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Final Report

Topic: Labour Market Mismatch by Field-of-Study on Entry Level Jobs in Hong Kong

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Abstract

In this paper we analyse the relationship between the field-of-study and the labour market mismatch of entry level jobs in Hong Kong. We want to know that students in what field are more likely to face labour market mismatches when they enter the job market, and to what extent when compared with other fields. The result provides great insights to the high school students who are choosing which field to study in the university as well as the current university students who want to know more about the entry level job market in Hong Kong. We scrape the individual profiles using LinkedIn, a professional networking and career development platform widely used by university students in Hong Kong, then we compare their academic fields and their current jobs to identify whether mismatches exist. Our empirical results indicate that the field-of-study has statistically significant impact on labour market mismatch and there exists a difference in extent among different fields, for instance, students who are in social science related majors are more likely to face labour market mismatch than art major students. The findings of this paper imply that the job market in Hong Kong has indeed inclined and favoured some fields than the others.

1. Introduction

Labour market mismatch exists when the qualifications and skills of an employee acquired through education and training are different from the ones required by the job held in the labour market (Kracke & Rodrigues, 2020). There are different dimensions of labour market mismatch, for instance, vertical and horizontal. For vertical, it exists when a person has the right skills for the ones required by his/her occupation, but the level of skills required is either lower or higher than what the person acquired (Kriechel & Vetter, 2019). Over-education, under-education, over-skilled and under-skilled mismatch can be classified into vertical labour market mismatch. For horizontal, it exists when a worker is trained in a particular field but works in another field (Montt, 2017). Field of education to occupation or field-of-study mismatch is classified into the horizontal dimension, and this type of mismatch is the focus of this paper. Labour market mismatch is a huge concern to the policymakers as it could lead to several social problems such as loss of human capital, lower overall productivity and increasing long-term unemployment. Especially for field-of-study mismatch, workers could gradually lose their skills since they do not have to use the skills acquired in college in their occupations. Moreover, as workers are not doing what they are most familiar with, their productivity could be lower than when there is no mismatch. As a result, the resources invested in education and training could not yield the maximum return.

The key contribution of the paper, first, it provides insights to the high school students who are choosing a field to study in the college. Career prospects are a very important factor when considering which major to study, the result of this research paper could give them expectations about the difficulty of finding a job in a given field. Second, the result could be an estimation of job demands in different fields. For example, a field with a high level of mismatch could indicate that the skill sets of the field might have lower demand in the market, so, people in that field could not be employed within their fields. We can quantify the

job demands of different fields based on our empirical results. To the current university students or recent fresh graduates, by looking at the result, they could develop more understanding of the job market that they are going to enter. They might consider acquiring skills in certain fields with low levels of mismatch to improve their competitiveness in the job market. Third, to the government, the result could be a reference for them to formulate education policy. For example, when the government is deciding the admission numbers of each major, it should consider whether the job market is able to absorb that number of graduates. The result of this paper allows the government to learn about the situation of the job market.

2. Literature Review

In the literature review, we are going to analyse the impact of field-of-study mismatch in terms of wages, job satisfaction and employment stability as well as the research methods utilised by the scholars to measure the mismatch.

2.1 Wages

Sattinger (1993) proposed that field-of-study mismatched workers are anticipated to earn less than well-matched workers because wages are a function of the match between the skills of workforces and the skill demand of jobs. Mismatched workers only acquire more readily transferable general skills in the workplace but not the job-specific skills gained in training. For employers, it is more costly and less productive for mismatched workers to gain job-specific skills via training, leading to a lower salary. Owing to this alignment process, the wage penalty is greater for individuals who have a greater distance from the occupational group in their field-of-study (Robst, 2008; Nordin, Persson et al., 2010), reflecting the lower productivity of mismatched labours compared to matched employees due to the lack of field-specific skill.

2.2 Job Satisfaction

In terms of job satisfaction, not only do mismatched workforces receive lower earnings, but they also tend to experience lower levels of job satisfaction, even in those circumstances where they do not suffer a wage penalty suggested by Béduwé and Giret (2011). In 22 out of the 23 countries, field-of-study mismatched personnel felt lower levels of job satisfaction, even though this correlation is only statistically significant only in Canada, Estonia, Finland, Italy, Korea, the Netherlands, Spain and the United States. In the United States, the portion of mismatched people by field-of-study who felt dissatisfied with their employment is higher than that of matched workers by over ten percentage points.

2.3 Employment Stability

Regarding employment stability, Wolbers (2003) finds that workers are more likely to accept a job which is unrelated to the field-of-study during high unemployment periods. Encountered by the possibility of being jobless, workers are more likely to take a job outside their fields. The likelihood of being unemployed or out of the labour force is higher for mismatched workers by field-of-study compared to matched workers, specifically percentage

