</td>
</tr>
</tbody>
</table>

| Parameter Estimate |  |

<p>| | | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Variable</td>
<td>DF</td>
<td>Parameter</td>
<td>Standard Error</td>
<td>t Value</td>
<td>Pr&gt;</td>
</tr>
<tr>
<td>---------------</td>
<td>----</td>
<td>-----------</td>
<td>----------------</td>
<td>---------</td>
<td>---------</td>
</tr>
<tr>
<td>Intercept</td>
<td>1</td>
<td>9.04416</td>
<td>0.02267</td>
<td>399.0</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td>male</td>
<td>1</td>
<td>0.22235</td>
<td>0.0096</td>
<td>23.16</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td>EXP</td>
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<td>0.06665</td>
<td>0.0019</td>
<td>35.1</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td>EXP2</td>
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<td>-0.00131</td>
<td>0.0000563</td>
<td>-23.2</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td>Married</td>
<td>1</td>
<td>0.1826</td>
<td>0.01045</td>
<td>17.48</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td>Postgraduate</td>
<td>1</td>
<td>0.35567</td>
<td>0.01138</td>
<td>31.24</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td>SocialSc</td>
<td>1</td>
<td>0.04581</td>
<td>0.01704</td>
<td>2.69</td>
<td>0.0072</td>
</tr>
<tr>
<td>Science</td>
<td>1</td>
<td>-0.01633</td>
<td>0.01618</td>
<td>-1.01</td>
<td>0.3128</td>
</tr>
<tr>
<td>Education</td>
<td>1</td>
<td>0.03764</td>
<td>0.02501</td>
<td>1.5</td>
<td>0.1324</td>
</tr>
<tr>
<td>Accounting</td>
<td>1</td>
<td>-0.01775</td>
<td>0.02095</td>
<td>-0.85</td>
<td>0.397</td>
</tr>
<tr>
<td>Finance</td>
<td>1</td>
<td>0.0207</td>
<td>0.01492</td>
<td>1.39</td>
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</tr>
<tr>
<td>Arts</td>
<td>1</td>
<td>-0.01363</td>
<td>0.02511</td>
<td>-0.54</td>
<td>0.5872</td>
</tr>
<tr>
<td>Law</td>
<td>1</td>
<td>0.29423</td>
<td>0.03519</td>
<td>8.36</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td>MedicalSc</td>
<td>1</td>
<td>0.2754</td>
<td>0.02207</td>
<td>12.48</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td>Service</td>
<td>1</td>
<td>0.02163</td>
<td>0.02298</td>
<td>0.94</td>
<td>0.3466</td>
</tr>
<tr>
<td>PubUtility</td>
<td>1</td>
<td>0.24572</td>
<td>0.06113</td>
<td>4.02</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td>Construction</td>
<td>1</td>
<td>-0.21178</td>
<td>0.02981</td>
<td>-7.11</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td>Wholesale</td>
<td>1</td>
<td>-0.09265</td>
<td>0.0189</td>
<td>-4.9</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td>Transport</td>
<td>1</td>
<td>-0.01511</td>
<td>0.02207</td>
<td>-0.68</td>
<td>0.4938</td>
</tr>
<tr>
<td>Financial</td>
<td>1</td>
<td>0.2243</td>
<td>0.01767</td>
<td>12.69</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td>Services</td>
<td>1</td>
<td>-0.08348</td>
<td>0.01817</td>
<td>-4.6</td>
<td>&lt;.0001</td>
</tr>
</tbody>
</table>

The total number of observations decreases by the amount of those who are graduate but not able to work in one of the seven fields. The results give insights that Law and Medical Science have a positive influence on one’s earning given all other factors constant, whereas other fields of study don’t seem to have a significant influence on one’s monthly earnings. The reason for this I suppose is that after graduation, college students might choose a different industry with his college major. For instance, a social science student might choose to work in the area of finance. Thus, after controlling the industry factors in the model, the major effect is minimized. In other words, a person’s education background is not a significant factor that influences his earnings if he chooses to work in a specific industry. The two majors that matters are very professional college majors that is Law and Medical Science. Students who study in these fields
certainly have an advantage in the industry they work in, for instance, the hospitals and the court.

As we can see from the figure, the 6 industries excluding the reference group “Manufacturing” mostly have a significant effect on monthly earnings. In fact except the industry “Transport” every industry factor is statistically significant on the dependent variable. “Public Utility” and “Finance” are the industry yields higher earning compared to “Manufacturing” (Reference group), whereas “Construction” “Wholesales” and “Service” are less profile than “Manufacturing”.

This paper aimed at exploring the gender earning difference among different college majors, so it is necessary to run the above model separately among male and female college students to see the differences between the two sexes.

