

Gender-based Occupational Segregation in China's Urban Sectors

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Abstract: Gender-based occupational segregation in the Chinese economy was substantial in the 1990s as the shift towards a market-based economic system intensified. Many argued that women were relatedly disadvantaged as they were routinely shifted from more to less lucrative industries. However, little work has been done of late to analyze the current level of occupational segregation by gender in the Chinese economy and its relationship to industries' average wages. Theory suggests that as the Chinese economy shifts towards greater market integration, with the associated decreasing role of the state, that the intensity of occupational segregation by gender would intensify initially and decrease in intensity over time. Furthermore, it has been found in capitalist economies that women's increased concentration in an industry is often associated with declining relative wages in said industry. Using multiple approaches to measuring the extent of occupation segregation and its relation to wages, this contribution examines the current trends in urban China from 2004 to 2014 to test these theories. The data utilized herein is published in *China Labour Statistical Yearbooks* (CLSY) by the National Bureau of Statistics of China and includes data from all 31 provinces. The findings herein indicate that there exists a strong negative correlation between the growth rate of women's employment in an industry and the average wage in several industries and a correlation, though weak, on average for the Chinese economy as a whole in support of the previous findings in capitalist economies. However, in opposition to the aforementioned theory, gender-based occupational segregation is still increasing in China, rather than decreasing in intensity. The combination of these findings implies that women's relative wages in the Chinese economy are actually falling more rapidly than theory would suggest. Finally, this work concludes with a discussion of policy reforms which may help alleviate the potential underlying causes of the negative relationship between the average wage and the concentration of women in an industry.

Keywords: gender; China; employment; occupational segregation

1. Introduction

Since the transition towards a market economy began in the mid-1900's in the People's Republic of China, hereafter China, there has been a concern that the shift may lead to substantial increases in economic inequality that were absent in the communist system (Xie and Hannum, 1996; He and Wu, 2014). This concern may be particularly salient in regards to gender equality as the Chinese state had previously actively promoted gender egalitarianism (Whyte and Parish, 1984). Thus, many have come to conclude that increased marketization (and the associated decreasing role of the state in the labor market) has resulted

in substantial increases in gender inequality in wages which may largely be due to occupational segregation (Charles and Grusky, 2004).

As the Chinese economy continues to transition from a state-controlled system towards a greater focus on markets, information on how the capitalist system creates and encourages inequality becomes more robust. The transition now well underway, there is sufficient data to analyze this macroeconomic question: how has occupational segregation evolved from 2004 to 2014 across the Chinese economy with the expansion of markets and what is its relationship to industry-specific wages?

This study contributes to the literature in several critical ways. First, it analyzes more recent trends using data from the *China Labour Statistical Yearbook* (2004-2014) and is therefore able to analyze this question from the perspective of an economy well into the transition process where previous studies evaluated occupational segregation early on in the process. Second, it utilizes data from across all 31 Chinese provinces and thus is able to speak more broadly to this issue across the entirety of the Chinese economy while previous works were usually limited to an analysis of a single province. Third, this work extends the previous work on occupational segregation by analyzing both the current extent of occupational segregation by gender in the Chinese economy and its relationship with industry-specific wages.

Calculating Duncan & Duncan indices (Duncan & Duncan, 1955) across time reveals that the decreasing role of the state and increased use of markets and capitalist properties have resulted in a substantial increase in gender-based occupational segregation. Furthermore, correlation calculations have resulted in the conclusion that there exists a negative relationship between an industry's average wage and the proportion of women working in the industry—a result that is robust across industries. Proposed policy solutions include the need for increased investments in women's human capital, and education spending in aggregate, a renewed focus on shifting export-sector production to domestic production, and governmental supplied/subsidized childcare.

This paper is organized as follows. The literature is surveyed in section two. Data and descriptive statistics are provided in section three while the analysis is provided in section four. The policy implications are presented in section five and the paper is concluded in section six.