point difference (shown in figure 1), indicating a selection process or skill heterogeneity. They may have lower skill levels or may have underlying features that make them less likely to be selected in the first place. powerful in Italy, Korea, Spain, Sweden and the United States which have a minimum 8 percentage point difference (shown in figure 1), indicating a selection process or skill heterogeneity. They may have lower skill levels or may have underlying features that make them less likely to be selected in the first place.
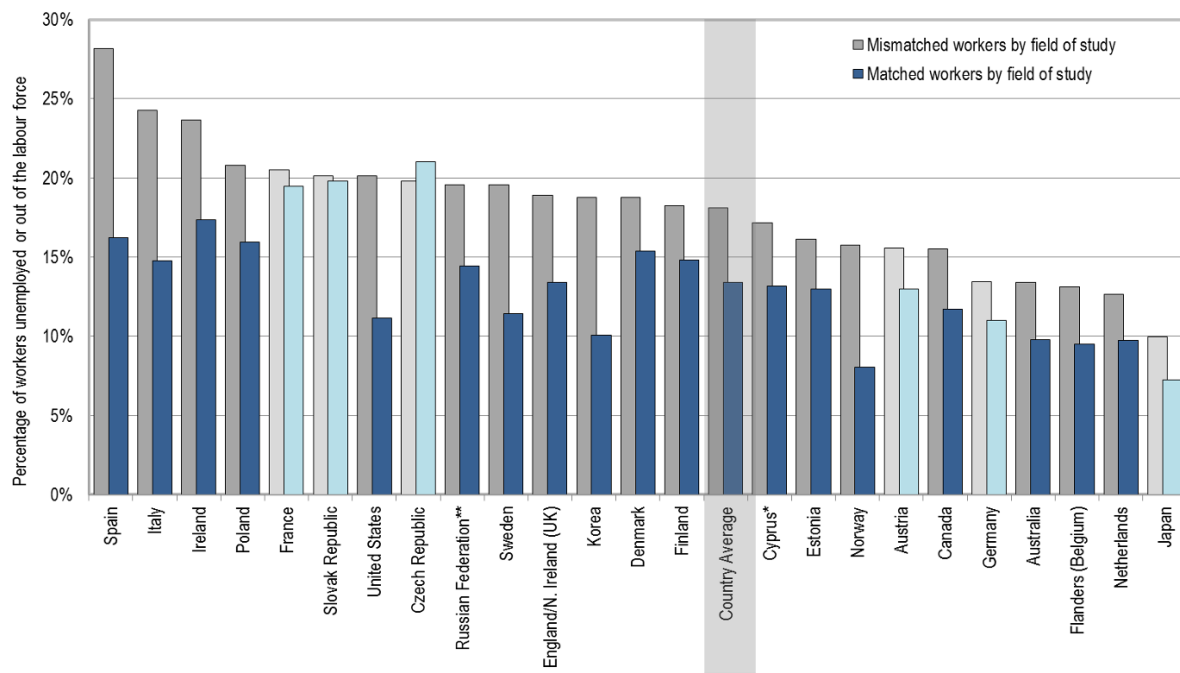
Figure 1. Field-of-study mismatch and the likelihood of unemployment or being out of the labour force

During our research, the worker self-assessment method (WA), job analysis method (JA) and realised matches method (RM) are the main research methods to measure the education-occupation mismatch. Among all, worker self-assessment methods are the most popular research method. Different research methodologies will be examined and provided to us as research method references.

2.4 Worker Self-assessment Method

The worker self-assessment method (WA) is based on the analysis of the workforce about the appropriate educational requisite for their occupation. Specifically, the employees are required to honestly evaluate if they have the proper field-of-study to accomplish the work. WA can be constructed into a direct method (DWA) and an indirect method (IWA) (Sellami, Verhaest & Trier, 2018). For the direct method, interviewees are questioned to what extent the education content is associated with their jobs. For the indirect method, interviewees are asked which field-of-study is necessary to complete their tasks. The direct method (DWA) is used more widely by scholars than the indirect method.

In this research method, the advantage is the heterogeneity of jobs that interviewees have the best knowledge of why field-of-study the tasks are required (International Labour Office, 2018). On the other hand, another disadvantage is the subjectivity in doing the survey which relies on the perception of the interviewees because different workers may have various opinions on what field-of-study is needed for their occupations. Moreover, the exact wording in the questions should be thoroughly selected. For instance, what field-of-study is required to get the job is distinctive from what field-of-study is required to perform the job.

Besides, how clearly to define a match, partial mismatch and mismatch is always a challenging part for scholars to define and set the cut-off point which will affect the results (Sellami, Verhaest & Trier, 2018). For example, Robst (2007) surveyed the US college graduates on whether their occupation is related to the field-of-study and provide suggestions of 'closely related', 'somewhat related', or 'not related' to their highest education level, assigning the answer into the scale of 'fully match', 'partly mismatch' and 'mismatch'.

2.5 Job Analysis Method

For the job analysis method, job analysts define the education required for each profession depending on occupational classification methods. Solga and Konietzka (1999) were the pioneers to use the job analysis method to measure education-occupation mismatch by using the International Standard Classification of Occupations (ISCO) in the 1968 version and stated field-of-study mismatch if the occupational education was unlike with and the first occupation. Standard Swedish Occupational Classification and International Standard Classification of Education (ISCED97) and Australian and New Zealand Standard Classification of Occupations were further developed in the later stage.

The main advantage of this method is that job analysts are objective to analyse what requirements for each job instead of asking workers. But the main disadvantage is the validity of the classifications under a time constraint (International Labour Office, 2018). Classifications become obsolete because they are sensitive to technological change: as jobs become more complicated, their educational requirements increase. Since classifications are based on entry requirements valid at the time of assessment was made, staff hired earlier or later may be mistakenly categorised as mismatched.

2.6 Realised Match Method

Realised match method which is a statistical approach that derives the compulsory educational level from the actual distribution of educational levels within professions and the mean or the modal educational level within an occupation has been used as a proxy for the required level of education for that occupation or occupational group.