The results are in the following tables. (The above one is the results of female)

**Figure 5**

<table>
<thead>
<tr>
<th>Part1</th>
<th>The REG Procedure For Female</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Model: Log Earning Model</td>
</tr>
<tr>
<td></td>
<td>Dependent Variable: Log Earning</td>
</tr>
<tr>
<td></td>
<td>Number of Observations Read 13092</td>
</tr>
<tr>
<td></td>
<td>Number of Observations Used 13092</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Source</th>
<th>DF</th>
<th>Sum of Squares</th>
<th>Mean Square</th>
<th>F</th>
<th>Pr&gt;F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model</td>
<td>18</td>
<td>1670.79618</td>
<td>92.82201</td>
<td>167.54</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td>Error</td>
<td>13073</td>
<td>7242.94793</td>
<td>0.55404</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Corrected</td>
<td>13091</td>
<td>8913.74411</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| Root MSE Dependent MEAN | 0.74434     |
| R-Square Adj R-Sq | 0.1874 0.1863 |
| Variables | DF | Parameter Estimates | Standard Error | t Value | Pr > |t| |
|-----------|----|---------------------|----------------|---------|------|---|
| Intercept | 1  | 9.09824             | 0.03934        | 231.25  | <.0001 |
| EXP       | 1  | 0.06986             | 0.00265        | 26.41   | <.0001 |
| EXP2      | 1  | -0.00145            | 0.00008655     | -16.77  | <.0001 |
| Postgraduate | 1 | 0.45418             | 0.01825        | 24.89   | <.0001 |
| SocialSc  | 1  | 0.19361             | 0.03136        | 6.17    | <.0001 |
| Science   | 1  | 0.07215             | 0.03402        | 2.12    | 0.0339 |
| Education | 1  | 0.17307             | 0.03771        | 4.59    | <.0001 |
| Accounting| 1  | -0.01453            | 0.03559        | -0.41   | 0.6832 |
| Finance   | 1  | 0.06079             | 0.02999        | 2.03    | 0.0426 |
| Arts      | 1  | 0.06949             | 0.04354        | 1.6     | 0.1105 |
| Law       | 1  | 0.37232             | 0.05918        | 6.29    | <.0001 |
| MedicalSc | 1  | 0.40091             | 0.036          | 11.14   | <.0001 |
| Service   | 1  | 0.14982             | 0.03716        | 4.03    | <.0001 |
| PubUtility| 1  | 0.26841             | 0.14845        | 1.81    | 0.0706 |
| Construction| 1 | -0.06306            | 0.06849        | -0.92   | 0.3572 |
| Wholesale | 1  | -0.13336            | 0.03072        | -4.34   | <.0001 |
| Transport | 1  | 0.01063             | 0.03686        | 0.29    | 0.773  |
| Financial | 1  | 0.20756             | 0.02956        | 7.02    | <.0001 |
| Services  | 1  | -0.26015            | 0.02916        | -8.92   | <.0001 |

### Part2

The REG Procedure For Male

Model: Log Earning Model
Dependent Variable: Log Earning

Number of Observations Read 13490
Number of Observations Used 13490

### Analysis of Variance

<table>
<thead>
<tr>
<th>Source</th>
<th>DF</th>
<th>Sum of Squares</th>
<th>Mean Square</th>
<th>F Value</th>
<th>Pr&gt;F</th>
</tr>
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<tbody>
<tr>
<td>Model</td>
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<td>2253.04712</td>
<td>125.16928</td>
<td>276.92</td>
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<tr>
<td>Error</td>
<td>13471</td>
<td>6088.85497</td>
<td>0.452</td>
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<td></td>
</tr>
<tr>
<td>Corrected Total</td>
<td>13489</td>
<td>8341.90209</td>
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</tr>
</tbody>
</table>
### Root MSE
0.67231

