Large Shocks and Small Changes in the Marriage Market for Famine Born Cohorts in China.

Loren Brandt  Aloysius Siow  Carl Vogel
University of Toronto  University of Toronto  NERA
The “Great Leap Forward” was a national-level political and economic experiment in China between 1958-1961. It resulted in the most severe famine in China in the 20th century.

Estimates of famine-related mortality range from 15 to 30 million deaths, births lost or postponed resulted in about 25 million fewer births. In general, the countryside was struck much harder than cities.

The economic experiment was abandoned by early 1962. The mortality rate quickly fell and the birth rate also quickly recovered.
Figure 1: Sichuan number of individuals by age, 1990

Figure 2: Sichuan sex ratios female ages, 1990
What were the marital outcomes of famine affected cohorts?

Complicated quantity and quality effects.

1. Famine-born cohorts should enjoy an increase in their scarcity values in the marriage market.

2. Relative scarcity in the labor market should increase their wages, and therefore marital attractiveness.

3. Bad health effects to famine born cohort reduced their labor and marital attractiveness.


Regression methods: Almond, et. al. and Porter.

- Cannot deal with general equilibrium effects.
- Collinearity of quantity and adverse health shocks.
• Paper presents two kinds of estimates:

1. Non-parametric reduced form estimates of total effects of the famine on affected cohorts.
   - NO functional form assumption.
   - Includes all general equilibrium effects.
   - Estimator is a first difference estimator.
   - Consistency depends on suitable choice of treatment and control.

2. Use reduced form estimates to estimate CS, a non-parametric structural model.
   - Use CS to decompose total effects into quantity versus quality effects.
   - Quality estimates based on residual accounting.
   - Consistency is model dependent.
• Data: Rural Sichuan and Anhui. Only discuss Sichuan here.

• Compare marital behavior of famine-affected cohorts in 1990 to their same age peers in 1982.

  1. In 1990, the post-famine cohort was 26-28. Most women of 26 and older would have acquired their permanent marital status. Except for 26 and 27 year olds, also true for men.

  2. The pre and post famine-born cohorts were between 32-34 and 26-28 in 1990, respectively.

  3. Compare the marital behavior of 26 to 34 year olds in 1990 to their peers in 1982.
1 Marriage market statistics

- Let $j$ denote type $j$ women and $i$ denote type $i$ men. $j = 1, \ldots, J$ and $i = 1, \ldots, I$.

- $F^t$ is the population vector of women at time $t$ with typical element $f_j^t$.

- $M^t$ is the population vector of men at time $t$ with typical element $m_i^t$.

- Let $\mu_{ij}^t$ be the number of type $i$ men married to type $j$ women at time $t$.

- $\mu_{i0}^t$ and $\mu_{0j}^t$ are numbers of unmarried type $i$ men and type $j$ women.

- $\mu^t$ is $I \times J$ matrix with typical element $\mu_{ij}^t$. 
Accounting identities:

\[
\mu_{i0}^t + \sum_{i=1}^{I} \mu_{ij}^t < \mathcal{f}_j^t \quad \forall \ j
\]
\[
\mu_{0j}^t + \sum_{j=1}^{J} \mu_{ij}^t < m_i^t \quad \forall \ i
\]

Marriage rates & spousal shares:

\[
 r_i^t = \frac{m_i^t - \mu_{i0}^t}{\mu_{i0}^t}, \quad r_j^t = \frac{f_j^t - \mu_{0j}^t}{f_j^t}, \quad i = 1, \ldots, I; \quad j = 1, \ldots, J
\]
\[
 o_i^t = \frac{m_i^t - \mu_{i0}^t}{\mu_{i0}^t}, \quad o_j^t = \frac{f_j^t - \mu_{0j}^t}{\mu_{0j}^t}, \quad i = 1, \ldots, I; \quad j = 1, \ldots, J
\]
\[
 s_{ij}^t = \frac{\mu_{ij}^t}{f_j^t - \mu_{0j}^t}, \quad s_{ji}^t = \frac{\mu_{ij}^t}{m_i^t - \mu_{i0}^t}, \quad i = 1, \ldots, I; \quad j = 1, \ldots, J
\]

(2)
Total gains to a \( \{i, j\} \) marriage:

\[
\pi_{ij}^t = \ln \frac{\mu_{ij}^t}{\sqrt{\mu_{i0}^t \mu_{0j}^t}}; \ i = 1, \ldots, I; \ j = 1, \ldots, J \tag{3}
\]

\[
= \ln \sqrt{o_{ij}^t o_{ji}^t s_{ij}^t s_{ji}^t} \tag{4}
\]

- \( \Pi^t \) is \( I \times J \) matrix with typical element \( \pi_{ij}^t \).