The main advantage is it is easy to apply and mismatch can be predictable by using core variables covered in the survey. However, it also assumes the homogeneity of educational requirements for all jobs with the same occupational code which are driven by the majority of older workers and those with longer tenure, thus reflecting historical entry requirements

rather than contemporary ones (International Labour Office, 2018). Moreover, since mismatch is expressed in relative terms, the predicted quantity of mismatched employees may differ every year merely because the modal level of education surges within a given occupation or occupational group. An adjustment in the mode may occur as the educational level of individuals newly engaged in that profession is higher.

3. Hypothesis

According to the Census and Statistics Department (2021) in Hong Kong, the four major industries, which are financial services, tourism, trading and logistics, and professional and producer services, accounted for more than half of the GDP and more than 40% of total employment in 2020. This shows the importance of these four industries to the Hong Kong economy, and many job occupations are within these industries. However, the skills required for most occupations within the four key industries are related to business, especially for financial services and trading and logistics, which have accounted for roughly 25% of the total employment share in 2020. Fields other than business have limited job opportunities in Hong Kong, which makes it hard for students who are in non-business fields to find a job in their own fields. Consequently, they would seek jobs in business fields, which gives rise to field-of-study mismatch. Apart from the business fields, the financial services industry also has a high demand for talents in the computer science field as computer science skills are becoming more and more important. For example, some positions in banks favour programming skills more than business skills. Overall, it can be expected that the Hong Kong job market, which is dominated by the four key industries, favours candidates in business or computer science fields.

Another situation in the Hong Kong job market is the salary difference. In 2020, the financial services industry accounted for 23.3% of total GDP but only 7.5% of the employment share. This could imply that the workers in this industry were creating more value, therefore they are receiving higher average salaries. In this sense, students who study in fields such as Art, Science or Social Science would be attracted by this high salary and thus choose to work in the financial services industry. This would also increase the field-to-study mismatch.

Therefore, our hypothesis is:
"Under Hong Kong's homogeneous economics structure, students who take business, engineering or related professional study will have a lower level of field-of-study mismatch while students who immerse into the fields like arts, social science and science tend to have a higher level of field-of-study mismatch."

4. Methodology

In this study, as we are going to investigate the relationship between field-of-study mismatch and subject majors, which is the hypothesis, data of individual graduates would be used to conduct analysis. Data of both bachelor's and master's graduates from the 8 University Grants Committee (UGC) funded universities in the year 2019, 2020 and 2021 with their corresponding educations, experiences and certificates information were collected from

LinkedIn. A logistic regression model was built based on the data we collected. The dependent dummy variable mismatch was regressed in the field of studies, with the control of experience and certificates.

5. Data Collection and Processing

As there is no available data about the field-of-study and jobs for the recent graduates on the internet from research institutions or government websites, LinkedIn graduates' profiles are the best option for the data source. Based on the search engine on LinkedIn, we filtered graduation years in 2019, 2020 and 2021, which focuses on the most recent graduates only. Besides, only the profiles that graduated from the UGC-funded universities were selected. The whole process was done by using Python libraries BeautifulSoup and Selenium. Raw data collected from LinkedIn is undergoing data cleansing in order to perform the regression analysis. Firstly, unrelated letters, symbols and irregularities for every observation were cleaned. Secondly, every individual observation was separated into match or mismatch manually based on his/her current working position and the corresponding majors/minors, using a set of selection criteria (Reis M., 2018) (see Appendix 9.1). Besides, the university majors/minors of every individual observation was classified into a set of fields. Finally, 12 independent dummy variables of fields and the mismatch dependent variable were created.

5.1 Dependent Variable

To present a match or mismatch, the dependent variable is a dummy variable to indicate the matching case for each of the graduates, where 1 if the case is a mismatch and 0 if the case is a match. As mentioned in 5.1, the dependent variable for each data point was determined by a set of selection criteria.

5.2 Independent Variables

The main independent variables are the field-of-study. As mentioned in the hypotheses, we would like to find out the relationship between the field-of-study at universities and the mismatch for the first graduate job. For the category of fields, 12 independent dummy variables of fields were created for the model. The majors/minors of all the graduate data were separated into these 12 variables, which are:

- *General Business Administration*
- *Accounting or Economics or Finance*
- *Information Technology or Computer Science*
- *Data Science or Statistics*
- *Art*
- *Social Science or Public Sector Related Subjects*
- *Engineering*
- *Education*
- *Media or Design*
- *Pure Science*
- *Medical Related Subjects*

- *Law*

To indicate the field for each of the graduates, where 1 if the graduate matches the field and 0 if the graduate does not match the field. Graduates could fall into several categories at the same time, based on the nature of their majors/minors. For example, a graduate majoring in computer science and finance will fall into the categories of both finance and information technology.

5.3 Control Variables

Control variables were introduced in the model in order to see if the personal status of a graduate would affect the relationship between the mismatch and field-of-study. There are 6 control variables for each data point:
- *Graduation Year (3 levels)*
- *Name of Universities (8 levels)*
- *Masters Degree (dummy, 1 = Master, 0 =Bachelor)*
- *Number of Working Experience*
- *Number of Volunteering Experience*
- *Number of Certificates*

For the categorical variable of graduation year, graduates were either class of 2019, 2020 or 2021. The year of graduation was taken into the model as graduating in the pandemic years may affect the match or mismatch results. The variable was indicated as 1 if the graduate graduated in that year and 0 otherwise.