### Dependent MEAN
10.0842

### Coef Var
6.66694

### Parameter Estimates

| Variables   | DF | Parameter Estimates | Standard Error | t Value  | Pr > |t| |
|-------------|----|---------------------|----------------|----------|------|---|
| Intercept   | 1  | 9.11483             | 0.02653        | 343.59   | <.0001 |
| EXP         | 1  | 0.09386             | 0.00235        | 39.91    | <.0001 |
| EXP2        | 1  | -0.00182            | 0.0007033      | -25.94   | <.0001 |
| Postgraduate| 1  | 0.28321             | 0.01418        | 19.98    | <.0001 |
| SocialSc    | 1  | -0.11237            | 0.02191        | -5.13    | <.0001 |
| Science     | 1  | -0.0548             | 0.01777        | -3.08    | 0.0021 |
| Education   | 1  | -0.02019            | 0.04266        | -0.47    | 0.636  |
| Accounting  | 1  | 0.03511             | 0.02823        | 1.24     | 0.2137 |
| Finance     | 1  | 0.02282             | 0.01729        | 1.32     | 0.1869 |
| Arts        | 1  | -0.05108            | 0.03096        | -1.65    | 0.099  |
| Law         | 1  | 0.2296              | 0.04334        | 5.3      | <.0001 |
| MedicalSc   | 1  | 0.23429             | 0.03193        | 7.34     | <.0001 |
| Service     | 1  | -0.1125             | 0.03285        | -3.42    | 0.0006 |
| PubUtility  | 1  | 0.26483             | 0.06425        | 4.12     | <.0001 |
| Construction| 1  | -0.21037            | 0.03228        | -6.52    | <.0001 |
| Wholesale   | 1  | -0.07579            | 0.02343        | -3.23    | 0.0012 |
| Transport   | 1  | -0.02439            | 0.02669        | -0.91    | 0.3609 |
| Financial   | 1  | 0.2395              | 0.02135        | 11.22    | <.0001 |
| Services    | 1  | 0.14405             | 0.02303        | 6.26     | <.0001 |

### Part3

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<th>bm</th>
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<th>Xm</th>
<th>Xf</th>
<th>Xm-Xf</th>
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<td>0.2374351</td>
<td>0.4284296</td>
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<td>9.09824</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Wholesale</td>
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<tr>
<td>Financial</td>
<td>0.2395</td>
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<tr>
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<td>0.0821876</td>
</tr>
<tr>
<td>Category</td>
<td>bm</td>
<td>bm-bf</td>
<td>Xf*(bm-bf)</td>
<td>sum</td>
</tr>
<tr>
<td>---------------</td>
<td>------------</td>
<td>-------</td>
<td>------------</td>
<td>------------</td>
</tr>
<tr>
<td>PubUtility</td>
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<td>0.0088955</td>
<td>0.0019859</td>
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<tr>
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<tr>
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</tr>
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<td>0.2376575</td>
<td>0.2836847</td>
</tr>
<tr>
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<td>0.2144552</td>
<td>0.1041094</td>
</tr>
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<td>0.0214233</td>
<td>0.0705775</td>
</tr>
<tr>
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<td>0.40091</td>
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<td>0.0886037</td>
</tr>
<tr>
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</tr>
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<td>0.1539108</td>
</tr>
<tr>
<td>SocialSc</td>
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<td>0.19361</td>
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<td>0.1912618</td>
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<tr>
<td>EXP2</td>
<td>-0.00182</td>
<td>-0.00145</td>
<td>271.7988139</td>
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</tr>
<tr>
<td>Total</td>
<td></td>
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<td>73.2846068</td>
</tr>
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</table>

bm*(Xm-Xf) bm-bf Xf*(bm-bf) sum
<table>
<thead>
<tr>
<th>lnYf</th>
<th>lnYm</th>
<th>lnYf-lnYm</th>
</tr>
</thead>
<tbody>
<tr>
<td>9.7404455</td>
<td>10.0842029</td>
<td>0.3437574</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>bm*(Xm-Xf)</th>
<th>Xf*(bm-bf)</th>
<th>Sum1/Sum2</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.091957932</td>
<td>0.252675903</td>
<td>0.363936297</td>
</tr>
</tbody>
</table>

Figure 6 is composite by 3 parts; the first two are the regression of log earning equation on male and female students. The log earning equation is different from the equation in figure 5 in that the model excludes “male” in the equation for the reason that male and female are separated.

To interpret these results, the maximizing income year of experience (the parameter of EXP divided by the parameter of EXP2 times 2, where EXP stands for experience and EXP2 stands for experience square. For female, the maximizing income experience is 24.09 years, for male is 25.79 years. Male has a slightly age advantage than that of female.

Given other factors constant, if a female college student pursues a postgraduate degree, her monthly income is supposed to increase by 45.42%, whereas under the same condition, the income of a male college student will only increase by 28.32%. That is to say, the payoff of additional human capital investment (in Postgraduate) is higher for female than that for male. After calculating, the number of students who pursue a postgraduate degree is 2015 for female and 3056 for male. It can be seen that although female students have a higher payoff in terms of human capital investment in study, fewer of them choose to invent in the investments. This probably because in Hong Kong, women still dominant the living affairs in the family, whereas male is in charge of the financial conditions. Which gives male more spare time to study, whereas female have to devote to the family.

Another insight from this is that we can see although woman might has a higher income fewer of them choose to go ahead and study, it is possibly to assume that this may also happen in terms of choosing college majors. In other
words, although some of the majors have less gender discrimination and usually yields a higher return in terms of monthly income, female may still not choose such majors for non-economics reasons. Thus, they choose to commit to the fields with less payoff and perhaps larger gender discrimination.

