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Abstract: This paper econometrically analyses the relationship between public spending and women's and men's urban employment in China for the period 1999–2009. Theoretically, spending on healthcare and education could increase employment growth and women's relative employment via the expansion of paid care work (increasing labour demand) and reductions in unpaid labour (increasing labour supply). To empirically test this, female, male, and relative employment growth are estimated as functions of public spending while both demand-side and supply-side factors are controlled for. Economic growth is also included in a simultaneous equation estimation. While healthcare results are mixed, education spending is positively associated with economic growth, employment growth for both women and men, and women's relative urban employment. Using economic significance calculations, I describe how well-directed public policies can promote both economic growth and long- and short-run benefits in employment equality between the sexes.

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Introduction

In the mid-to-late 1990s, women in the People's Republic of China (hereafter China) appeared perfectly positioned to experience significant gains in their relative livelihoods as China's high growth rate was accompanied by one of the world's highest rates of female labour-force participation (Maurer-Fazio, Hughes, and Zhang 2005). Instead, however, Chinese scholars urged urban women to voluntarily leave paid labour and return to the home to make room for men in the workplace (Liu 2007). Cultural and structural shifts, all consequences of economic reforms implemented to initiate the transition from a centrally planned economy to a market economy, appear to have affected men and women to differing extents as women's employment has declined more significantly than men's and recovered more slowly since the dawn of the economic reforms (Fan 2003; Ding, Dong, and Li 2009).

The economic reforms implemented during this time are quite complex, as evidenced by the many shifting patterns of production and the coexistence of socialist and capitalist characteristics. Thus, a thorough evaluation of the effects of these reforms on the differences between women's and men's employment is a substantial undertaking that has yet to be completed in the literature. However, by separating out a component of the reforms – specific elements of public spending – I provide a unique analysis of its relationship with women's and men's employment and employment equality so as to discover what role public spending may have played in the lack of significant advancement in women's relative welfare from 1999 to 2009, and what role it can play in the future.

Of the many possible measurements for gender equality – including wage, employment, education, time poverty, and mortality, among others – I focus exclusively on employment for two main reasons: First, employment measures the level of integration into paid labour and thus may indicate the extent to which an economy values and incorporates women's work. Second, employment provides women with access to external income, which even if lower than that of their male counterparts, increases their provisioning capacity and thus their relative bargaining power within the household. Given that bargaining power is positively correlated with voice, agency, autonomy, and control over household resources, employment represents

the first step in the movement towards equality in welfare (Braunstein 2008). Thus, while employment may not be a sufficient condition for increasing women's welfare, it is a necessary one and, as such, is my chosen measure of gender equality.

Specifically, I focus on two categories of public spending – spending on education and healthcare, and social-infrastructure spending (term borrowed from Seguino [2010]) – and aim to determine if such spending is positively correlated with employment in a neutral or equality-enhancing way. Spending on health and education, termed "care" sectors, can influence women's relative labour demand strongly, as these sectors act as employment engines for women (Razavi et al. 2012). Often considered women's domains, healthcare and education involve the reproduction of the labour force and therefore exhibit greater association with women's labour demand than men's (Braunstein, van Staveren, and Tavani 2011). I also test for the possibility of a "win-win" situation as proposed by Seguino, Berik, and van der Meulen Rodgers (2010), who argue that infrastructure spending may enable policymakers to reach development goals while also increasing gender equality. Using a system of simultaneous equations, I estimate employment growth for both women and men as a function of social-infrastructure spending controlling for supply- and demand-side effects, supply-side (demand-side) effects being those factors that influence the supply (demand) of labour. Finally, I offer calculations of the economic impacts of social-infrastructure spending, structural change, and economic growth on sex-disaggregated employment in China during the period of economic reforms and discuss how these results can be beneficial to policymakers.

Given the recent literature advocating for gender sensitivity in public policy decisions and the unique position of China in the world economy, this paper provides an original, timely analysis of Chinese public policy and its effects on employment for women and men as well as on economic growth. The results indicate that spending on education may provide a win-win scenario for policymakers – it is positively associated with employment growth for women and men, women's relative employment, and economic growth in the short run. Thus, education spending may be able to be used as a policy lever in China to achieve development goals in a gender-sensitive manner.

Our study contributes to the literature in several ways: First, I focus on the impacts of public spending and employment at the macro

level, an approach that remains somewhat unexplored in the literature. Second, I provide a uniquely applied theoretical model that supports the inclusion of multiple controls that are largely unique – such as a proxy for the role of industrialisation, and separate controls for foreign and domestic investments. Third, I provide empirical support for the inclusion of specific gender-sensitive policy options – namely, public spending on education and healthcare. While spending on education has been discussed as a public policy option in the literature (see the discussion of Du and Dong [2013] below), the evaluation of its specific impacts on women's employment is unique to this study.

The paper is organised as follows: I first present a discussion of the historical background of women's employment in the Chinese economy, followed by a survey of the literature. Then, I build my theoretical models for employment and economic growth, going on to describe the data and econometric tests. I then present the results and economic significance estimations. Finally, potential future policy discussions are deliberated before concluding remarks are presented.

Background

The status and value of women's work shifted drastically and rapidly with changes to the state sector, social norms, and institutions in China during the economic transition from a centrally planned economy to a market-based orientation (Liu 2007; Ding, Dong, and Li 2009).

While women had previously been incorporated into the paid labour market by necessity (Fan 2003), the retreating presence of state enterprises, in addition to the diminishing pervasiveness of communist ideals, brought about the return of traditional patriarchal values and, with them, sex discrimination in wages and employment (Ding, Dong, and Li 2009). From 1993 to 1999, employment in state-owned enterprises declined from 76 to 47 million workers, effectively dissolving the deep-seated cultural norm of employment guarantees; by 2009 state employment reached a low of 51 per cent of all urban employees (National Bureau of Statistics of China 2010b). Women comprised approximately 60 per cent of layoffs nationwide despite their smaller relative role in the labour market (Liu 2007). While women's unemployment was already rising faster than men's, when

unemployment began to rise for Chinese citizens, many in the media began to encourage women to return to the household and leave the paid labour market to make room for greater employment opportunities for men (Liu 2007; Ding, Dong, and Li 2009). Further intensifying the ever-growing gap in employment, an early retirement schedule mandated that men working blue-collar jobs retire at the age of 55 and women working the same jobs at age 50 in order to increase firm efficiency and ease the emerging unemployment problem (Ding, Dong, and Li 2009). Additionally, occupational segregation in the labour market resulted in women being employed in industries most vulnerable to employment losses, and men in industries more effectively shielded (Maurer-Fazio, Rawski, and Zhang 1999). The amalgamation of the inherently gendered components of the economic transition created, and subsequently intensified, employment inequality during the era of economic reforms. Gender inequality was, of course, not ushered in by the economic transition; rather, the shifting economic structure allowed the previously dormant patriarchal system to reconstruct itself.