For the categorical variable of the name of schools, graduates graduated from 1 of the 8 UGC-funded universities, which are The University of Hong Kong (HKU), The Chinese University of Hong Kong (CUHK), The Hong Kong University of Science and Technology (HKUST), The City University of Hong Kong (CityU), The Hong Kong Polytechnic University (PolyU), Hong Kong Baptist University (HKBU), The Education University of Hong Kong (EdUHK) and Lingnan University (LU). The name of universities was taken into the model as higher-ranking universities may affect the match or mismatch results. The variable was indicated as 1 if the graduate graduated from that university and 0 otherwise.

For the dummy variable of master's degree, graduates graduated either as bachelors or masters. Master degree holders were taken into the model as graduates may pursue master's degrees to increase their competitiveness or they may switch field-of-study in their master's degrees, which may affect the match or mismatch results. The variable was indicated as 1 if the graduate graduated with a master and 0 as a bachelor.

For the numerical variables of the number of working experience, the number of volunteering experience and the number of certificates, the number were counted from the LinkedIn profile of each graduate. These 3 numerical variables were taken into the model as they could

reflect the competitiveness of the resume of each graduate, which may affect the match or mismatch results.

6. Analysis

6.1 Statistical Summary

There were 2983 observations in our sample after all the cleaning and processing, where 2151 of them were bachelor graduates and 832 of them were master graduates (see Appendix 9.2). 2454 out of 2983 observations were matches and 529 out of 2983 observations were mismatches. The overall mismatching rate was 17.73%. For bachelor graduates, 407 out of 2151 observations were mismatches. For master graduates, 122 out of 832 observations were mismatches. The Bachelor mismatching rate was 18.92% while master mismatching rate was 14.66%.

	Matches	Mismatches	Matches + Mismatches	Mismatch rate
Bachelor graduates	1744	407	2151	18.92%
Master graduates	710	122	832	14.66%
All graduates	2454	529	2983	17.73%

6.2 Model

Logistic regression is used to predict and interpret mismatch in this study. As the dependent variable is not a numerical variable, linear regression could not be used here, otherwise the regression line would fall outside the range [0,1]. Although in a logistic regression model, it is difficult to interpret the coefficients, the relationship between dependent variables and independent variables could still be analysed. The dependent variable is the logit, which is the log of the odds ratio of mismatch to match. When the odds ratio is larger than 1, then the independent variable has relatively more odds contributed to the dependent variable, which means the dummy independent variable tends to be 1, holding other factors constant. When the odds ratio is smaller than 1, then the independent variable has relatively fewer odds contributed to the dependent variable, which means the dummy independent variable tends to be 0, holding other factors constant.

The first model is regressing dummy dependent variable mismatch on the field-of-study. The second model is regressing dummy dependent variable mismatch on the field-of-study, plus a set of control variables that are mentioned in section 5.4.

The first model:

$$P(Mismatch) \ = \ 1 \ \div \ \left[1 \ + \ e^{-(\alpha + \sum\limits_{i=1}^{12} \beta_i \times field-of-study_i)} \right]$$

The second model, with control variables:

$$P(Mismatch) \ = \ 1 \ \div \ \left[1 \ + \ e^{-(\alpha + \sum\limits_{i=1}^{12} \beta_i \times field-of-study_i + \sum\limits_{k=13}^{25} \beta_k \times control\ variables_k)} \right]$$

$where\ the\ 13\ control\ variables\ are$
$Name\ of\ universities\ (7),$
$Graduation\ year\ (2),$
$Masters\ degree\ (1),$
$Number\ of\ Working\ Experience\ (1),$
$Number\ of\ Volunteering\ Experience\ (1),$
$Number\ of\ Certificates\ (1)$

6.3 Results

Table 1:

	Model 1	Model 2
	Dependent variable:	
	is_Mismatch	
is_Master		−0.820*** (0.134)
schoolNameCuhk		−0.478 (0.474)
schoolNameEdu		0.118 (0.527)
schoolNameHkbu		−0.364 (0.318)
schoolNameHku		−0.447 (0.274)
schoolNameHkust		−0.560* (0.309)
schoolNameLingu		0.264 (0.342)
schoolNamePolyu		0.011 (0.306)
gradYear2020		−0.139 (0.145)
gradYear2021		−0.128 (0.136)
is_BusinessAdministration	−0.953*** (0.150)	−1.084*** (0.157)
is_Accounting.Economics.Finance	−1.570*** (0.180)	−1.690*** (0.187)
is_IT.Computer	−1.256*** (0.179)	−1.389*** (0.187)
is_Statistics.DataScience	−0.307 (0.210)	−0.137 (0.215)
is_Art	0.952*** (0.171)	0.869*** (0.179)
is_Public.SocialScience	1.068*** (0.164)	1.185*** (0.169)
is_Engineering	−0.506** (0.206)	−0.644*** (0.215)
is_Education	−0.769* (0.396)	−0.602 (0.429)
is_Media.Design	−0.419* (0.223)	−0.469** (0.232)
is_Science	0.949*** (0.186)	0.983*** (0.196)
is_Medical	0.373 (0.407)	0.590 (0.419)
is_Law	0.447 (0.281)	0.774*** (0.297)
num_Exp		−0.001 (0.021)
num_Cert		0.025* (0.015)
num_Volunteering		−0.021 (0.040)
Constant	−0.995*** (0.143)	−0.302 (0.319)
Observations	2,983	2,983
Log Likelihood	−1,162.770	−1,129.519
Akaike Inf. Crit.	2,351.540	2,311.039

Note: *p<0.1; **p<0.05; ***p<0.01

Table 1

In the above table, Model 1 includes baseline specifications while Model 2 includes several control variables besides the field-of-study. Both models provide similar evidence that most of the field-of-study are statistically significant to mismatch or not, as most of the variables from field-of-study are statistically significant.

