DYNAMIC FEMALE LABOR SUPPLY:
APPLICATIONS IN CHINA

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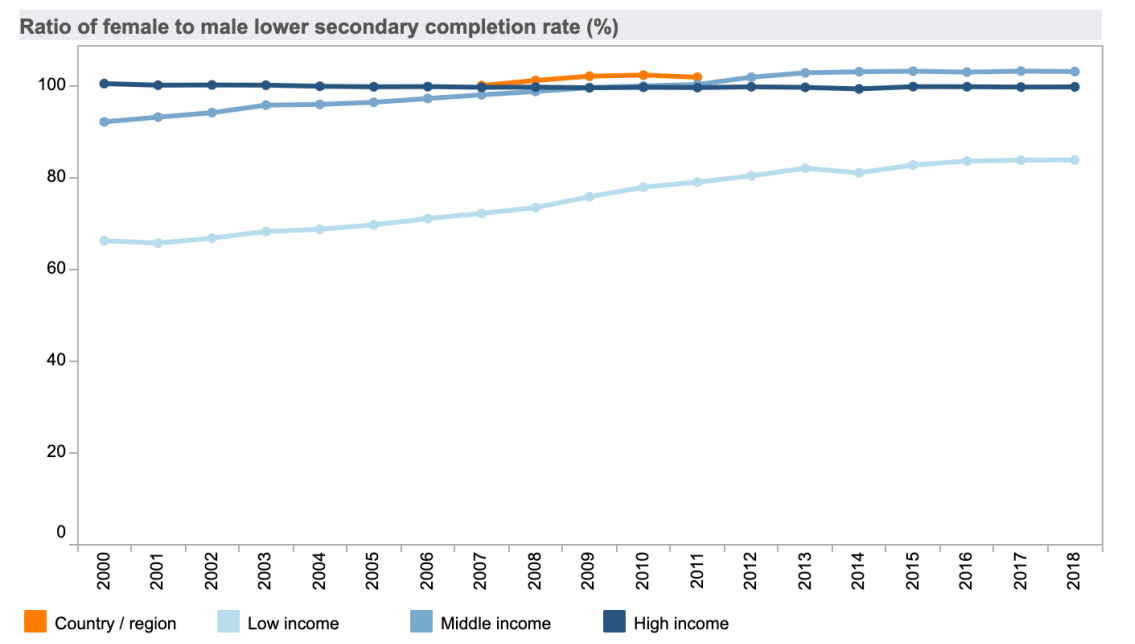
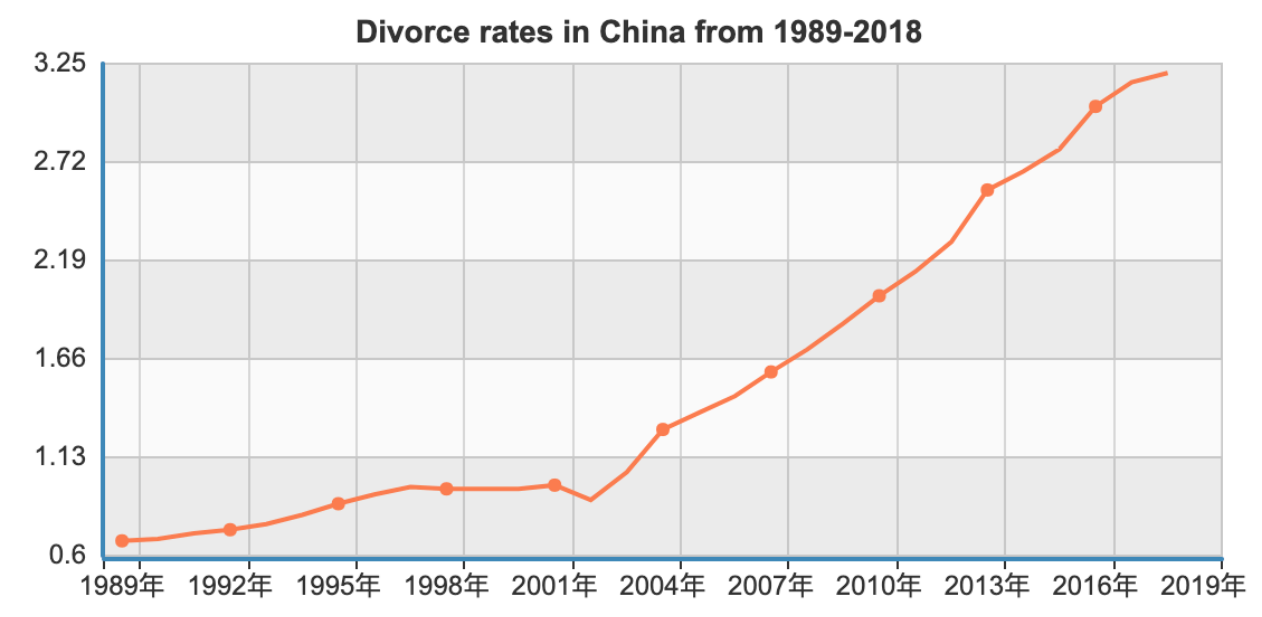
Research Questions: Can the change in female labor participation in China from 1980s to 2010s be explained by increased female schooling, increased female earnings, decreased fertility rates, and lower marriage rates? And to what extent?