Figure 1. Public Expenditure as a Proportion of GDP, 1978–2009
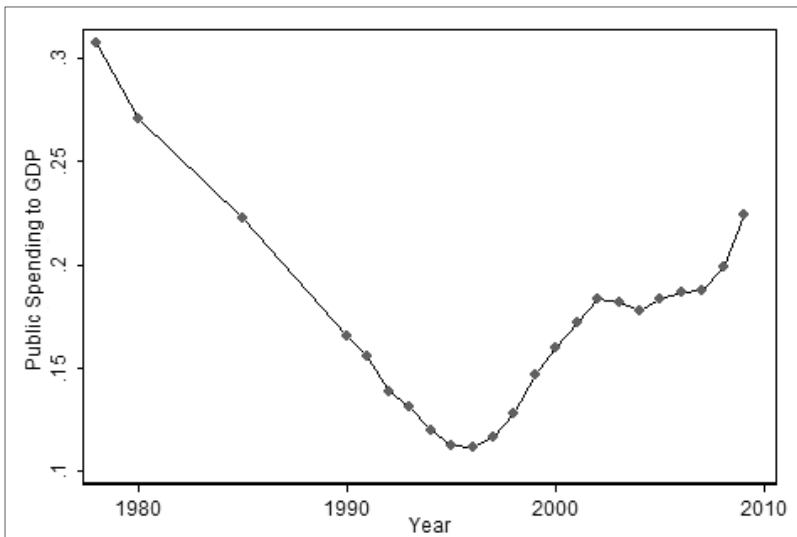
Source: National Bureau of Statistics of China (2010a).
Note: Public expenditures include expenses accrued from local, provincial, and central sources.

Unemployment relief finally arrived when tax reforms and increased efficiency in state-owned enterprises increased the fiscal status of the state sector, providing it with the revenue needed to build infrastructure and administer social relief (Wong 2000). This rebuilding is illustrated in Figure 1, which shows public spending rising from its low of 11 per cent in 1995 to 22 per cent by 2009. Unfortunately, the damage had already been done, as women's relative employment was not to recover as quickly as men's.

   As can be seen in Figure 2, which illustrates the growth rate of sex-disaggregated employment from 1999 to 2009, employment declined for women and men from 1999 to 2003. During the recovery period, from 2004 to 2009, the growth rate of men's employment was often greater than women's, indicating that overall, women's relative employment fell during this time period.

Figure 2. Annual Sex-Disaggregated Employment Growth, 2000–2009
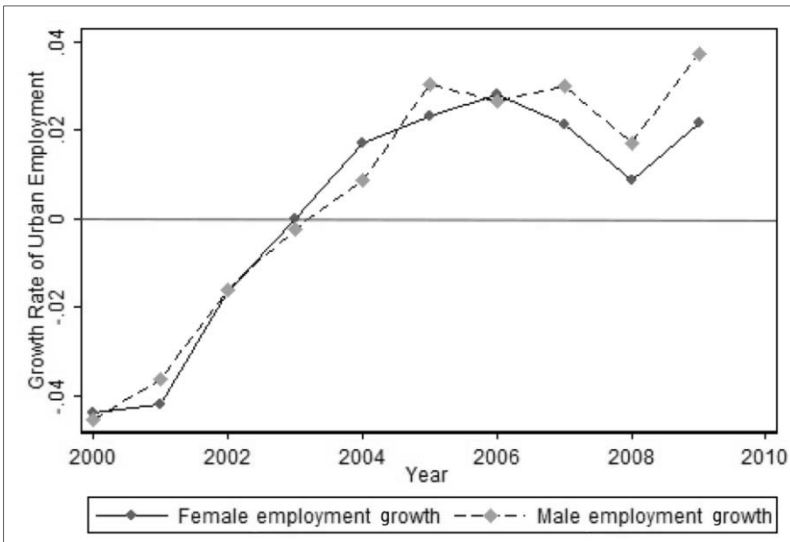
Source: National Bureau of Statistics of China (2000b–2010b).
Note: Urban employment figures include only formal employees working in an urban
           area at year's end.

In spite of the current negative trajectory, a solution may be present within the system itself. The state continues to be a dominant force in

the Chinese economy and may have the power and influence to reverse this damaging trend if certain public expenditures can, in fact, be shown to have a positive influence on women's relative employment.

Literature Review

In a China-specific analysis of the relationship between aggregate public-sector spending and employment, Ding, Dong, and Li (2009) evaluate urban married women's employment in 11 provinces from 1988 to 2002 and find that the decreased role of the state led to greater declines in women's employment than in men's, demonstrating a potential gender bias in Chinese public-sector employment. Du and Dong (2013) find that a specific source of public-sector restructuring – reductions in education and childcare – may have resulted in a decline in women's labour-force participation during the late 1990s and early 2000s. They further argue that public policies aimed at broad-based development should include such public provisions, as low-income families may be harmed most by the lack of childcare funding and availability. Furthermore, Song and Dong (2013) argue that the public-sector restructuring led to social and institutional factors that increased the incidences of downward mobility for both genders, but the effect for women was greater than that for men. Finally, Ji et al. (2017) find that state-sector layoffs disproportionately affected women who were subsequently unable to find formal employment following such dismissals. They suggest that new gender norms, with the intense segregation and stratification of women's labour, have emerged via endorsement by the state, historical social norms and traditions, and the new presence of the market.

Seguino and Braunstein (2012) utilise data from Latin America for the 20-year period beginning in 1990 and find that public spending on social infrastructure is related positively to the ratio of female-to-male employment. Additionally, they find that employment rates for women and men are affected by public investments, women's slightly more than men's. Similarly, Ilkkaracan, Kim, and Kaya (2015) analyse women's and men's employment in the case of Turkey and find that spending on social care can increase women's relative employment via side effects of both supply and demand. Women's access to funding for education reduces their unpaid labour burden,

increasing their ability to participate in paid labour, their bargaining power within the household, and gender equality (Braunstein 2008). This chain of causality may be particularly relevant in the case of Chinese migrant workers who are often forced to leave urban areas when denied access to education and childcare. Urban governments have been known to use education as a tool to decrease the flow of migrants from the rural areas by denying education to migrant children and closing schools not officially sanctioned by the government in order to reduce the supply of migrant labour in urban sectors (Jacobs 2011).