In Model 1, there are a total of 9 statistically significant variables for field-of-study. General Business Administration, Accounting or Economics or Finance, Information Technology or Computer Science, Engineering, Media or Design these 5 fields are statistically significant and have a negative correlation with the mismatch. Art, Social Science or Public Sector Related Subjects, Science these 3 fields are statistically significant and have a positive correlation with the mismatch. For example, graduates having art as their major would have

$e^{0.952} = 2.59$ times the odds of the graduates not having art as their major, to have a mismatch in their first job. Therefore, there is approximately a 160% increase in the relative chance of getting a mismatch for art graduates. Graduates having engineering as their major would have $e^{-0.506} = 0.60$ times the odds of the graduates not having engineering as their major, to have a mismatch in their first job. Therefore, there is approximately a 40% reduction in the relative chance of getting a mismatch for engineering graduates.

Hence, from the Model 1, graduates with majors in social science or public sector related subjects are the most likely group to have a mismatch for their first graduate jobs, while graduates with majors in accounting or economics or finance are the least likely group to have a mismatch for their first graduate jobs.

In Model 2, after adding the control variables, the overall correlation between field-of-study and mismatch seems to be consistent with the conclusion in Model 1, but the variable of law field is now significant and tends to have a mismatch with the first graduate job. The reason is that the variable is_Law could not capture the omitted variables in Model 1 and there are confounding factors for it.

Also, the number of certifications is significant now and positively correlated with a mismatch. That means having more certifications (on LinkedIn) tends to have a higher probability to mismatch compared to having fewer certifications.

Another finding is that the variable of master degree is significant and tends to be negatively correlated with mismatching for a first job. That being said, the master graduates should have an overall lower mismatch rate than the bachelor graduates. In fact, in section 6.1, the overall mismatch rate for master graduates (14.66%) is lower than the overall mismatch rate for bachelor graduates (18.92%). Master degree graduates are less likely to have mismatches against their fields, compared to bachelor degree graduates, holding other things constant.

It is interesting that master degree graduates might be more professional in terms of credentials, or the master degree graduates have changed fields that differ from their bachelor degrees. In fact, from the sample data of master degree graduates, 198 out of 259 of them have changed fields, and the most popular fields are general business administration, information technology/computer science and data science/statistics, in descending order. Unfortunately, from the limited data points (259), we could not build a reliable model in order to dig deeper into this topic. This analysis could be further analysed when more data are available.

Other independent variables like graduation year, name of universities, number of working experience and the number of volunteering experiences are not statistically significant. It is surprising that the number of working experiences could not explain the mismatch or match. As more working experiences for a student such as intern experiences or other kinds of participation could lead to a more diversified personal resume, the student shall have wider

options in picking his/her first graduate job. Hence, having more or less working experience or volunteering experience does not affect the match or mismatch of the first graduate job.

7. Implications and Limitations

7.1 Market demands talents in diverse fields to provide different insights

From our statistical summary, nearly one out of five graduates will work in different fields and some art graduates tend to work as human resources professionals in the business field. In fact, people with backgrounds in subjects like philosophy, history, and English can produce new values in the workplace because graduates of the arts and humanities offer employers a wide range of transferable skills. According to the National Employer Survey 2015, skills like communication in both written and verbal and foreign languages are positioned as favourably as numerical skills and business acumen while personal attitudes such as being ethically and socially aware were desirable by employers (Flanagan, 2015). These traits can be achieved over the course of an arts degree together with personal development. Art students are better prepared to use their creativity and challenge conventional intelligence than business students. The independent art study assists in building resilience to cope with a quickly changing environment and the versatility as well as the non-vocational type of research are directly applicable to the workplace. Some banks and tech giants hire art graduates because they possess more innovative and analytical thought procedures and are less prone to tunnel vision than their colleagues from technical backgrounds. Even working in different fields, the market demands skills from various backgrounds, bringing diverse perspectives in decision-making applicable to companies.

7.2 Career-oriented subjects have a lower field-of-study mismatch with occupations

From the empirical results, engineering, finance and information systems are statistically significant and have a negative correlation with the mismatch. They share the same characteristics: people can become professionals with their unique skills acquired in college and these subjects are career-oriented. These subjects are designed with a strong link with the real world, for example, engineers can apply the theories and mathematics learnt from the course to building bridges and towers and computer sciences students learn coding and directly apply it in software engineering jobs. While humanities ranging from linguistics, sociology and history which investigate the relationships among individuals within those societies are less career-oriented subjects. The humanities help us understand others through their languages, histories and cultures and reveal how people have tried to make moral, spiritual and intellectual sense of the world, teaching us to reason about being human and to ask questions about our world. The humanities do not emphasise too much the hard skills such as coding, python, video-editing and mathematics that are demanded heavily by society but foster soft skills including logical thinking and critical thinking which could not be demonstrated apparently. Moreover, students who take arts and social sciences cannot

become professionals easily with their soft skill to ensure their irreplaceability and value in society. Therefore, less career-oriented subjects such as humanities tend to have a larger field-of-study mismatch.