The part 3 of this figure is mainly based on the model mentioned in Methodology part of the paper, the Oaxaca model. In the chart, “bm” is the intercept of each of the variables in the male regression, “bf” is that in the female regression. “bm-bf” measures the intercept difference between male and female. Intuitively, “bm-bf” is a measurement of gender discrimination, the difference in effects of the specific input. For example, for the variable “Postgraduate” the difference in the intercepts measures the effects of human capital investment—postgraduate on the monthly earning. Xm and Xf are the mean value of the variables. “Xm-Xf” is the input difference between male and female students. For example, “Xm-Xf” for the variable postgraduate is 0.0726274, means that the average endowments of postgraduate endowment for male is 7.26% higher than female. Intuitively, the number means there is more male input in postgraduate investment. For the two indicators “bm-bf” and “Xm-Xf”, the former one values the difference in intercept of the X variables in the equation, and the latter value measures the difference in the average values of X variables in the equation. However, the log earning equation has R-square 18.74% and 27.01% for female and male respectively, and the t-value of some of the variables are not big enough to make the coefficients significant, so the indicator “bm-bf” has limitation and may lead to biased results. In comparison, the indicator “Xm-Xf” measures the average value of the variables, and the values are accurate.

From the “bm-bf” indicator, the value of the indicator is positive mostly in the industry variables, such as “Services” “Wholesales” and “Financial”, which give insights that male has certain advantages in terms of monthly income in those particular industries. And the values begin to drop below 0 from the industry of “Public Utility” and most of the fields of studies have a negative value of “bm-bf”. For those variables that are statistically significant such as “Law” “Medical Science” and “Social Science”, the values are all negative, and “Social Science” has
the biggest absolute value followed by “Medical Science” and “Law”, which in theory means that female has an advantage in these human capital inputs.

For the “Xm-Xf” indicator, since both the industry variables and the field variables are binary, the average value would be a measurement of percentage. This figure is the measurement of the difference in the amount of endowments between male and female. We can see from the chart, the study fields “Science” has the biggest value, then followed by some of the industry variables such as “Construction” “Transports” and “Public Utility”. So in sum, except the industry “Wholesales” and “Services” male has a bigger absolute value than female, for study fields except “Science” “Arts” and “Law” the values of the indicator are all negative.

As mentioned in the Methodology part of this paper, the difference of gender earnings LnYm-LnYf=bm(Xm-Xf)+Xf(bm-bf) can be explained by two parts. First is the difference in the human capital endowment, the other can be viewed as gender discrimination. That is the part “Xf(bm-bf)”. The sum of the total two parts should be equal to the difference in the log average earnings. From the chart, it can be seen that the sum of the variables in the right side of the equation is 0.344633835, whereas LnYm-LnYf is 0.3437574, the figures are close.

The measurement of gender discrimination—“Xf(bm-bf)”. It can be seen from the chart that the descending order of this figure is almost the same as the figure “bm-bf”. And the numbers in most of the fields are negative, except the field “Accounting”. Which in theory means that except the field accounting other fields of study has a female advantage. Or in other words, other fields of study have negative gender discrimination. This is not an absolute result but a relative result with reference group of “Others” and “Manufacturing”. Also, in the model, other important influencing factors of wage such as length of working time, Size of the firm and Education/job match is not included. Thus, the number might be subject to biased results.
The log earning difference between female and male is calculated by adding up two parts. Gender difference \(= bm \cdot (X_m - X_f) + X_f \cdot (bm - bf) \). The sum of the first part result is 0.091957932 and the sum of the second part result is 0.252675903. The ration of the two sums is 0.363936297. If the first part is viewed as the explained part of the gender difference, and the other part is the unexplained part of the gender difference. If denote the total gender difference as 100%, then the part of difference can be explained using the above model is 36.39% whereas the part cannot be explained is 63.61%.

To interpret gender differences among different majors, it is necessary to know the population disparity among the ten different fields (including Others the reference group). Following is the population disparity among ten fields. The

<table>
<thead>
<tr>
<th>Field</th>
<th>Female</th>
<th>Male</th>
<th>F-M</th>
</tr>
</thead>
<tbody>
<tr>
<td>SocialSc</td>
<td>0.1912618</td>
<td>0.1078577</td>
<td>0.0834041</td>
</tr>
<tr>
<td>Science</td>
<td>0.1041094</td>
<td>0.2144552</td>
<td>-0.1103458</td>
</tr>
<tr>
<td>Education</td>
<td>0.0705775</td>
<td>0.0214233</td>
<td>0.0491542</td>
</tr>
<tr>
<td>Accounting</td>
<td>0.0821876</td>
<td>0.0524833</td>
<td>0.0297043</td>
</tr>
<tr>
<td>Finance</td>
<td>0.2836847</td>
<td>0.2376575</td>
<td>0.0460272</td>
</tr>
<tr>
<td>Arts</td>
<td>0.0368164</td>
<td>0.0417346</td>
<td>-0.0049182</td>
</tr>
<tr>
<td>Law</td>
<td>0.015582</td>
<td>0.0195701</td>
<td>-0.0039881</td>
</tr>
<tr>
<td>MedicalSc</td>
<td>0.0886037</td>
<td>0.0421053</td>
<td>0.0464984</td>
</tr>
<tr>
<td>Service</td>
<td>0.0693553</td>
<td>0.0371386</td>
<td>0.0322167</td>
</tr>
<tr>
<td>Others</td>
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</tr>
<tr>
<td>Total</td>
<td>1</td>
<td>1.000001</td>
<td></td>
</tr>
</tbody>
</table>