Analysing the converse, where public spending on healthcare declines, Elson (1995) argues that such reductions often manifest as decreased funding for clinics and immunisations, thus increasing the time required to care for the sick in the home. Such tasks, which are often allocated to women, reduce their ability to participate in paid labour. Another reported result of this reduction in healthcare is the negative impact on school enrolment for girls. As girls are often the first taken out of school to care for ailing family members, their future labour supply and relative wages fall with reductions in healthcare spending (Elson 1995). In the case of the Chinese economy, the declining fertility rate, due largely to the one-child policy, may continue to reduce the unpaid labour burden as it relates to women's labour supply. However, easing of household-production requirements may be largely offset by China's ageing population (a larger generation of elderly adults with an extended life expectancy), who are traditionally cared for in the home by women (Banister, Bloom, and Rosenberg 2012).

Boschini (2003) argues that education spending can affect women's labour in the future as well, given that cuts in education spending lead to decreasing rates of human-capital attainment, particularly among girls. Monetary constraints may force families to choose to educate only those with the highest expected returns, often male children, thus constraining future employment opportunities and wages for girls. Wang and Cai (2008) argue that this chain of causality is especially true in China, as evidenced by the general preference for educational investment in boys. It follows that when reductions in education spending result in human-capital distortions, women's relative labour-market opportunities and outcomes are depressed; the resulting gender inequality in education can significantly impact the econ-

omy via lower levels of economic growth in the long-run (Boschini 2003; Dollar and Gatti 1999; Klasen and Lamanna 2009).

Theoretical Approach

As will be described in detail below, employment is estimated under the framework of the conceptual model presented in Knight (2018) – therein, employment is estimated at the macro level with supply and demand determinants and extends beyond the traditional neoclassical labour-market model by incorporating institutional and feminist factors.

Labour Supply

Rather than focus on the intensive margin of the labour/leisure trade-off perspective of labour supply, I choose to analyse the extensive margin of labour supply via the paid/unpaid labour trade-off, where labour supply in the paid labour market is affected by unpaid labour requirements in the home. This feminist model incorporates the basic dynamics of the intra-household bargaining model by Braunstein (2008) where relative capacity (including constraints such as time, wages, and priorities) and voice (the ability to make decisions and express priorities within the household) determine outcomes such as labour supply, well-being, and the distribution of household goods (Braunstein 2008).

　　Within this framework, social and physical infrastructure spending and population growth influence labour supply via opportunity-cost effects. These determinants influence women's paid labour via constraints that increase unpaid labour requirements in the home, such as caring for children and the ill, engaging in home production, and allocating time to new additions to the family, respectively. Last, individual capabilities (relative capacity) influence labour supply as they increase the opportunity cost for not supplying labour.

Labour Demand

Within the framework of the basic Keynesian model of employment, firms choose labour and capital to maximise profit while such decisions are also affected by overall economic activity and trends. This implies that domestic capital and economic growth are determinants

of employment. Additionally, longer-term structural shifts in the economy influence employment, as they are facilitated by the substitutability of capital and labour in an effort by business to maximise profit. When a shift towards industrial output occurs, labour demand may rise in related sectors and decline in others. As per the Keynesian perspective, governments may choose to invest in their own economy to increase growth and employment by alleviating demand shortages in the market for loanable funds and invest (via public spending) in public infrastructure. Finally, such a model needs to incorporate the foreign sector as businesses engage in export-sector production and utilise foreign investments, thereby increasing labour demand in order to take advantage of foreign demand for goods and to utilise the additional available capital.

To estimate employment, I combine the theoretical supply and demand factors in a reduced-form estimation of employment (*Emp*) with disaggregated public spending such that

(1)

$$
\begin{aligned}
Emp_{pt} = \beta_p &+ \beta_1 Health_{p,t-1} + \beta_2 Educ_{p,t-1} + \beta_3 Gr_{p,t-1} \\
&+ \beta_4 FInv_{p,t-1} + \beta_5 DInv_{p,t-1} + \beta_6 G_{p,t-1} \\
&+ \beta_7 Exports_{p,t-1} + \beta_8 Pop_{p,t-1} + \beta_9 HC_{p,t-1} \\
&+ \beta_{10} Ind_{p,t-1} + \epsilon^1_{pt}
\end{aligned}
$$

where *Health* and *Educ* are public spending on health and education as percentages of real gross provincial production (GPP), respectively; *Gr* is economic growth measured as the growth rate of GPP per capita; *FInv* and *DInv* are foreign and domestic investments, respectively, as percentages of GPP; *G* is public spending less spending on social infrastructure as a share of GPP; *Exports* are measured as a share of GPP; *Pop* is the change in the population; *HC* is sex-specific human-capital completion of at least the secondary level; *Ind* is industrial output as a percentage of GPP (proxy for structural change); ϵ^1 are typical disturbance terms; β_p are time-invariant provincial fixed effects; and β terms are unknown parameters I wish to estimate, for all provinces, *p*, in time, *t*. The sex-specific human-capital variable refers to women's (men's) human-capital attainment in the estimation of women's (men's) employment and the ratio of female-to-male human capital when estimating the gap. Employment is estimated with

lagged values of all independent variables under the assumption that they take time to effectively stimulate employment.

This equation is used to estimate three separate dependent variables: the growth rate of urban female employment, the growth rate of urban male employment, and equality in urban employment. My proxy for equality in employment, henceforth the "gap," is similar to that of Seguino and Were (2014) and is estimated such that

$$Emp^{gap} = \frac{Employment^f}{Population^f} - \frac{Employment^m}{Population^m}$$

where positive correlations with the gap imply increases in equality measured in employment opportunities, and vice versa.

The Endogeneity of Economic Growth

The presence of economic growth as an explanatory variable in the employment specification above complicates this analysis, as it is itself endogenous. I rectify this violation of the basic ordinary least squares (OLS) assumption that all explanatory variables are uncorrelated with each equation's error term by building a functional form for economic growth to be estimated along with the employment equations in a system of simultaneous equations.