2. Literature

Gender-based occupational segregation, defined here as the distribution of women and men across and within industries, may have substantial impacts on a country as such segregation can stimulate growth when women provide the majority of the labor in export sector production (Seguino, 2000). There are also individual incentives for such segregation. The evidence indicates that men tend to move into jobs with higher relative earnings thus squeezing

out women from these higher paying jobs and resulting in a situation where jobs filled largely by women offer relatively lower pay (Shu, 2005).

While the gender gap in wages tends to be the most utilized tool in the literature to analyze gender inequality, the change in occupational segregation is at least as important as it often determines much of the gender gap in wages (Marini and Fan, 1997) and it is related to other indicators of well-being, including job security and occupational safety, among others (Anker, 1998). Furthermore, occupational segregation in the Chinese economy contributes to women's limited ability to access vertical and horizontal mobility and thus capitalize on advancement opportunities (Liu, 2007). Occupational segregation itself is quite complex as one could assume such segregation is voluntary and thus not to be concerned about—the traditional neoclassical perspective—however, this argument ignores the more complex social and political components that are pervasive in the Chinese economy that direct occupational options. That is, for many reasons, it is difficult if not impossible for a Chinese citizen to shift from one region or sector to another and find gainful employment due to the household registration system and state-directed employment programs (Fan, 2003; Fleisher and Yang, 2006). In addition to these political and institutional restrictions, culturally, women are often encouraged to leave the paid labor market to provide those positions to men looking for work (Liu, 2007). These factors combine to significantly limit women's ability to find jobs in the highest-earning fields and to advance (Tilly, 1998).

Results from previous research on gender inequality in occupational segregation has tended to agree that gender-based occupational segregation may be present—though there are differing reasons given for this—and that it was the largest contributor to the gender wage gap. Maurer-Fazio, Rawski, and Zhang (1997) find a negative relationship between the percentage of female workers in a sector and the sector's average wage. Shu (2005) finds that marketization during the economic transition has led to increased gender segregation by occupation where men enter higher paying fields and push women out, simultaneously exacerbating gender segregation and the gender-wage gap. Seguino (2005) argues that women's employment in manufacturing industries in China are likely to be transitory thereby reversing over time and that even these gains are likely to occur at lower relative wages. Furthermore, Seguino argues that women tend to be concentrated in labor-intensive industries which are highly susceptible to foreign competition and thus are associated with lower relative wages. In research with the International Labor Organization, Anker, Malkas, and Kortén (2003) find that occupational sex segregation increased from 1990 to 2000 in China. Finally, Meng (1998) finds that occupational segregation in the Shandong province is largely attributed to differing treatment of stereotypical female and male attributes and that the subsequent segregation is the driving force in the extent of wage inequality

by gender. Finally, Knight (2016) finds that occupational segregation has intensified since the mid 1990s.

3. Data and Descriptive Statistics

The data utilized in this paper is published in *China Labour Statistical Yearbooks* (CLSY) by the National Bureau of Statistics of China from 2004 to 2014 and

Table 1: Descriptive Statistics

Industry	Wages (in yuan)		Female Participation	
	Mean	Standard Deviation	Mean	Standard Deviation
National Total	30,127	12,793	37.2%	1.0%
Agriculture, Forestry, Animal Husbandry (Farming of Animals) and Fishery	14,028	6,430	36.8%	0.4%
Construction	23,294	16,337	13.4%	2.2%
Culture, Sports and Entertainment	35,515	11,418	41.9%	1.8%
Education	31,053	15,610	49.4%	1.1%
Finance/Financial Intermediation	55,342	10,215	49.4%	1.6%
Health and Social Service (Sanitation, Social Security and Social Welfare)	33,790	13,646	59.9%	1.8%
Hotels and Catering Services (Accommodation and Restaurants)	20,576	14,363	54.4%	0.8%
Information Transmission, Software and Information Technology (Computer Services)	55,829	7,682	38.4%	0.7%
Leasing/Tenancy and Business Services	34,540	19,443	33.2%	1.4%
Management of Water Conservancy, Environment and Public Facilities	21,830	27,240	40.6%	1.5%
Manufacturing	26,282	11,762	41.8%	0.9%
Mining	35,358	14,813	20.4%	0.8%
Production and Supply/Distribution of Electricity, Heat, Gas and Water	39,456	19,286	29.3%	0.6%
Public Management, Social Security and Social Organization	31,500	8,175	27.9%	0.4%
Real Estate	31,182	8,880	34.0%	2.4%
Scientific Research and Technical Services (and Geologic Perambulation)	45,742	13,191	31.2%	1.6%
Service to Households, Repair and Other Services (Resident Services and Other Services)	23,951	14,121	41.1%	0.9%
Traffic, Transport, Storage and Post	33,912	13,915	27.2%	1.0%
Wholesale and Retail Trades	27,630	11,754	46.1%	1.1%