Figure 6 Figure is measured in percentage, and F-M is the difference between the percentages of female students with that of male students. If this figure is positive, the field of study will be denoted as female population dominant fields, otherwise the fields will be denoted as male population dominant fields. In this case, excluding “Others”, Male population dominant fields are “Science”, “Arts” and “Law”.

In figure 5, the significance of the 10 fields of study variables are different, for female college students, “Social Science”, “Education”, “Law”, “Medical Science” and “Service” result statistically significant effects on monthly earning given other factors constant; whereas for male college graduates, “Social Science”, “Law”, “Medical Science” and “Service” are the fields turned out to be statistically
significant. Other fields such as “Accounting” “Finance” and “Arts” seem not having significant statistically effects. One of the reasons is probably that, the industries are not divided precisely coordinate with the fields of study. Thus, a college student graduates from Accounting major might work in the industry such as “Wholesale” “Financial” or “Service”, which are the industries in the model. If that is the case, an Accounting student within each of the community but not specific industry might not show a clear monthly income tendency. Other than these defects, some of the figures show significant effects on the earnings of male or female students.

To interpret the results, I combined the results from figure 5 and figure 6, female population dominated fields “Social Science” has an intercept of 0.19316 for female and -0.11237 for male; “Service” has an intercept of 0.14982 for female and -0.11250 for male; “Education” has an intercept of 0.17307 for female and -0.02019 for male; “Medical Science” has an intercept 0.23429 for male and 0.40091 for female. Whereas for male population dominated fields, “Law” has an intercept of 0.23429 for male and 0.37232 for female; “Science” has an intercept of -0.05480 for male and -0.05108 for female, while it is noted that this result is not statistically significant, the same situation as with “Arts”. From the above figure, it can be seen that female population dominated fields yield a higher influence on female compared with male, except “Medical Science”. In the case of Medical Science, it is probably because nurses are usually female thus has a lower monthly income that doctors. On contrary, male population dominated fields, which are “Law” “Science” and “Art”, do not have a clear advantage to male graduates. The regressions of male and female are done separately; that is to say, the intercept of each of the field is specifically the influence on one sex, male or female. From the figure 5, it seems that pursuing a higher education has a bigger positive influence on female than that on male, and studying in a female dominated fields has a higher payoff to female than to male. And that payoff is measured to the single sex. For example, if the person is a female, and she wants to decide to study in which of the field, figure 5 will give her insights that to study in a female dominated field usually has a positive influence to her future monthly income. The reference group here is “Others” in the classification of the
fields. “Others” are mainly the sum of non-popular majors among first-degree college study. If we assume that female graduates do not take gender discrimination into consideration, that is the female doesn’t care if the field of study usually ends up in a huge gender earning gap or not but only care if the field of study will bring her more benefits or not, then it is reasonable to assume that the female graduate will choose to study in a female dominated field, say “Service”, “Social Science”, “Education” etc. And indeed these fields of study will yields a positive monthly for female graduates (from Figure 5).

Figure 3, the chart is sorted by gender earning gap in descending order. We can get the results that gender earning gaps (the difference between average monthly income of male and female graduates divided by the wage of female graduates) among different fields from the highest to lowest is: “Accounting”, “MedicalSc”, “Finance”, “Education”, “Arts”, “Science”, “Service”, “Social Science”, and “Law”. From Figure 6, we can get the information about the population disparity among male and female graduates. To make the relationship more clearly, Figure 7 is used to illustrate the population spread among different sexes. In Figure 7, the former one is ordered by female population percentage in descending order and the latter one is ordered by male population percentage in descending order. The green column is the percentage differences between female and male.
It can be seen from the two charts that, the order varies slightly between female and male. The top three most popular majors for male and female are the same, which are “Finance”, “Social Science” and “Science”. “Medical Science” and “Accounting” are the medium popular fields of study for female, with the rank of 4 and 5 separately, and for male, with the rank of 5 and 4 respectively. And the field of “Service” and “Law” are in the same place in the ranking for both male and female, with 7 and 9 respectively. The fields of “Arts” and “Service” are in the lower part in the population ranking and it seems that “Arts” attracts more male and “Service” attracts more female students.
It seems that Popular fields of study are universality between female and male student in Hong Kong. The fields that are popular among male graduates have the tendency to be popular also among female graduates, such as Finance and Social Science, on contrary the fields that are less popular among female may also attract less male, such as Arts and Law.