Motivation

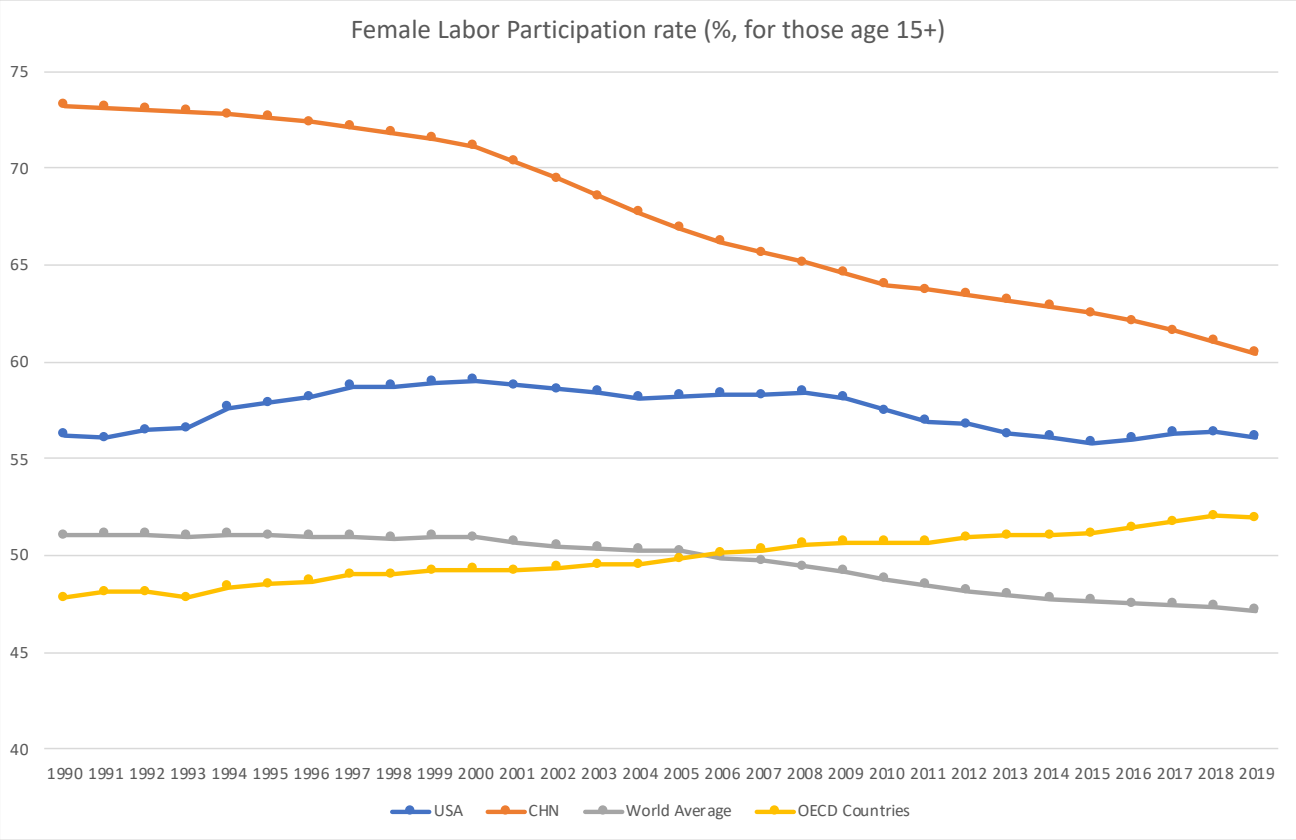
- China experienced **similar progress in female rights** as other countries in the world since 1980s
  - Increased female education levels
  - A rise in the wage of females and narrowed gender wage gap
  - Decreased marriage rates and a boom in divorce rates
  - A decline in fertility (might mostly due to the implementation of One Child Policy)