Notes: Means and standard deviations calculated using annual data from 2004 to 2014. Source: *China Labour Statistical Yearbook*(2004-2014).

includes data from all 31 provinces. Data herein includes urban formal employees physically present and actively working either part-time or full-time in an urban area at years' end and includes migrant workers. The Labor Ministry, the reporting agency for CLSY, limits urban units to cities only, and thus the data is restricted to this narrow definition of urban employment. Lastly, the CLSY reports data on formal employment only and thus the data provided here refers solely to formal employees. Table 1 provides descriptive statistics related to average wages and female participation by industry measured from 2004 to 2014.

The industry with the highest average wage over this time period is Information Technology, followed closely by Finance with mean wages of 55,829 and 55,342 yuan, respectively. The industry with the lowest mean wages is Agriculture with a mean wage of just over 14,000 yuan. The industry with the highest percentage of female participation is Health and Social Services with women's employment almost 60% of total while the industry with the lowest percentage of women is Construction with a mean of just over 13.4%.

Take a deeper look into the changes in women's employment by industry elicits an even more interesting picture. By calculating the percent change in the proportion of women's participation in each industry (Figure 1), industry-specific trends emerge. For example, women's proportional employment in education exhibits a positive growth year every year indicating that women's employment in this already female dominated sector is growing still further (Table 1). With one exception (2010), the same is true of the proportion of women working in health and social services. This comes alongside of the falling proportion of women employed in manufacturing, computer services,

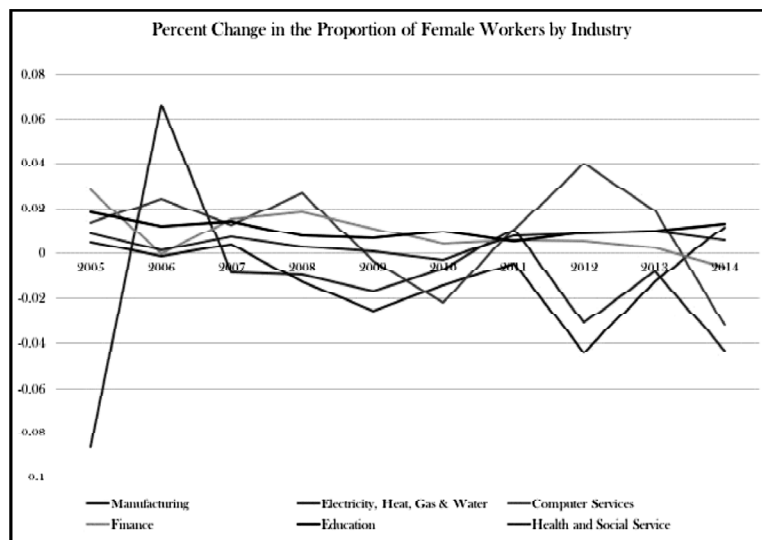


Figure 1: Percent change in the proportion of female workers by industry

and electricity, heat, gas, and water—already male dominated industries (Table 1). Finally, the finance industry exhibits mixed results in terms of the proportion of women employed with two years with positive growth rates while the rest are negative.