In deriving a basic model of short-run economic growth, I begin with a traditional neoclassical growth model where economic growth (measured via the growth rate of gross domestic product, or GDP, per capita) is modelled as a function of the current level of GDP and investments in capital in order to account for Solow convergence and production capacity, respectively. Subsequently, the basic growth model incorporates human capital as a determinant of technological progress (Glomm and Ravikumar 1998). Extensions of new growth theory suggest that other macroeconomic conditions, such as government spending policies, changes in the population, and international orientation also influence economic growth (Barro and Sala-i Martin 1995; Barro 1999; Acemoglu, Johnson, and Robinson 2005). Thus, the traditional neoclassical growth model with the addition of these extensions allows me to formulate the growth rate of real GPP per capita, *Gr*, such that

(2)

$$
\begin{aligned}
Gr_{pt} = \ &\gamma_1 GPPpc_{p,t=0} + \gamma_2 FInv_{p,t-1} + \gamma_3 DInv_{p,t-1} \\
&+ \gamma_4 Trade_{p,t-1} + \gamma_5 Pop_{p,t-1} + \gamma_6 HC_{p,t-1} \\
&+ \gamma_7 Health_{p,t-1} + \gamma_8 Educ_{p,t-1} + \gamma_9 Sci_{p,t-1} \\
&+ \gamma_{10} Trans_{p,t-1} + \gamma_{11} Admin_{p,t-1} \\
&+ \gamma_{12} Proj_{p,t-1} + \epsilon_{pt}^{g}
\end{aligned}
$$

where $GPPpc_{t=0}$ is the natural log of GPP per capita in 1999; *Trade* is measured as the sum of exports and imports as a share of GPP; *HC* is the ratio of female-to-male completion of at least secondary school; *Sci*, *Trans*, *Admin*, and *Proj* are public spending respectively on science, transportation, administration, and community projects as percentages of GPP; ϵ^g are disturbance terms with usual properties; and γ terms are unknown parameters. This formulation is similar to that of Gramlich (1994), who analyses the impact of public infrastructure on output in the United States. It is also consistent with the Chinese growth literature (Zhang and Zou 1998; Lin and Song 2002; Wei and Hao 2010). As this is a short-run model, all independent variables are lagged one period under the assumption that these determinants take one year to effectively stimulate growth. This assumption limits the interpretations of the results in that I am only capturing the short-term effects of each determinant and not, for example, the implications that government spending on education will have on the quality of the labour force of the next generation.

Data

Our panel data, originating from three National Bureau of Statistics of China (NBS) publications – namely, *China Statistical Yearbook* (CSY), *China Labour Statistical Yearbook* (CLSY), and *China Population and Employment Statistics Yearbook* (CPESY) – includes data from all 31 Chinese provinces for the period from 1999 to 2009 (see the Appendix for detailed descriptions and sources).

In the data, employment is determined by the number of individuals employed – those physically present and actively working either part-time or full-time – at year's end in urban units (CLSY). This includes foreign and domestic workers with either urban or rural

household registration; employees with rural household registration must be employed in their urban unit for a time period exceeding six months at year's end to be counted as employed. The reporting agency for CLSY, the Labour Ministry, provides a narrow definition of "urban" that refers exclusively to cities (National Bureau of Statistics of China 2010a). Finally, this data includes only formal workers – those who report their income to the state who may be self-employed or working for either public or private enterprises. Thus, "formal employment in urban units" refers to all individuals physically present and active (both full-time and part-time), whether self-employed or working for either public or private enterprises in urban areas in China; the implications and conclusions provided herein should be considered solely within this context.

Referring to the descriptive statistics in Table 1, mean formal female employment in urban units is approximately 1.4 million employees per province, just over half that of mean formal male employment in urban units, estimated at 2.3 million. With a mean of -11.9 per cent, the gap indicates that urban female employment as a ratio of the urban female population is 11.9 percentage points lower than that of the ratio of urban male employment to the urban male population.

In the aggregate, provincial-level public spending (reported by NBS, as is all data in the following unless otherwise specified), net of spending on social infrastructure, is calculated as the sum of public expenditures on science, transportation, finance, security, social welfare, community projects, government administration, and agriculture with a mean of 8.2 per cent of GPP. Education and health expenditures account for approximately 2.6 per cent and 0.8 per cent of GPP, respectively. These public expenditures include spending from local, provincial, and central sources and are not specific to a certain ownership type. The "Brief Introduction" to Section 8 (Government Finance) of the NBS (2010a) details the data-collection techniques of the Ministry of Finance, the reporting unit for public expenditure data.

Figure 3 illustrates the general trends of social-infrastructure spending from 2000 to 2010 measured as the provincial averages of healthcare and education spending. While spending on healthcare as a percentage of GPP remains relatively steady, it begins to rise slowly in 2007. However, spending on education is more erratic and rises and falls across this time frame, where it is lowest in 2008 and highest in 2010.

Table 1. Descriptive Statistics

	Mean	**Standard Deviation**
Growth (%)	11.7	7.7
Population (million)	39.4	25.1
F-to-M population (%)	96.3	3.3
Urban population (million)	19	14.1
F-to-M urban population (%)	95.5	2.5
Public spending as % of GPP	8.2	6.7
Science as % of GPP	0.2	0.1
Transportation as % of GPP	0.4	1.0
Community projects as % of GPP	0.6	0.8
Administration as % of GPP	4.6	4,6
Health as % of GPP	0.8	0.6
Education as % of GPP	2.6	1.2
Foreign investment as % of GPP	1.5	1.3
Domestic investment as % of GPP	22.7	10.8
Trade as % of GPP	29.0	38.2
Exports as % of GPP	14.9	18.2
Industrialization as % of GPP	87.3	39.5
Female employment (million)	1.4	0.9
Female HC as % of female employees	19.2	12.1
Male employment (million)	2.3	1.3
Male HC as % of male employees	22.9	10.1
F-to-M human capital (%)	80.0	15.7
F-to-M employment (%)	59.5	7.1
Gap (%)	-11.9	7.8

Source: National Bureau of Statistics of China (2000–2010): *China Labour Statistical Yearbook*, *China Statistical Yearbook*, and *China Population and Employment Statistics Yearbook*.

Note: Means and standard deviations calculated as annual averages from 1999 to 2009, and across all 31 provinces.