To see how gender discrimination differs from fields to fields, I use the following chart to illustrate the relationship between the amount of college students in the fields of study and the gender earning gap in the fields.

Figure 8

The population data is from figure 6 and the gender earning gap is the same as in the figure 2. Population is measured by the percentage of the total population in among female and male college students. The percentage rather than the number of students shows the popularity of a major among female or male separately. The total percentage of population added up is 1 for female and for male. The Blue bar represents the percentage of population for female and the red bar is the percentage of population for male. The length of the bar doesn’t represent the number of the students, but the popularity of a field of study in the particular sex. “Adj. GEG” stands for adjusted gender earning gap, it is using the data from figure 2, the “gender earning gap” divided by 3.81. Thus the comparative relationships do not change, and the sum of the total gender
earning gap is 1. It is adjusted to show the relationship between the population percentage and the gender earning gap more clearly.

To interpret the results, all the gender earning gaps are positive, which means in all the fields of study, the monthly earning of male is higher than that of female, even if the fields of study is female dominated. The popular fields, as defined in figure 7, “Finance” “Social Science” and “Science”, have a relatively low gender earning gap. The gap is the biggest in the medium popular fields of study, say, “Accounting” “Medical Science” and “Education”. The gap decrease again as the popularity of the major decrease, in other words, gender earning gap is low to modest in the least popular fields of study which are “Service” “Arts” and “Law”. From figure 7, we know that the popular fields of study are more or less the same among female and male college students. In Figure 8, the fields of study is ordered by female popularity in descending order. From Figure 8, it can be seen an inversed “M” shaped gender earning gap disparity. The most popular fields of study and the least popular fields of study have the relatively low gender earning gap, the medium popular fields of study have relatively higher gender earning gap. Here, the rank of Most popular is the top 3, Least popular is the least 3 and Medium popular is the middle 3 in the popularity among female students.

As we can see an inversed “M” shaped relationship between gender earning gap and the population, to see if population is correlated with the average monthly earnings, I formed the following charts. In theory, as the price of the goods increase, the amount of supply should also be increased. In this case, as the payoff of the human capital investments increase, the number of students should also be increased. In other words, there supposed to be a positive relationship between average monthly earning and the population. However, as the population of a single field of study also depends on the demand for the specific fields and demographic factors, such as family background, being a male or female etc. So the positive relationship might not be clear.
In this chart, “Female” (the blue column) and “male” (the red column) are the average monthly earnings for female and male, “Adj. # of Female/male” are the adjusted number of students in the fields of study. “Total” is the total average monthly earnings. The order of fields is based on “Total” in descending orders. From the chart, the maximum yields fields of study, the fields of study with the highest monthly earnings, “Law” “Medical Science” and “Finance”, as the wage decrease, the number of students increases for both male and female graduates. For the medium fields of study, “Education” “Arts” and “Accounting”, as the wage decrease, the number of students for male increases, the least fields areas of study, as the wage decrease, the number of students for female decrease. Among the medium popular fields, “Accounting” has abnormally high population of female, while among least popular fields “Science” has abnormally high population of male.

The result observed from the above figure is just opposite to the prediction. It is predicted that earning are positively related with population. However, the results showed a partial negative relationship between yields and quantity. The correlation of the two factors are negative in both High (top 3) and Medium (middle 3) popular fields of study. And the results coordinate with prediction
only in the least popular fields of study. This is probably due to the crowding out effects. High yield fields of study have relatively higher restriction on the population of graduates. Such as “Law” and “Medical Science”. The keen competition due to high demand may also be the reason that pushes down the monthly income for popular fields. Such as “Finance” and “Accounting”.

**Conclusion**

In this paper, I explore the relationship between the fields of study among college students and the gender earning gap. First, I use the 5% census data to calculate the average monthly earnings and the population of male and female separately and then work out the gender earning gap among different fields of study. (Figure 2) Then to find out the correlations, I work out Figure 3, Figure 7, Figure 8 and Figure 9, these figures show in charts how the three terms, “average monthly earnings”, “population” and “gender earning gap”, have any correlation or trend among different college fields of study.

Furthermore, I use the log earning equation model to specify the influence of each of the field of study on the monthly earning. To exclude industry differences’ influence on the earning, I include 7 industries in the model. To use the log earning model, the reference group of the fields of study variable is “Others” which include non-popular college majors, and the reference group of the industries is “Manufacturing”. The result is shown in Figure 4.