4. Analysis

There are multiple ways to test the relationship between women’s employment in an industry and industry-specific wages. This section provides many of these tests: first, an analysis of the relationship with a focus on the industries with the largest and smallest increases in pay and their associated changes in women’s employment; second, an evaluation of the correlation between the two variables; and third, an analysis of the extent of occupational segregation in the Chinese economy over this time period.

Table 2 includes data on the changes in average wages, net of average change in all industries, and the change in female employees. The change in the average wage is calculated net of the national average to remove trends in the wage—calculated this way, a negative (positive) figure for the wage data indicates a wage that rising slower (faster) than the national average. The data is sorted by the change in average wages from smallest to largest growth rates. It is evident that Information Technology, while having the highest average wage (Table 1) over this time period, experiences the slowest growth—conversely, finance, which fell only slightly below Information Technology in terms of average wage, grew the fastest. What becomes even more evident with an evaluation of this table is the association between the change in wages and women’s relative employment in each industry. With few exceptions, industries that had slower growth than the national average saw positive movements in the percentage of female employees and industries with faster growth tended to also see declines in women’s employment as a percentage of the total.

Table 2: Changes in Wages and Occupational Segregation between 2004 and 2014, by Industry

<i>Industry</i>	<i>Change in Average Wage net of average change all industries (in %)</i>	<i>Change in Female employees (in %)</i>
Information Transmission, Software and IT (Computer Services)	-65.0%	9.3%
Real Estate	-60.5%	6.7%
Service to Households, Repair and Other Services (Resident Services and Other Services)	-55.8%	-3.8%
Hotels and Catering Services (Accommodation and Restaurants)	-55.2%	0.4%

contd. table 2

<i>Industry</i>	<i>Change in Average Wage net of average change all industries (in %)</i>	<i>Change in Female employees (in %)</i>
Management of Water Conservancy, Environment and Public Facilities	-52.5%	1.2%
Public Management, Social Security and Social Organization	-38.5%	12.9%
Culture, Sports and Entertainment	-12.2%	7.5%
Health and Social Service (Sanitation, Social Security and Social Welfare)	-1.0%	5.1%
Production and Supply/Distribution of Electricity, Heat, Gas and Water	1.9%	-13.1%
Education	6.9%	11.4%
Manufacturing	7.2%	-9.1%
Leasing/Tenancy and Business Services	8.2%	-3.9%
Traffic, Transport, Storage and Post	8.9%	-9.7%
Construction	12.1%	-34.4%
Scientific Research and Technical Services (and Geologic Perambulation)	15.5%	-5.2%
Agriculture, Forestry, Animal Husbandry (Farming of Animals) and Fishery	15.8%	1.4%
Mining	82.1%	-28.4%
Wholesale and Retail Trades	102.5%	12.3%
Finance/Financial Intermediation	120.3%	8.7%

The data provided in Table 2 supports the hypothesis posited here that even after the initial shift toward marketization, there is a negative relationship between the change in the average wage, net of average change all industries, and the change in female employees in a given sector. While Shu (2005) found this to be true during the initial shift toward a market-based economy, these results indicate that decades later, women may still be crowded into industries whose wages are falling and out of industries whose wages are rising. While there are several exceptions¹—see the few notable sectors where there exists a positive relationship between the change in the average wage and the change in female employees in Table 2—these results are consistent across multiple analytic techniques.

The correlation coefficient between wages and women's share of employment is approximately -.17 implying a weak but negative relationship between the relative change in the average wage and the growth rate of women's employment. This can also be seen in Figure 2 where a scatterplot with a trendline indicates a negative relationship between the variables.