Figure 3. Average Public Spending on Social Infrastructure, 2000–2010
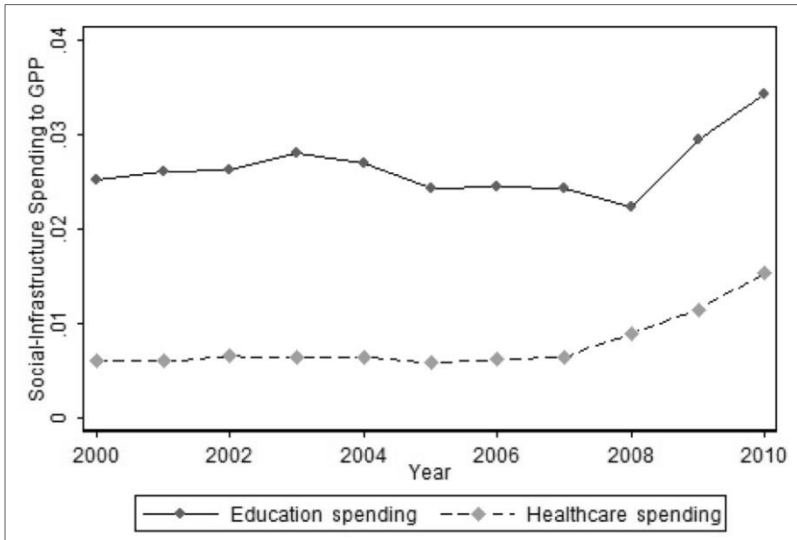
Fixed assets, a flow variable that captures the volume of construction activities and purchases of equipment, materials, and technology that adds to its current stock, is commonly used throughout the Chinese growth literature as a proxy for investments (Chen and Fleisher 1996; Lin and Liu 2000). Structural change, measured as industrial output as a proportion of GPP, has a mean of 87.3 per cent, while the mean of trade, calculated as the sum of exports and imports, is about 29 per cent of GPP. Human capital, measured as the completion of at least secondary-level formal education, is disaggregated by sex with means of 19.2 per cent and 22.9 per cent for female and male employees, respectively. Provincial-level population, including both rural and urban residents, has a mean of approximately 39 million people per province, while the mean of the urban population is about 19 million.

We completed all statistical tests appropriate for the data and chosen methodology. All data is stationary, either true of the original data or made so through first-differencing. Time-invariant fixed effects are included in all estimations, as it is reasonable to assume that

provincial differences may motivate changes in relative employment. Standard errors robust to both heteroscedasticity and cross-sectional dependence are included in all estimations. No set of variables, other than trade and initial GPP, exhibit strong collinearity, and serial correlation is not evidenced in any of the estimations. Finally, the simultaneous equation system satisfies both the rank and order conditions necessary for identification – thus I am confident that the derived structural coefficients are unique.

Results and Economic Significance Estimations

Table 2 provides the results from the three-stage least squares (3SLS) simultaneous equation estimation in which the gap, female urban employment growth, male urban employment growth, and economic growth are the dependent variables. These results are robust to alternative specifications using multiple econometric techniques including OLS, two-stage least squares (2SLS), and generalised method of moments (GMM) estimations. Additional results available upon request.

Table 2. Simultaneous Equation Estimation

	Female employment growth	Male employment growth	Gap	Economic growth
Growth	0.232 (0.048)***	0.213 (0.038)***	0.059 (0.031)*	
Foreign investments as % of GPP	0.267 (0.371)	-0.528 (0.284)*	0.200 (0.172)*	1.763 (0.840)**
Domestic investments as % of GPP	0.172 (0.099)*	0.208 (0.080)***	-0.079 (0.064)	0.054 (0.146)
Public spending as % of GPP	0.045 (0.108)	-0.029 (0.095)	0.167 (0.130)	
Population growth	-0.081 (0.067)	-0.051 (0.065)	0.011 (0.050)	-0.243 (0.109)**
Gendered HC	0.002 (0.001)**	0.003 (0.001)***	0.006 (0.031)	0.189 (0.095)**
Health as % of GPP	4.142 (1.682)**	3.103 (1.433)**	-1.846 (1.427)	-14.970 (6.156)**
Education as % of GPP	2.945 (0.720)***)	2.091 (0.548)***	1.633 (0.749)**	4.916 (1.973)**

	Female employment growth	Male employment growth	Gap	Economic growth
Exports as % of GPP	0.143 (0.053)***	0.138 (0.044)***	0.015 (0.019)	
Industry as % of GPP	0.037 (0.036)	0.116 (0.030)***	-0.011 (0.016)*	
Trade as % of GPP				-0.100 (0.037)***
Initial GPP per capita				0.302 (0.112)***
Science as % of GPP				21.457 (7.819)***
Transportation as % of GPP				6.658 (2.291)***
Community projects as % of GPP				-6.396 (1.537)***
Administration as % of GPP				-2.090 (0.621)***
Observations	279	279	279	279
R2	0.49	0.52	0.95	0.47

Note: Standard errors in parentheses. All independent variables are lagged one period. Foreign and domestic investments, public spending, health, education, science, transportation, community projects, administration, trade, and industry are all first-differenced. Women's (men's) employment is estimated using women's (men's) human capital, gap using the ratio of female-to-male human capital.
* significance at 10%, ** significance at 5%, *** significance at 1%.

Estimates of economic significance allow me to compare the relative magnitudes of the results across independent variables; while some variables may exhibit statistical significance, their economic impact may be inconsequential. Using a slight alteration of the process outlined by Miller and van der Meulen Rodgers (2008), I include economic significance calculations in Table 3 in which each entry can be viewed as the number of additional employed persons (or the change the employment gap), given a one standard deviation increase in the independent variable (see Appendix for details).