7.3 Limitations

There are two main limitations to our research. First, only data from LinkedIn was used in our sample, which might lead to sampling bias. There is a difference in the extent of the use of LinkedIn for students from different majors. For example, students from business-related fields use LinkedIn much more heavily than those who are in the other fields, especially those who study in fields which are considered "specialist degrees" like Education, Nursing, Medicine or Law. Moreover, only a small percentage of people who are working in the non-business sector have LinkedIn accounts. For instance, occupations like school teachers, nurses or social workers seldom use LinkedIn, but most people who work in the business sector such as banks or other large corporations like property developers would have a LinkedIn account. As a result, our sample could be relatively more inclined toward business students as well as people working in the business sector since LinkedIn is our source of data.

Second, the determination of whether there is a mismatch could be difficult sometimes. Although we have set some rules to determine the mismatch, as the classification process was done manually, a few inconsistencies with the set rule could still happen. Besides, the mismatch can be classified into "Strict Mismatch" and "Partial Mismatch". "Strict Mismatch" is that the field-of-study of a person is completely different from his/her occupation field and the required skills of that occupation, while "Partial Mismatch" is the case when the field-of-study does not match with the occupation field, but part of the skills gained in the field-of-study are transferable to the occupation. Using the set rules is able to determine "Strict Mismatch" easily but not as easy for "Partial Mismatch". For the "Partial Mismatch" cases, some personal judgments would still be needed to determine. It was quite hard to construct a perfect way to determine a match or mismatch systematically.

8. Conclusion

From our empirical result, field-of-study has a significant effect on labour market mismatch. Students from fields such as Business Administration, Accounting or Economics or Finance, Information Technology or Computer Science and Engineering are expected to face fewer mismatches than other majors. In other words, they are relatively more willing to work in their own fields, and this might be due to the lower difficulty to find a job in their fields or the salary factor. However, students from fields such as Art, Social Science or Public Sector Related Subjects and Science are expected to face more mismatches in the job market, which shows that they are more willing to work in different fields, and this might be due to the higher difficulty to get a job or lower salaries are offered within their fields. Overall, most fields included in our study show significant results correlated to the mismatch. This result implies that the Hong Kong entry-level job market has indeed inclined to certain fields and favoured people with certain skill sets.

9. Appendix

9.1 Tables for mismatch selection criteria

Table 6 The field of study-occupation matches

Field of study	Occupations that match the field of study their field of education
Teacher training and education science (general programmes)	*Education methods specialists*
Education science	*Education methods specialists*, education managers
Training for pre-school teachers	*Early childhood educators*
Training for teachers at basic levels	*Primary school teachers*, special needs teachers
Training for teachers with subject specialisation	*Secondary education teachers*
Training for teachers of vocational subjects	*Vocational education teachers*, arts teachers
Arts (general programmes)	*Visual artists, graphic and multimedia designers and creative and performing artists*, arts teachers
Fine arts	*Visual artists, graphic and multimedia designers and creative and performing artists*, arts teachers
Music and performing arts	Other arts teachers; *musicians, singers and composers*; film, stage and related directors and producers; actors
Audio-visual techniques and media production	*Visual artists, graphic and multimedia designers and creative and performing artists*
Design	*Designers*
Craft skills	*Visual artists, graphic and multimedia designers and creative and performing artists*
Religion	*Religious professionals*
Foreign languages	*Language teachers*; translators, interpreters and other linguists
Mother tongue	*Language teachers*
History and archaeology	Archivists and museologists; *philosophers, historians and political scientists*
Philosophy and ethics	*philosophers, historians and political scientists*
Social and behavioural science (general programmes)	*Sociologists, anthropologists and related professionals*
Psychology	*Psychologists*
Sociology and cultural studies	*Sociologists, anthropologists and related professionals*
Political science and civics	*Philosophers, historians and political scientists*
Economics	Financial analysts; *economists*
Journalism and reporting	Authors and related writers; *journalists*; announcers on radio, television and other media
Library, information, archive	*Librarians and related information professionals*; archivists and museologists
Business and administration (general programmes)	Business services and administration managers; sales and marketing managers, advertising and marketing professionals, public relations professionals and sales professionals; *administration professionals*
Wholesale and retail sales	*Retail and wholesale trade managers*; sales and marketing managers
Marketing and advertising	Advertising and public relations managers; *advertising and marketing professionals, public relations professionals and sales professionals*; sales and marketing managers
Finance, banking, insurance	Finance managers; financial and insurance services branch managers; *financial analysts*
Accounting and taxation	*Accountants*
Management and administration	*Managing directors and chief executives*; agricultural and forestry production managers; manufacturing managers and mining managers; construction managers; supply, distribution and related managers; child care services managers, aged care services managers, social welfare managers and sports, recreation and cultural centre managers; health services managers; education managers; hotel and restaurant managers; services managers; human resource professionals; administration professionals; human resource managers; retail and wholesale trade managers; financial and insurance services branch managers
Working life	*Human resource professionals*
Law	*Lawyers*; judges; legal professionals
Life science (general programmes)	*Biologists, botanists, zoologists and related professionals*
Biology and biochemistry	*Biologists, botanists, zoologists and related professionals*
Environmental science	*Biologists, botanists, zoologists and related professionals*
Physical science	*Physicists and astronomers*; meteorologists; geologists and geophysicists
Physics	*Physicists and astronomers*
Chemistry	*Chemists*
Earth science	Physicists and astronomers; meteorologists; *geologists and geophysicists*

Table 6 (continued)