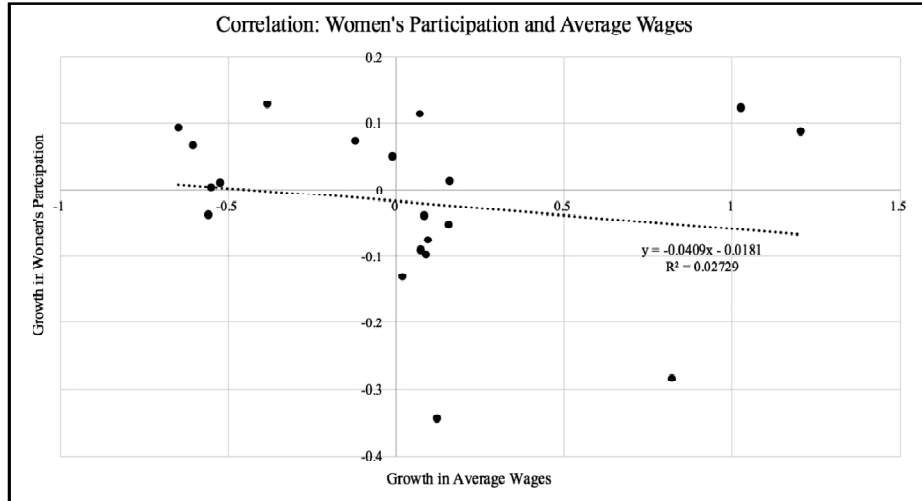


Figure 2: Correlation: Women's Participation and Average Wages

Furthermore, disaggregating this data by industry indicates an even stronger negative relationship between these two variables in certain industries. Figure 3 illustrates this relationship in the manufacturing sector which exhibits a strong relationship with few deviations from the trendline. Figure 4 below illustrates a similar strongly negative relationship in regards to the Production and Supply/Distribution of Electricity, Heat, Gas and Water industry.