Table 3.   Economic Significance

1 std. dev. change in:	Female employment (increase in employees)		
	Direct effect	Indirect effect	Total effect
Growth	**25,279**		**25,279**
For. inv. as % of GPP	2,040	**3,125**	5,165
Dom. inv. as % of GPP	**7,936**	(1,595)	6,341
Exports as % of GPP	**36,909**		**36,909**
Industry as % of GPP	4,933		4,933
Public as % of GPP	1,394		1,394
Gendered HC	**343**	**9,755**	**10,098**
Health as % of GPP	**11,891**	**(9,971)**	**1,921**
Education as % of GPP	17,792	6,890	24,682
Science as % of GPP		5,057	5,057
Trans. as % of GPP		11,598	11,598
Com. proj. as % of GPP		**(9,926)**	**(9,926)**
Admin. as % of GPP		(10,957)	(10,957)
1 std. dev. change in:	Male employment (increase in employees)		
	Direct effect	Indirect effect	Total effect
Growth	**38,172**		**38,172**
For. inv. as % of GPP	**(6,636)**		**(1,917)**
Dom. inv. as % of GPP	**15,785**		13,376
Exports as % of GPP	**58,583**		**58,583**
Industry as % of GPP	**25,438**		25,438
Public as % of GPP	(1,478)		(1,478)
Gendered HC	**428**	**14,730**	**15,158**
Health as % of GPP	**8,908**	**(15,056)**	**(6,148)**
Education as % of GPP	**12,633**	**10,405**	23,038
Science as % of GPP		7,637	7,637
Trans. as % of GPP		17,513	17,513
Com. proj. as % of GPP		**(14,989)**	**(14,989)**
Admin. as % of GPP		**(16,545)**	**(16,545)**

1 std. dev. change in:	Gap (change in the gap, in %)		
	Direct effect	Indirect effect	Total effect
Growth	**0.5**		**0.5**
For. inv. as % of GPP	0.1	**0.1**	0.2
Dom. inv. as % of GPP	(0.3)	(0.0)	(0.3)
Exports as % of GPP	0.3		0.3
Industry as % of GPP	(0.1)		(0.1)
Public as % of GPP	**0.4**		**0.4**
Gendered HC	0.1	**0.1**	0.7
Health as % of GPP	**(0.4)**	(0.0)	**(0.6)**
Education as % of GPP	**0.7**	**0.1**	**0.8**
Science as % of GPP		(0.0)	**0.1**
Trans. as % of GPP		**0.1**	0.2
Com. proj. as % of GPP		(0.0)	**(0.2)**
Admin. as % of GPP		**0.1**	**(0.2)**

Note: Entries in bold indicate statistical significance. Parentheses indicate negative
       values.

Using path analysis similar to that of Klasen and Lamanna (2009) and
Dollar and Gatti (1999), economic significance estimates include the
direct, indirect, and total effects (the sum of the direct and indirect
effects) of each independent variable. While direct effects illuminate
the relationship between the dependent variable and employment
growth/the gap (Table 2, columns 1–3), indirect effects illustrate how
the dependent variables relate to economic growth (Table 2, column
4), which in turn relates to employment growth/the gap.

It is imperative to specify that a movement towards equality in
urban employment (an increase in the gap) is desirable only if it oc-
curs via a rise in women's employment (upward harmonisation),
while avoiding reductions in male employment (downward harmoni-
sation). Therefore, given my formulation of the gap, where positive
coefficients imply greater equality, and vice versa, these results may
indicate equality-promoting policies in public spending on education
and economic growth, as both are associated with increases in em-
ployment growth for women and men (Table 2, columns 1 and 2)
and in the gap (Table 2, column 3).

The total effect of an increase in education spending as a share of GPP from 2.6 per cent to 3 per cent translated into an additional 24,700 female and 22,000 male urban employees, respectively, and a 0.8 per cent increase in the gap. The larger positive effects on women's relative employment may be due to the impact that spending on education has on labour demand, via employment in care sectors, and labour supply, via the reduction in unpaid labour burdens, both of which exhibit greater significance in female employment estimations than male. Additionally, public spending on education is positively related to economic growth and thus this policy option provides the potential for a win-win for Chinese policymakers.

Spending on education is especially lucrative in terms of its impact on employment. To provide a comparative example, in Beijing, where government spending on education amounted to approximately CNY 32 billion in 2008, creating the employment gains mentioned above would necessitate an increase in education spending by approximately CNY 800 million, implying a cost per employee of about CNY 16,000 (USD 2,300, measured using exchange rates from January 2017), contrasted with, for example, spending on transportation, which would cost an additional CNY 980 million to create 11,600 jobs for women and 16,700 for men – or approximately CNY 34,600 per employee (USD 5,000).

Growth is also an effective job creator, as a one standard deviation increase in economic growth is associated with an additional 25,300 female and 38,200 male employees, respectively, and raises equality in employment by 0.5 per cent. However, it is important to note that attaining growth to this extent is difficult, as a one standard deviation increase in economic growth amounts to a growth rate of approximately 7.7 per cent – quite a lofty aim. This amounts to a cost per worker of about CNY 1.3 million.

While domestic investments, healthcare expenditures, and exports are positively associated with employment growth for women and men, they are not related to the gap at a statistically significant level. Alternatively, foreign investments are positively related to the gap, though the results indicate that this may be due to negative pressure on men's employment (downward harmonisation) as opposed to increased opportunities for women. Additionally, equality in human capital is positively associated with economic growth (Table 2, col-

umn 4), a result consistent with findings by Klasen and Lamanna (2009).

The statistically significant negative relationship between the gap and industrial output as a percentage of GPP – my proxy for the process of industrialisation – is evident in the results, occurring via upward pressure on men's employment and demonstrating no association with women's. This process of shifting production from goods for domestic consumption with a focus on local growth and subsistence to a manufacturing sector with international appeal is likely to have consequences beyond an expansion of exports. For example, Tejani and Milberg (2010) find that women's employment may be disproportionately affected by the process of industrialisation, as women tend to be more highly concentrated in low-skill manufacturing and less so in high-skill production. Industrialisation is correlated with an additional 5,000 female urban employees (though this relationship is not statistically significant), 25,400 male employees, and a fall in the gap of approximately 0.1 per cent. This result, in combination with the intense sex-based occupational segregation in China, supports the argument that the industrialisation may have a negative impact on women's relative employment (Ghosh 2002; Liu 2007) and is consistent with the findings presented by Tejani and Milberg (2010).

Discussions of Future Policies

Analysing data on healthcare and education spending from 2011 to 2016 (Figure 4) indicates that the former public expenditure was rather unresponsive to the poor economic conditions worldwide, whereas the latter appears to fluctuate somewhat with economic conditions. It is apparent that healthcare spending has been on a slow rise (as a percentage of real gross provincial product), even as economic growth has slowed its pace from a mean of 11.7 per cent from 2000 to 2010 to 8.1 per cent from 2011 to 2016, using 2010 prices (National Bureau of Statistics of China 2016a). The fall in education spending as a percentage of GPP beginning in 2013 indicates that this category of spending may be used to somewhat lessen the impact of the global financial crisis on the Chinese economy. While education spending increased in 2016, it has yet to recover to its peak, reached in 2013.