Motivation

- However, China experienced **decreased** female labor participation rate since 1990s
  - Though the female labor participation rate in China is still higher than many other countries.



The reasons behind the phenomenon might be:

- A shift in population structure: an increase in the population of elderly people.
- Other explained reasons.

Can the traditional theory used to account for female labor participation in western countries be applied to explain a Chinese story?

Introduction to the theory background

- **Life cycle model of consumption and earnings** (Heckman, 1974)
  - Presented a neoclassical model of life cycle consumption and labor supply.
  - Another model is proposed afterwards to analyze female labor supply particularly (Heckman & Macurdy, 1980). In this model, two dimensions of labor supply activity-annual hours of work and annual labor participation-are analyzed in a coherent intertemporal framework.

- **Dynamic stochastic discrete choice labor supply model** (Eckstein & Wolpin, 1989)
  - The authors present an estimated structural dynamic model of married women's labor force participation and fertility in which wages are stochastic and work experience or cumulative labor participation is endogenous.
  - The empirical part of this study applies this model to a relatively small sample of Nation Longitudinal Survey of Labor Market Experience from 1966-1981, with 3020 annual observations of 318 women.

Introduction to current empirical results

- Dynamic Female Labor Supply (Eckstein & Lifshitz, 2011)
  - Use repeated cross-section CPS data from 1964-2007 for women born in the 1955 cohort to obtain the estimate parameters. The rise in education levels account for about 33 percent of the increase in female employment, and the rise in wages and narrowing of the gender wage gap account for another 20 percent, while about 40 percent remains unexplained by unobserved household characteristics.

  - (Das et al., 2015) Examines the determinants of female labor participation in India.
  - (Fernandez & Wong, 2014) Use the estimate parameters obtained from life-cycle statistics for the 1935 cohort to assess the decisions faced by the 1955 cohort. A higher divorce probability and changes in wage structure are each able to explain a large proportion of the LFP increase.
  - (Cubas, 2016) Examines the differences between female labor participation between countries. The prices of household appliance and access to infrastructure are important to explain the differences quantitatively.

Model specification (Eckstein & Lifshitz, 2011)

Women's choice of p_t ($p_t = 1$, the woman choose to work at period t) is subject to the following maximization problem:

$$E_t\left[\sum_{k=0}^{T-t}\delta^t U\left(p_{t+k}, x_{t+k}, K_{t+k-1}, N_{t+k,j}(j=1,..,J), S, M_{t+k}, v_{t+k}\right)\right]$$

T: total decision periods; δ: subjective discount factor;
x_t: consumption; K_{t-1}: experience (the number of previous working periods);
N_{tj}: the number of children at period t of age group j; S: schooling (set as given); M_t: marital status; v_t: preference shock.