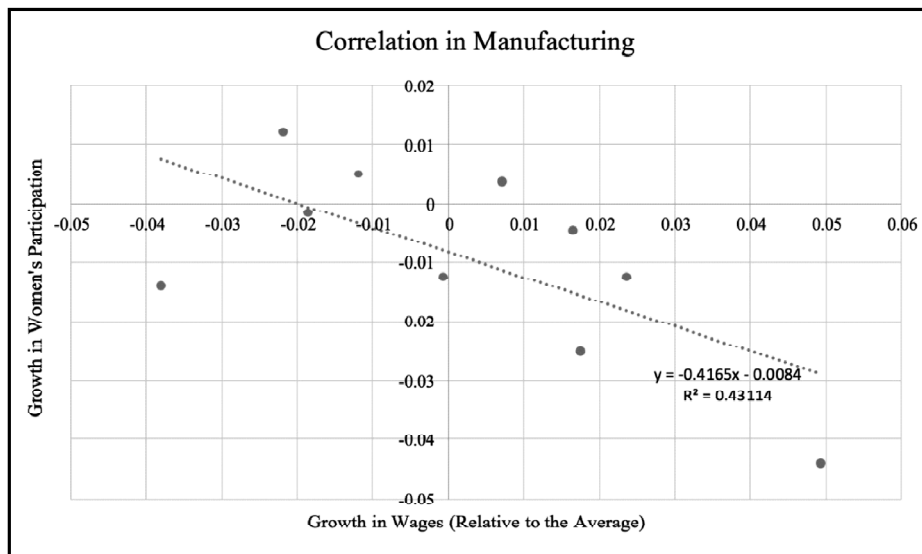


Figure 3: Correlation in Manufacturing

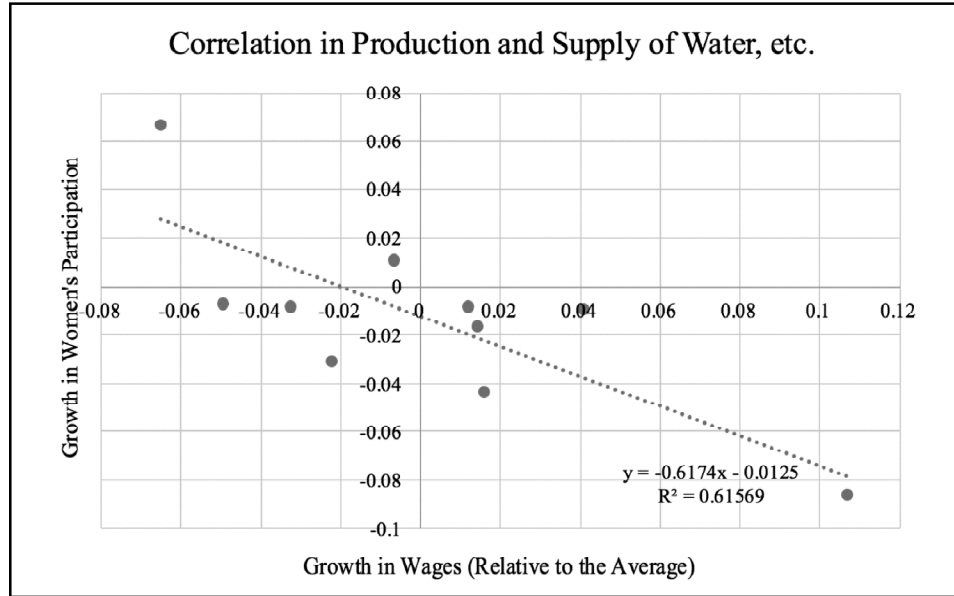


Figure 4: Correlation in Production and Supply/Distribution of Electricity, Heat, Gas and Water

Table 3 provides the sector-level correlation coefficients which reflect the relationship between the growth rate of women's employment and the change in the relative wage. The table is sorted by correlation coefficient from smallest to largest. While the majority of industries exhibit a strong negative correlation between these variables, several strong results are worth mentioning. The three industries which exhibit the strongest negative relationship are 1) Production and Supply/Distribution of Electricity, Heat, Gas and Water, 2) Manufacturing, and 3) Agriculture, Forestry, Animal Husbandry (Farming of Animals) and Fishery. The absolute value of these correlation coefficients are all greater than 0.50 indicating a strong relationship. There are a few industries that exhibit little-to-no relationship between the variables, or even small or medium positive relationships including 1) Traffic, Transport, Storage and Post, 2) Real Estate, and 3) Finance.

Duncan & Duncan indices (Duncan and Duncan, 1955) are used here (Figures 5) to illustrate sectoral employment imbalances by gender across time averaged across all regions using the following formula

$$S = \frac{1}{2} \sum_i |m_i - f_i|$$

such that S represents the calculated index, m_i the ratio of men's employment in industry i to total men's employment and f_i the ratio of women's employment

Table 3: Correlation Coefficients, by Industry

<i>Industry</i>	<i>Correlation Coefficient</i>
Production and Supply/Distribution of Electricity, Heat, Gas and Water	-0.78
Manufacturing	-0.66
Agriculture, Forestry, Animal Husbandry (Farming of Animals) and Fishery	-0.58
Construction	-0.43
Public Management, Social Security and Social Organization	-0.38
Scientific Research and Technical Services (and Geologic Perambulation)	-0.35
Culture, Sports and Entertainment	-0.34
Wholesale and Retail Trades	-0.31
Education	-0.28
Mining	-0.25
Hotels and Catering Services (Accommodation and Restaurants)	-0.20
Management of Water Conservancy, Environment and Public Facilities	-0.19
Service to Households, Repair and Other Services (Resident Services and Other Services)	-0.02
Health and Social Service (Sanitation, Social Security and Social Welfare)	0.07
Information Transmission, Software and Information Technology (Computer Services)	0.11
Leasing/Tenancy and Business Services	0.19
Traffic, Transport, Storage and Post	0.32
Real Estate	0.36
Finance/Financial Intermediation	0.54

Notes: Calculations provided here utilize data on the growth rate of women's employment and the change in the relative wage in each sector.

in industry i to total women's employment. This index is formulated such that $0 \leq S \leq 100$ where a score at the bottom of the range represents a complete lack of segregation while one at the top indicates complete segregation between the genders.

Occupational segregation has been increasing at a steady pace in the Chinese economy over this time period with indices starting at 19.5 and growing to over 25.7 in just an 11-year time span. This can be interpreted as the percentage of women who would need to switch from female dominated industries to male dominated ones so as to reach parity across the industries. This index began at under one-fifth of women in the work force and ended at more than one quarter.