Figure 4. Average Public Spending on Social Infrastructure, 2011–2016
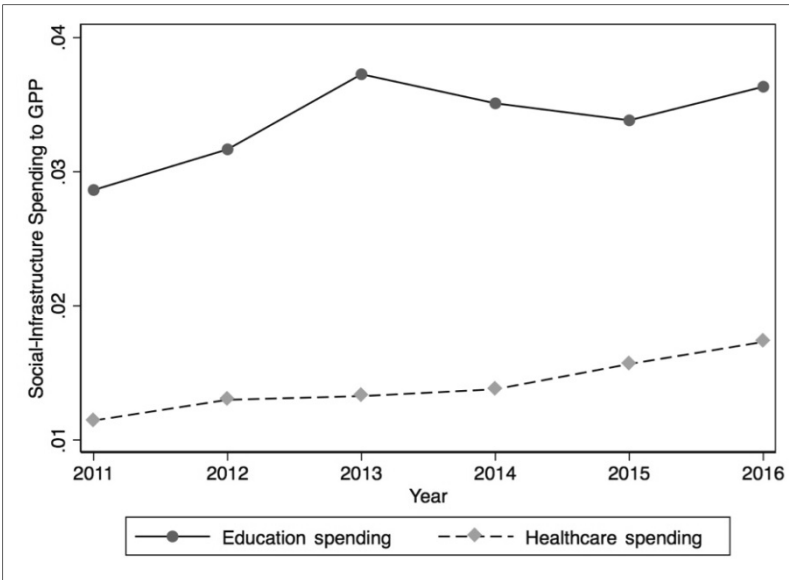
So as to explain the real impacts of the results provided above, Table 4 includes estimated economic impacts of an increase of each determinant of employment by an amount equal to 1 per cent of GPP. This table is sorted by impact on gender equality in employment from largest to smallest.

As is evidenced in Table 4, policymakers who wish to implement a policy with the largest positive impact on gender equality in employment per yuan would find that increasing education expenditures would be the policy of choice, as a 1 per cent increase in this category of spending is estimated to increase gender equality in employment by 1.9 per cent. I estimate this increased spending would increase women's employment by almost 58,000 jobs and men's by just over 54,000. This category is followed somewhat closely by spending on science, which – with the same increase in yuan – would raise gender equality in employment by 1.3 per cent and raise women's and men's employment by about 71,000 and 107,000 employees, respectively.

The remainder of the expenditures and other determinants of investment provide a less than 1 per cent increase in the gap with the same magnitude of investment.

Table 4. Economic Impacts

	Estimated impact of the equivalent of a 1% increase in GPP in each category		
	Female employment	Male employment	Gap in %
Education expenditures	**57,938**	**54,077**	**1.90**
Science expenditures	**70,595**	**106,603**	**1.30**
Transportation expenditures	**21,905**	**33,078**	**0.40**
Foreign investments	9,587	-3,557	0.30
Public expenditures	638	-676	**0.20**
Growth	**3,290**	**4,968**	**0.10**
Industrial output	525	**2,706**	0.00
Domestic investments	1,949	4,111	-0.10
Administration expenditures	**-6,876**	**-10,384**	**-0.10**
Community projects expenditures	**-21,043**	**-31,777**	**-0.40**
Healthcare expenditures	9,487	-30,369	-2.80

Note: These figures are estimated using the econometric results provided in this study and 2010 mean data. Entries in bold indicate statistical significance. Parentheses indicate negative values.

With this in mind, the following lessons can be ascertained from past relationships between public spending and sex-disaggregated employment and applied to future policy decisions: First, public spending on education is positively related to employment for both sexes and provides the strongest positive impact on gender equality per yuan. Second, science expenditures produce another strong positive effect on gender equality and provide the strongest positive impact on employment for both genders per yuan. Third, the large increases in industrial output – which have grown 89 per cent over the time frame of this analysis measured as the provincial average – signifies that its strong positive relationship with men's employment, and only men's employment, will likely reduce gender equality in employment. This can be countered, however, if combined with a strong job crea-

tor for women, such as the policy lever of increased spending on education. While industrial production remains a significant focus of Chinese leadership, a balanced approach to growth and development would include a counterweighted policy of investments in education to grow human-capital attainment and gender equality in employment simultaneously.

Conclusion

While the recent pattern of women's relative employment in the Chinese economy has been one of great loss and slow recovery, there is hope for women's employment opportunities in the future via well-directed public policies. In this paper, I analyse how social-infrastructure spending can foster economic growth and urban employment gains for women and men in the Chinese economy via an econometric estimation of my model of equality in employment – a function of public spending on social infrastructure, controlling for other demand- and supply-side factors. Finally, I provide calculations that signify the relative impacts of the results and inform the policy implications.

The results provided here support the hypothesis that at least one category of spending on social infrastructure is positively related to employment for women and men. Specifically, the results pertaining to education spending support the "win-win" scenario proposed by Seguino, Berik, and van der Meulen Rodgers (2010) and allow me to argue that this expenditure can serve as a gender-sensitive development policy option for the Chinese economy that may increase economic growth in the short run and equality in a way that is upwardly harmonising.

Furthermore, I find that industrialisation, while positively associated with men's urban employment, is negatively related to equality in employment. Given the current patterns of industrialisation and the likelihood that they will persist, this implies that if not countered with equality-promoting policies, men's employment options may surge, leaving women behind. Thus, Chinese policymakers should consider countering these negative impacts with equality-promoting policies and social protections in order to increase women's abilities to capitalise on the additional labour-market opportunities.

This research aims to highlight the importance of social-infrastructure spending and its relationship with sex-disaggregated employment while bringing to light the impacts of structural change on gendered outcomes. It is hoped that this study will encourage further explorations of the ways in which considerations of the differing outcomes women and men face can be incorporated into public policy decisions in other country-specific studies.

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Appendix

Derivation of direct effects: computed as the product of one standard
deviation in the independent variable, the estimated coefficient in the
simultaneous equation estimation, and mean employment. For ex-
ample, the direct effect of a one standard deviation increase in spend-
ing on healthcare is approximately 11,900 female employees, and is
calculated as the product of 0.202% (one standard deviation, found in
the Appendix A), 4.142 (the coefficient on healthcare found in Table
2), and 1.42 million employees (mean female employees, found in
Table 1).