Next, to explore the gender difference among different fields of study, I use the above model on male and female students separately. Then using the “Oaxaca gender earning gap analysis method” to explore the explained reason and the unexplained reason of the gender earning difference. The results showed that the explained difference, \( bm*(Xm-Xf) \), constitutes 36.39% of the total difference. Whereas, the unexplained difference, \( Xf*(bm-bf) \), constitute the other 63.61%.

We can draw certain conclusions from the results. From figure 2, the relationship between the gender earning gap and monthly earning, we can see that male dominated fields of study, “Law” “Science” and “Art” are those fields
with lower gender earning gap, on contrary, female dominated fields has quite large gender earning gap, say “Accounting” “Medical Science” and “Finance”. The earnings of these female dominated fields increase as the gender earning gap increases. We can see a female crowding out effects from this figure, that is to say, fields that are popular among females, “Education” “Finance” “Medical Science”, usually ends up in higher gender earning gap while at the same time, combined with higher monthly earnings despite the large gender earning gap. The field “Accounting” has the highest gender earning gap, however, not the highest earning, but at an above average level.

Does female and male choose their fields of study based on totally different consideration? The answer to this is no, the male and female popular fields are almost the same in Hong Kong. From Figure 7, the population in percentage for male and female is calculated and classified with 3 categories, The Most popular, the Medium and the Least. As we can see from figure 7, fields of study in these three categories are basically the same for male and female. That is to say, popular majors among female, “Finance” “Social Science” and “Science”, are also popular among male.

However, the popularity of the fields doesn’t show a clear trend with gender earning gap. In figure 8, popularity of fields of study and its gender earning gap is shown in the chart. The three categories of fields of study can be separately analyzed. The trend is clearer if we separate the three categories. An inversed “M” shape or a “∩” shaped population-gender gap can be seen from the figure. The Medium popular fields of study have the highest gap, the Most and Least has low to modest gap. From this we can observe a disadvantage toward female graduate. According to the theory of normal distribution, the medium popular fields of study will constitute most of the population. Which also has the highest gender earning gap. That to say, the majority of the female graduates might be suffer from relatively large gender discrimination.

Finally from the regression model, we can see that the unexplained part of the gender earning difference constitutes 63.61% of the total difference. From figure
9, we see the relationship between the earnings and the population. It is reasonable to assume that the more earning one can get, the more students shall choose the fields of study. However, the trend in figure 9 is not cleat. In fact it shows a negative relationship if we classify the fields of study in to three categories. The Highest yield, the Medium yield and the Least yield.

In sum, the results of the study show that there is no straight or linear relationship between the fields the students choose and the gender earning gap he or she will suffer. A more suitable correlation ship for the popularity and gender earning gap is a quadratic relation ship, like “∩”. Fields of study has certain influence on earnings and shall be take into consideration in the study of gender earning discriminations. Choosing the fields of study is a personal decision while the total results of the fields choosing can have a certain influence on the future earning or gender earning gap.

Generally, I would suggest that future researchers can include more earning related factors, such as length of working time, job match etc., into the model to make the log earning model more precise. And to find the relationship between gender earning gap and fields of study, a time serie of data is better be used to analysis the trend of major choosing each year and its influence on earnings or gender earning gap. Furthermore, to explore the reason for such a tendency in Hong Kong, it is better to compare the gender discrimination in the past decades and their relationship with industrial change, the change in structure of production and finally the major choice decision of college students.

References:

9. Gender Equality and social institution in Hong Kong, China by Development center OECD.
10. Students’ choices of college majors that are gender traditional and nontraditional Anne Childers Lackland; De Lisi, Richard. Journal of College Student Development 42. 1: 39, Jan/Feb 2001.
15. Transfer students in STEM majors: Gender differences in the socialization factors that influence academic and social adjustment by Dimitra Lynette Jackson Dimitra Lynette Jackson.


Appendix

Nominal Wage Indicators for different Industries, table from Census and Statistics Department Website.
### Nominal Salary Indices for Middle-Level Managerial and Professional Employees Analyzed by Selected Industry Sections

#### Table 019: Nominal Wage Indices for Employees up to Supervisorial Level (Excluding Managerial and Professional)

<table>
<thead>
<tr>
<th>Year</th>
<th>Month</th>
<th>Manufacturing</th>
<th>Imports/Export, Wholesale and Retail Trades</th>
<th>Transportation</th>
<th>Accommodation and Food Service Activities</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010</td>
<td>Dec</td>
<td>153.7</td>
<td>1.0</td>
<td>175.3</td>
<td>153.9</td>
</tr>
<tr>
<td>2011</td>
<td>Mar</td>
<td>16.1</td>
<td>177.3</td>
<td>5.8</td>
<td>154.6</td>
</tr>
<tr>
<td></td>
<td>Jun</td>
<td>164.3</td>
<td>161.7</td>
<td>7.1</td>
<td>158.2</td>
</tr>
<tr>
<td></td>
<td>Sep</td>
<td>185.6</td>
<td>185.7</td>
<td>9.7</td>
<td>161.4</td>
</tr>
<tr>
<td></td>
<td>Dec</td>
<td>170.0</td>
<td>188.1</td>
<td>8.4</td>
<td>161.8</td>
</tr>
</tbody>
</table>