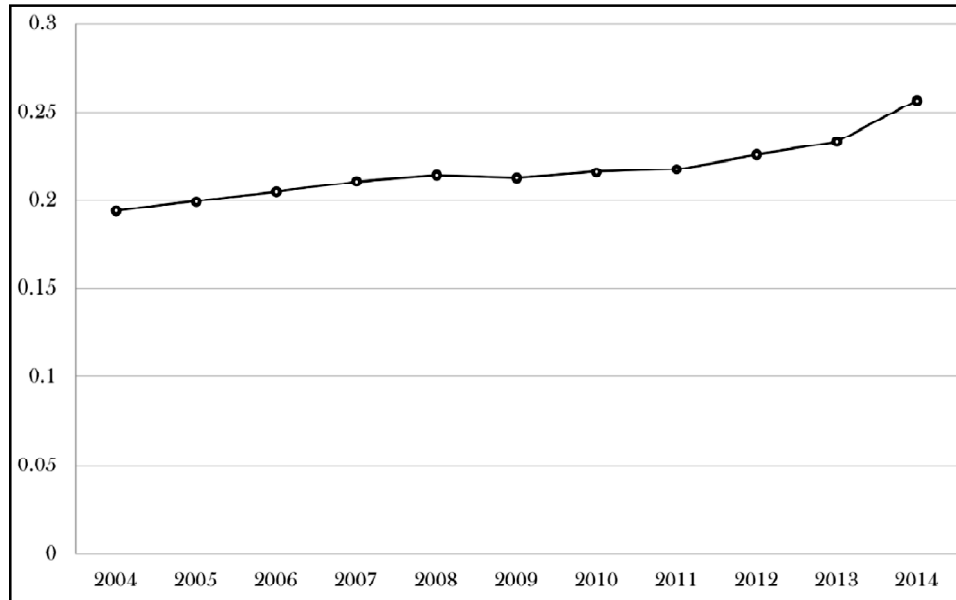


Figure 5: Duncan & Duncan Indices over time (author's calculations)

5. Policy Implications

The results provided above indicate that occupational segregation by gender is still increasing in the Chinese economy and that on average, changes in women's employment is negatively related to the industry's wage—what is less certain is the exact cause. Wage changes could be the precipitating factor, or it could be the changes in employment.

It could be the case that as wages increase in an industry due to demand-pull effects, that women are pushed out of those positions (Shu, 2005). Conversely, as wages fall in an industry due to a shrinking in aggregate demand for the industry, women may be crowded into said industry as cultural norms indicate that women's income is more akin to "pin" money (Traflet, 2012) than a living wage. Alternatively, it could be the case that when women shift into an industry to the extent that women's employment is greater than men's, wages in the industry fall as the occupation is now stigmatized as women's work and is thus less valuable than it was before when it was dominated by male employees (Levanon, England, and Allison, 2009). Lastly, there are a couple of potential arguments in regards to a reduction of women's employment and associated increase in wages. For one, it could also be the case that as women leave an industry, the labor supply is reduced thereby increasing the wages. This is a strictly Neoclassical perspective that reduces the issue to a pure supply and demand explanation that is anything but complete or inclusive of the current complexity of the gendered labor market

in China. A more institutional explanation that is inclusive of gender norms and the unique Chinese economy is that women are often pushed out of growing industries that tend to be associated with higher relative wages. This includes those pushed out of the labor force all together as a growing social norm to have women return to the home was popularized (Shu & Bian, 2003). There are other potential explanations, of course, for these four chains of causality but these are just a few that can help explain the potential causes. The chart provided in Figure 6 below lays out these possibilities and associated policy solutions to each case.