Derivation of indirect effects: First, the direct effect of each de-
pendent variable on growth (the product of the variable's estimated
coefficient in the economic growth estimation and a one standard

deviation increase in the variable) is computed and then how this increase in economic growth affects employment (using the process for deriving direct effects) is calculated.

Table A1. Descriptive Statistics of Transformed Variables, in %

	Mean	Standard deviation
Growth	11.7	7.7
Population growth	-0.002	3.0
Public spending as % of GPP	0.9	2.2
Science as % of GPP	0.0	0.1
Transportation as % of GPP	0.1	0.5
Community projects as % of GPP	0.1	0.5
Health as % of GPP	0.1	0.2
Education as % of GPP	0.1	0.4
Administrative as % of GPP	0.5	1.6
Foreign investment as % of GPP	0.1	0.5
Domestic investment as % of GPP	2.9	3.3
Trade as % of GPP	29.0	38.2
Exports as % of GPP	15.0	18.4
Industry as % of GPP	5.8	9.4
Female employment growth	-0.2	4.0
Female HC	19.2	12.1
Male employment growth	0.2	4.0
Male HC	22.9	10.1
F-to-M HC	80.0	15.7
Gap	-11.9	7.8

Sources: *China Labour Statistical Yearbook*, *China Statistical Yearbook*, and *China Population and Employment Statistics Yearbook* 2000–2010.

Note: Means and standard deviations calculated as annual averages from 1999 to 2009, and across all 31 provinces. Public spending (including aggregate and disaggregated spending categories), fixed assets, trade, and industry measured in CNY billions. All categories of public spending, investments, and industrialisation are differenced once.

Table B1. Descriptions of Data

Variable	Description	Source
Female and male employment	The total number of female and male employees in urban units (provided by the Labour Ministry), including workers with urban and rural (employed in their urban unit for at least six months) household registration, not including not-on-post workers.	CLSY Indicators: Female Employment [Number of Employed Persons] in Urban Units at Year End by Sector and Region (2000–2010)
Population	The total number of people alive at midnight, 3l December, within a given region, not including Chinese nationals residing abroad, and estimated by annual surveys of approximately 1% of the population using a stratified cluster sampling scheme (National Sample Surveys on Population Changes).	CSY Indicator: Household, Population, Sex Ratio and Household Size by Region (2000–2010)
Inflation	Index calculated using a consumer price index (urban and rural households) with a base year of 2000 where each subsequent year equals the product of the yearly growth of CPI and the index of the prior year.	Author's calculations, CSY Indicator: Residents Consumer Price Indices and Retail Price Indices of Commodities by Region (2000–2010)
Gross provincial product (GPP)	The value of final products produced by all resident units at market prices, measured in year 2000 CNY.	CSY Indicator: Gross Regional Product and Indices (2000–2010)
Economic Growth	Calculated as the growth rate of real GPP.	Author's calculations, CSY Indicator: Gross Regional Product and Indices (2000–2010)
Science	Public expenditures related to basic and applied research, R&D, and their administrative expenses, measured in year 2000 CNY.	CSY Indicator: Government Expenditures by Region (2000–2010)
Transportation	Road, waterway, railway, civil aviation, and postal service public expenses, measured in year 2000 CNY.	CSY Indicator: Government Expenditures by Region (2000–2010)

Community projects	Officially reported as "Development Expenditure," this includes public spending on projects aimed at supporting underdeveloped areas including the planning and management of urban and rural communities, public facilities, housing, and sanitation, among other development projects, measured in year 2000 CNY.	CSY Indicator: Government Expenditures by Region (2000–2010)
Health	Public expenses including general medical and health services, women's and children's health, disease prevention and control, health inspection and supervision, and rural healthcare, measured in year 2000 CNY.	CSY Indicator: Government Expenditures by Region (2000–2010)
Education	Government appropriation for education including the total allocation for education, capital construction and research, measured in CNY at current prices.	CSY Indicator: Government Expenditures by Region (2000–2010)
Administration	Public expenses including the affairs of the People's Congress, the People's Political Consultative Conference, and other political parties, reforms, statistics, taxation, audit, customs, human resources, discipline inspection and supervision, population and family planning, trade, intellectual property, oceanic administration, surveying and mapping, earthquake relief, ethnic affairs, religious affairs, affairs of Hong Kong, Macau, Taiwan, and overseas Chinese, measured in year 2000 CNY.	CSY Indicator: Government Expenditures by Region (2000–2010)
Trade and exports	The sum of exports and imports (goods transported through Chinese customs valued at free on board prices and services provided between resident and non-resident units), measured at the provincial level in USD. Given the total value of trade in yuan, converting to year 2000 CNY requires a calculation of each province's trade share of the countrywide total in USD as the product of the countrywide trade in year 2000 CNY.	CSY Indicator: Total Value of Imports and Exports by Location of Importers/Exporters (2000–2010)

Foreign investments	The volume of construction (including materials, technology, and equipment) and the purchases of fixed assets financed by foreign borrowings, foreign direct investments, and other foreign investments, measured in year 2000 CNY where foreign currencies are converted into CNY applying the current exchange rate.	CSY Indicator: Total Investment in Fixed Assets by Ownership (2000–2010)
Domestic investments	Includes fixed investments described above financed by domestic (non-state) funds, calculated as total investment in fixed assets less foreign-funded fixed assets and state-owned fixed assets, measured in year 2000 CNY where foreign currencies are converted into CNY applying the current exchange rate.	CSY Indicator: Total Investment in Fixed Assets by Ownership (2000–2010)
Industriali-sation	The total value of industrial products and services produced during the reference period in a given region, measured in year 2000 CNY.	CSY Indicator: Main Indicators of Industrial Enterprises above Designated Size by Region (2000–2010)
Female human capital	The percentage of female employees who have completed a minimum of senior-level education.	CLSY Indicator: Educational Attainment Composition of Female Employment by Region (2000–2010)
Male human capital	The percentage of male employees who have completed a minimum of senior-level education.	CLSY Indicator: Educational Attainment Composition of Male Employment by Region (2000–2010)
Female-to-male human capital	The ratio of female human capital to male human capital.	CLSY (2000–2010)

Contents

Research Articles

Analyses

Contributors   189