**Notes:**
- The above statistics are derived based on the Hong Kong Standard Industrial Classification (HSIC) Version 2.0 and the series has been backcasted to March 1992 based on the statistic periods

#### Table 024: Nominal Salary Indices (A) for Middle-level Managerial and Professional Employees Analyzed by Selected Industry Section (June 1995 = 100)

<table>
<thead>
<tr>
<th>Year</th>
<th>Manufacturing, Electricity and Gas Supply</th>
<th>Building and Construction and Related Trades</th>
<th>Import/Export, Wholesale and Retail Trades</th>
<th>Transportation, Storage, Communications and Travel Agencies</th>
<th>Financing and Insurance</th>
<th>All Selected Industry Sections</th>
</tr>
</thead>
<tbody>
<tr>
<td>2007</td>
<td>113.9</td>
<td>105.2</td>
<td>127.1</td>
<td>121.4</td>
<td>138.5</td>
<td>124.7</td>
</tr>
<tr>
<td>2008</td>
<td>117.3</td>
<td>113.5</td>
<td>130.8</td>
<td>122.3</td>
<td>146.5</td>
<td>130.6</td>
</tr>
<tr>
<td>2009</td>
<td>116.2</td>
<td>113.0</td>
<td>127.4</td>
<td>120.8</td>
<td>141.1</td>
<td>137.1</td>
</tr>
<tr>
<td>2010</td>
<td>117.5</td>
<td>116.9</td>
<td>129.8</td>
<td>123.6</td>
<td>145.8</td>
<td>130.3</td>
</tr>
<tr>
<td>2011</td>
<td>121.1</td>
<td>125.6</td>
<td>137.7</td>
<td>127.7</td>
<td>154.9</td>
<td>136.0</td>
</tr>
</tbody>
</table>

**Notes:**
- The above statistics are compiled based on the Hong Kong Standard Industrial Classification (HSIC) Version 2.0 and the series has been backcasted to 2004 whereas the statistics prior to 2 are based on HSIC Version 1.1. Users may also download "HSIC Version 1.0 and 2.0" for reference. For more details on the revision of HSIC, please refer to the feature article "Hong Kong Standard Industrial Classification (HSIC) Version 1.0 and the revision to HSIC Version 2.0".

**Source:**
- Wages & Labour Costs Statistics Section (2),
- Census and Statistics Department
  (Enquiry telephone no.: 3105 2388)

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### Nominal Salary Indices (B) for Middle-level Managerial and Professional Employees Analyzed by Selected Industry Section (June 1995 = 100)

<table>
<thead>
<tr>
<th>Year</th>
<th>Manufacturing, Electricity and Gas Supply</th>
<th>Building and Construction and Related Trades</th>
<th>Import/Export, Wholesale and Retail Trades</th>
<th>Transportation, Storage, Communications and Travel Agencies</th>
<th>Financing and Insurance</th>
<th>All Selected Industry Sections</th>
</tr>
</thead>
<tbody>
<tr>
<td>2007</td>
<td>137.8</td>
<td>143.5</td>
<td>151.0</td>
<td>160.0</td>
<td>165.6</td>
<td>154.1</td>
</tr>
<tr>
<td>2008</td>
<td>143.6</td>
<td>155.7</td>
<td>165.7</td>
<td>167.0</td>
<td>180.7</td>
<td>163.3</td>
</tr>
<tr>
<td>2009</td>
<td>143.3</td>
<td>155.2</td>
<td>154.5</td>
<td>169.9</td>
<td>175.1</td>
<td>160.6</td>
</tr>
<tr>
<td>2010</td>
<td>148.0</td>
<td>161.8</td>
<td>156.5</td>
<td>171.5</td>
<td>181.7</td>
<td>165.7</td>
</tr>
<tr>
<td>2011</td>
<td>152.2</td>
<td>177.4</td>
<td>170.5</td>
<td>178.8</td>
<td>196.6</td>
<td>178.1</td>
</tr>
</tbody>
</table>

**Notes:**
- The above statistics are compiled based on the Hong Kong Standard Industrial Classification (HSIC) Version 2.0 and are based on the HSIC tables published in the Hong Kong Monthly Digest of Statistics.

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