Increasing women's access to human capital may be a potential solution to the reduction in women's employment in an industry if the response to higher wages is a shift to men's employment with the perception of greater level so human capital. Knight (2018a) and Fleisher, Li, and Zhao (2010) find that increasing women's human capital in the Chinese economy would not only increase gender equality in employment but would also have substantial positive impacts on economic growth. The same is also true of spending on education, broadly speaking (Knight, 2018a). However, if women are pushed out of an industry with growing wages because social norms dictate that higher paid positions belong to men as head of the household, the integration of the

Wage-causes	Policy Solutions
↑ wages → ? women's employment	→ Increase women's access to human capital → Spending on education
↓ wages → ? women's employment	→ Export industries greater domestic focus
Employment-causes	Policy Solutions
↑ women's employment → ↓ wages	→ Export industries greater domestic focus
↓ women's employment → ↑ wages	→ Childcare support

Figure 6: Wage and Employment Causes and Potential Solutions

social and economic spheres makes policy options to alleviate this inequality become increasingly limited (Knight, 2018b).

Shifting export-oriented industries to focus more on domestic production may be a solution to export-focused industries such as textiles which employ a large fraction of the female labor force at very low wages. This policy option is explored and outlined in detail by Rodrik (2010) and determined to be gender equality promoting by Knight (2016). Finally, increased governmental support for childcare may help stem the flow of women out of the paid labor market and reduce inequality in employment and income (Francois, 1998; Shu & Bian, 2003).

Solutions proposed by Liu and Zhao (2015) and others support limited policy reforms in an effort to reduce the widening urban income gap caused by the Marketization period in the Chinese economy, however the reforms they specify rely on markets to solve the issue when the introduction of markets is the cause of the growing gap². Instead, employment and wage protections need to be implemented at the government level as markets will not automatically eliminate discrimination as is perpetuated in the neoclassical methodology (Becker, 1971). Francois (1998) produces a model which challenges the traditional theories underlying Becker's (1971) model and explains how phenomenon such as occupational segregation by gender can emerge in a market system even without innate differences between the sexes. Francois also models the emergence of wage differentials in the market, largely tracing them to household bargaining within the home. Furthermore, Francois' model illustrates how an equilibrium can emerge where firms do not wish to discriminate and actually prefer not to when specific policies are in place, such as those mentioned above. Thus, it seems unlikely that a market solution to a problem caused by the introduction of markets would work to alleviate the growing gender inequality. Instead, the marketization process in China will require regular course corrections and some specific policy options, such as those provided above, can help alleviate this emerging gender inequality.

6. Conclusion

This work endeavors to determine if patterns in occupational segregation by gender, which began in the 1990s, where men tended to take over higher paying fields and thus relegating women to sectors with lower relative compensations, have continued of late in the Chinese economy.

The analyses provided herein indicate that women in China may still be actively shifted out of industries as they become more lucrative, and into industries that are less so. While it is correlation and not causality that is tested here, the evidence provided here on the direction of the relationship between changes in the wage and female employment are consistent with the evidence from early in China's economic transition and indicate that the mechanisms which worked to de-feminize high-yielding industries are likely still at work

long into the economic transition in China. The inverse relationship between women's wages in an industry and women's share of employment in said industry is exists across almost every industry.

Furthermore, as the Chinese economy's focus on markets picks up steam, as does the occupational segregation along gender lines. Industries are become more and more gender-segregated such as of 2014, it would take over one quarter of the women employed to shift from female-dominated sectors to male dominated ones in order to reach gender parity across industries. While the two results, growing segregation and the negative relationship between women's wages and employment in a sector, appear separate, they in fact present a startling picture of how quickly gender inequality can emerge in an economy moving to embrace capitalism and the market structure.

While several policy options are presented here—such as additional focus on women's human capital, shifting from export to domestic industries, and government support for childcare—the concerning factor is that the Chinese economy is continuing to embrace this new economic system and thus it would be difficult to reverse this damaging trend without substantial government intervention—exactly what the economy is looking to limit. How the Chinese economy will react to the emergence of these discriminatory attributes of capitalism is still to be determined.

Notes

1. Services to Households, Education, Agriculture, Wholesale and Retail Trades, and Finance are the exceptions.
2. Liu and Zhao (2015) propose that the government should “eliminate market distortions, to promote fair and perfect competition” as well as “promote equal access to employment.”

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