Field of study	Occupations that match the field of study their field of education
Mathematics	*Mathematicians*
Statistics	*Statisticians*
Computer science	Database and network professionals; *systems analysts*
Computer use	Database and network professionals; *systems analysts*
Data processing	*Database and network professionals*; systems analysts
Engineering and engineering trades (general programmes)	Electrical and electronics engineers; *mechanical engineers*; mining engineers, metallurgists and related professionals; cartographers and surveyors
Mechanics and metal work	*Mechanical engineers*; mining engineers, metallurgists and related professionals
Electricity and energy	*Electrical and electronics engineers*
Electronics and automation	*Electrical and electronics engineers*
Chemical and process	*Chemical engineers*
Motor vehicles, ships and aircraft	*Mechanical engineers*
Manufacturing and processing (general programmes)	*Industrial and production engineers*
Food processing	*Industrial and production engineers*
Textiles, clothes, footwear, leather	*Industrial and production engineers*
Materials (wood, paper, plastic, glass)	*Industrial and production engineers*
Mining and extraction	*Mining engineers, metallurgists and related professionals*
Architecture and town planning	*Building architects and town planners*
Building and civil engineering	*Civil engineers*
Agriculture, forestry and fishery (general programmes)	*Farming, forestry and fisheries advisers*
Crop and livestock production	*Farming, forestry and fisheries advisers*
Horticulture	*Farming, forestry and fisheries advisers*
Forestry	*Farming, forestry and fisheries advisers*
Fisheries	*Farming, forestry and fisheries advisers*
Veterinary	*Veterinarians*
Health (general programmes)	Physiotherapists; *nursing professionals*; dieticians and nutritionists; audiologists and speech therapists
Medicine	*Medical doctors*
Nursing and caring	*Nursing professionals*; environmental and occupational health and hygiene professionals
Dental studies	*Dentists*
Medical diagnostic and treatment technology	*Nursing professionals*
Therapy and rehabilitation	*Physiotherapists*; nursing professionals; dieticians and nutritionists; audiologists and speech therapists
Pharmacy	*Pharmacists*
Child care and youth services	*Social work and counselling professionals*
Social work and counselling	*Social work and counselling professionals*
Personal services (general programmes)	*Child care services, aged care services, social welfare and sports, recreation and cultural centre managers*
Hotel, restaurant and catering	*Hotel and restaurant managers*
Travel, tourism and leisure	*Hotel and restaurant managers*
Sports	*Child care services, aged care services, social welfare and sports, recreation and cultural centre managers*
Domestic services	*Child care services, aged care services, social welfare and sports, recreation and cultural centre managers*
Hair and beauty services	*Child care services, aged care services, social welfare and sports, recreation and cultural centre managers*
Transport services	*Supply, distribution and related manager*