And her budget constraint in this period is given by:

$$\left((1-\alpha)(1-M_t)+\alpha\right)\left(y_t^m p_t + y_t^f M_t\right) = x_t + \sum_{j=1}^{J}\left(c_j + c_{jm}(1-M_t)\right)N_{tj} + \left(b + b_m(1-M_t)\right)p_t$$

y_t^m , y_t^f : the husband's earning (if any) and the female's earning; α: the share of a married women in household income
$\sum_{j=1}^{J}\left(c_j + c_{jm}(1-M_t)\right)N_{tj}$: the cost of children;
$\left(b + b_m(1-M_t)\right)p_t$: the additional cost of maintaining a household if the women is not married

Model specification (Eckstein & Lifshitz, 2011) (cont.)

Female's utility function, as stated before, can be further demonstrated as the following linear expression:

$$U_t = (\alpha_1 + v_t)p_t + x_t + \alpha_2 p_t x_t + \alpha_3 p_t K_{t-1} + \sum_{j=1}^{J} \alpha_{4j} N_{tj} p_t + \alpha_5 p_t S + f(N_{tj})$$

where $f(N_{tj}) = \gamma_0 N_{tj} - (\gamma_1 + \gamma_2 S_{tj}) N_{tj}^2$ denotes how children enter into the utility function.

Her earnings is determined by the standard Mincer/Ben-Porath earning function:

$$\ln y_t^w = \beta_0 + \beta_1 K_{t-1} + \beta_2 K_{t-1}^2 + \beta_3 S + \beta_4 t + \varepsilon_t$$

Her probability of accepting a job offer at period t is given by:

$$\Pr_t = \frac{\exp(\rho_0 + \rho_1 S + \rho_2 K_{t-1} + \rho_3 K_{t-1}^2 + \rho_4 p_{t-1})}{1 + \exp(\rho_0 + \rho_1 S + \rho_2 K_{t-1} + \rho_3 K_{t-1}^2 + \rho_4 p_{t-1})}$$

Other estimation parameters of interest include those enter into women's probability of giving birth to another child, the probability of getting married and the probability of divorced, which will not be stated in detail here.

Model specification (Eckstein & Lifshitz, 2011) (cont.)

Given the specifications above, women's maximization problem is obtained by a standard backward recursion process:

$$V_t(K_{t-1}, \varepsilon_t, \Omega_t) = \max[V_t^1(K_{t-1}, \varepsilon_t, \Omega_t), V_t^0(K_{t-1}, \varepsilon_t, \Omega_t)]$$

where $V_t^1(\cdot)$ and $V_t^0(\cdot)$ represent the maximum expected discounted utility when the female is working at that time $p_t = 1$ and when she is not $p_t = 0$. This problem can be solved by standard dynamic programming.

Notes:

- The parameters are obtained through simulated method of moments (SMM), which minimize the distance between the actual moments and the moments simulated by the model.
- The specification of the model requires further adjustments to accommodate the situation in China. For example, the probability of having another children might be regarded as given.

Data

China Health and Nutrition Survey (CHNS)

- The longest survey that contains longitudinal individual and household data in China.
  - The survey was designed to examine the policy effects on the health and nutritional status of Chinese people.
  - The survey is constituted by household survey, individual survey, nutrition & physical examination, and community survey, which includes detailed information about basic demographic information of individuals, income and time allocation in labor market, as well as other information within the household.

Survey Year	Number of Communities	Number of Households	Number of Individuals
1989	180	3,795	15,907
1991	189	3,619	14,797
1993	181	3,456	13,895
1997	191	3,875	14,441
2000	215	4,396	15,831
2004	216	4,387	12,308
2006	218	4,467	11,860
2009	217	4,517	12,178
2011	289	5,923	15,725
2015	360	7,319	20,914
Participated ever	388	11,130	42,829

Possible contributions

- Contribute to current literature in using Chinese data
  - Modifications of the model will be made to accommodate special policy environment in China (e.g. One Child Policy / Women retires at age 50 or 55 for most sectors).
  - Test if the dynamic female labor supply model can help explain the “reversed” trend in Chinese female labor participation.
  - Might reflect the current insufficiency of micro-level data in China. This also presents as a large potential limitation and drawback of this study.

- Anticipated outcomes
  - The change in female labor supply can also be explained by a combination impact of increased schooling, female earnings, divorce rate, and a decreased fertility.
  - However, a larger fraction of the unexplained factors is anticipated.