Occupations used to represent tasks in each field of study are in italics

9.2 Sample dataset

	is_Misma	s_Mas	schoolNa	degreeName	fieldName	gradYe	ssAdd	/Ec	/Co	cs/I	is_	/Sc	ngii	du	dii	Sci	Me	is_Li	num_E	currentComp	currentTitle	num_Cer	num_Volunteer
5	0	1	Hku	Postgraduate	EMBA	2019	1	0	0	0	0	0	0	0	0	0	0	0	7	Mark A Brand Management Company	General Manager	0	0
8	0	1	Polyu	Master of Philosophy -	Industrial and Systems Engine	2021	0	0	1	0	0	0	1	0	0	0	0	0	6	The Hong Kong Polytechnic University	Research Assistant	8	1
18	0	1	Hku	Master of Science - MS	Marketing	2019	1	0	0	0	0	0	0	0	0	0	0	0	4	JD.COM	Marketing and Advertising	0	0
19	0	1	Hku	Master's degree	Statistics	2020	0	0	0	1	0	0	0	0	0	0	0	0	5	Bloomberg LP	Market Data Support Specialist	4	0
30	0	1	Hku	硕士	Global Management with Dis	2021	0	0	0	0	0	0	0	0	0	0	0	0	7	KPMG China	Associate	6	0
48	0	1	Polyu	Master's degree	Bilingual Corporate Commun	2021	0	0	0	0	1	0	0	0	0	0	0	0	2	深圳市创梦天地科技有限公司	Brand Promotion	0	0
109	0	1	Hku	Master of Science - MS	Educational Speech-Languag	2020	0	0	0	0	1	0	0	1	0	0	0	0	10	Hong Kong Children Association	Speech Language Pathologist	5	0
117	0	1	Hku	Master of Laws - LLM	Master of Laws - LLM	2020	0	0	0	0	0	0	0	0	0	0	0	1	3	Societe Generale	VP - Compliance Risk Review Controller, APAC	2	0
149	0	1	Hku	Master of Arts - Transp	Master of Arts - Transport Po	2020	0	0	0	0	1	1	0	0	0	0	0	0	3	DFS Group Limited	Senior Assistant Planning Manager	0	0
162	0	1	Polyu	Master's degree	Computing	2021	0	0	1	0	0	0	0	0	0	0	0	0	3	AIA Hong Kong and Macau	Senior Full Stack Engineer	0	0
200	0	1	Hku	Master of Laws - LLM	Law	2021	0	0	0	0	0	0	0	0	0	0	0	1	13	H.Y. Leung & Co. LLP, Solicitors 梁浩然	Trainee solicitor	2	1
220	0	1	Hkbu	Master of Science - MS	Information Technology Mar	2021	0	0	1	0	0	0	0	0	0	0	0	0	7	Royal Shalom Group	Business Analyst	2	0
247	0	1	Lingu	Master's degree	Finance	2019	0	1	0	0	0	0	0	0	0	0	0	0	3	GUTEN Capital	Business Development in CNs Market & Finan	0	0
248	0	1	Hku	Master of Social Scien	Advertising	2021	1	0	0	0	0	0	0	0	0	0	0	0	3	Shearman & Sterling LLP	Pitch and Research Assistant	0	0
263	0	1	Hku	Master of Laws - LLM	Corporate and Financial Law	2021	0	1	0	0	0	0	0	0	0	0	0	1	4	Goldman Sachs	Executive Director, Conflicts Resolution Group	0	0
264	0	1	Hkust	Master's degree	Mathematics	2019	0	0	0	0	0	0	0	0	0	1	0	0	2	Hong Kong Institute of Education	Teaching Fellow	1	0
270	0	1	Hkust	Master of Business Adr	Master of Business Administr	2019	1	0	0	0	0	0	0	0	0	0	0	0	1	Google	International Growth Consultant	0	0
271	0	1	Hku	Master's degree	Business Analytics	2021	0	0	0	1	0	0	0	0	0	0	0	0	3	Cinda International Securities Limited	Equity and derivatives Dealer	0	0
291	0	1	Hku	Master of Science - MS	Finance	2020	0	1	0	0	0	0	0	0	0	0	0	0	6	China Securities (International) Finance	Investment Banking Analyst	0	0
299	1	1	Hku	Master's degree	Social Sciences (Counselling	2020	0	0	0	0	1	0	0	0	0	0	0	0	5	The Hongkong and Shanghai Hotels, Lir	Senior Marketing Manager, Peninsula Mercha	0	0
314	0	1	Hku	Master of Science - MS	New Media	2019	0	0	0	0	0	0	0	0	1	0	0	0	3	Alibaba Group	Operation Specialist of International Short Vid	0	2
346	0	1	Hkust	Master of Science	Business Analytics	2020	1	0	0	1	0	0	0	0	0	0	0	0	3	State Street	Campaign and Client Experience Manager	1	0
371	0	1	Polyu	Master of Science - MS	Information Technology	2021	0	0	1	0	0	0	0	0	0	0	0	0	4	Alphalion Technology	Project Business Analyst	0	0
396	0	1	Hkust	Master of Business Adr	Master of Business Administr	2021	1	0	0	0	0	0	0	0	0	0	0	0	7	foodpanda	Customer Insights Manager	0	1
411	1	1	Hku	Master of Arts - MA	International/Global Studies	2020	0	0	0	0	1	0	0	0	0	0	0	0	5	Sina Com Technology (China) Co. LTD	Product Operator	0	0
435	0	1	Hkust	Master of Business Adr	Banking, Corporate, Finance,	2021	0	1	0	0	0	0	0	0	0	0	0	1	5	Convoy Financial Services Ltd.	Consultant	0	0
439	0	1	Hku	Master of Science	Food Industry: Management	2021	1	0	0	0	0	0	0	0	0	0	0	0	4	Metro Food Sourcing	Quality Assurance Coordinator	2	0
479	0	1	Hkust	Master of Philosophy -	Computer Science	2020	0	0	1	0	0	0	0	0	0	0	0	0	8	The Hong Kong University of Science a	Research Assistant	0	0
498	0	1	Hku	Master of Business Adr	Master of Business Administr	2021	1	0	0	0	0	0	0	0	0	0	0	0	6	First Abu Dhabi Bank (FAB)	Financial Institution Group	0	0
516	1	1	Edu	Master's degree	International Management	2021	1	0	0	0	0	0	0	0	0	0	0	0	4	Nokia Bell Labs	Student Consultant	0	0
537	0	1	Hku	Master of Business Adr	Finance	2021	0	1	0	0	0	0	0	0	0	0	0	0	5	Fosun Hani Securities Limited	Investment Banker	3	0
541	0	1	Hku	Master of Laws in Corp	Master of Laws in Corporate	2021	0	1	0	0	0	0	0	0	0	0	0	1	5	JPMorgan Chase & Co.	Associate	1	0
570	0	1	Hku	Master of Science - MS	Mechanical Engineering	2021	0	0	0	0	0	1	0	0	0	0	0	0	3	CLP Holdings Limited	Engineer	0	3
583	0	1	Hku	Master's degree	Economics	2021	0	1	0	0	0	0	0	0	0	0	0	0	3	Asia Global Institute	Research Assistant	0	0
586	0	1	Hku	MBA	Marine Engineering	2021	0	0	0	0	0	1	0	0	0	0	0	0	3	Chellship	Technical Superintendent	0	0
599	0	1	Hku	Master degree	Business/Corporate Commun	2021	1	0	0	0	1	0	0	0	0	0	0	0	3	Crypto.com	Information Technology Support Engineer	4	2
601	0	1	Hkust	Master of Business Adr	Business Administration and	2021	1	0	0	0	0	0	0	0	0	0	0	0	1	Meiyume	Director - Quality Management	4	0
613	0	1	Hku	Master of Science - MS	Data Science	2021	0	0	0	1	0	0	0	0	0	0	0	0	6	China Great Wall AMC (International) I	Assistant Manager	2	0
618	0	1	Hku	Master of Science - MS	Data Science	2021	0	0	0	1	0	0	0	0	0	0	0	0	2	Fintech and Business Analytics Centre	Research Assistant	0	0
624	1	1	Hku	Master of Science - MS	Computer Science	2020	0	0	1	0	0	0	0	0	0	0	0	0	6	Deloitte	Senior Associate	4	0

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