\( \Pi^t \) : alternative accounting for \( \mu^t \).

Given \( \Pi^t, M^t \) and \( F^t \), use (3) to recover \( \mu^t \).

- Consider time \( t' \), with \( \mu^{t'}, M^{t'} \) and \( F^{t'} \) and \( \Pi^{t'} \).

\[
\Delta \Pi^{t't'} = \Pi^{t'} - \Pi^t \text{ is a complete description of changes in marital behavior between } t \text{ and } t'.
\]

Tautologically, \( \Delta \Pi^{t't'} \) are due to both changes in population supplies and marital attractiveness.
• Total gains, \( \Pi^t \) (accounting):

\[
\pi_{ij}^t = \ln \frac{\mu_{ij}^t}{\sqrt{\mu_{i0}^t \mu_{0j}^t}}
\]

• Reduced form model:

\[
\Pi^t = \kappa(M^t, F^t, \Lambda^t)
\]

\[
\Delta \Pi^{t't} = \kappa(M^{t'}, F^{t'}, \Lambda^{t'}) - \kappa(M^t, F^t, \Lambda^t)
\]

\( \Lambda^t \) determines marital attractiveness.

• Structural model:

\[
\Pi^t = \kappa(\Lambda^t)
\]

\[
= \Lambda^t
\]

\[
\Delta \Pi^{t't} = \Lambda^{t'} - \Lambda^t
\]

In other words, \( \pi_{ij}^t \) is a preference parameter in the structural model.
In an \( \{i, j\} \) marriage, a surplus \( \Pi_{ij} \), is generated.

\( \tilde{\tau}_{ij} \) is the wife’s share of the surplus.

Utility of male \( g \) of type \( i \) in \( \{i, j\} \) marriage:

\[
v_{ijg} = \Pi_{ij} - \tilde{\tau}_{ij} + \varepsilon_{ijg}
\]

(5)

\( \varepsilon_{ijg} \): i.i.d. type I extreme value random variable.

Utility from remaining unmarried, \( j = 0 \):

\[
v_{i0g} = \Pi_{i0} + \varepsilon_{i0g}
\]

(6)

The utility from his optimal choice will satisfy:

\[
v_{ig} = \max_j [v_{i0g}, \ldots, v_{ijg}, \ldots, v_{iJg}]
\]

(7)
\( \mu_{ij} \) : number of type \( i \) men who want type \( j \) spouses.

Type \( i \)'s quasi-demand for \( j \) spouses satisfy:

\[
\ln \frac{\mu_{ij}}{\mu_{i0}} = \Pi_{ij} - \widetilde{\tau}_{ij} - \Pi_{i0} \tag{8}
\]

Type \( j \)'s quasi-supply for \( i \) spouses satisfy:

\[
\ln \frac{\mu_{ij}}{\mu_{0j}} = \widetilde{\tau}_{ij} - \Pi_{0j} \tag{9}
\]

The equilibrium number of \( \{i, j\} \) marriages, \( \mu_{ij} \):

\[
\mu_{ij} = \mu_{i,j} = \mu_{i,j} \forall i, j \tag{10}
\]

Add quasi demand and supply to get CS:

\[
\ln \frac{\mu_{ij}}{\sqrt{\mu_{i0} \mu_{0j}}} = \frac{\Pi_{ij} - \Pi_{i0} - \Pi_{0j}}{2} = \pi_{ij} \forall i, j
\]

Non-transferable utilities:

\[
\ln \frac{\mu_{ij}}{\sqrt{\mu_{i0} \mu_{0j}}} = \pi_{ij}(\tau_{ij}) = \kappa_{ij}(M^t, F^t, \Lambda^t)
\]
Figure 3: Sichuan marriage rates, 1990, 1982
Figure 5: Sichuan share of husband by his age gap, 1982

Figure 6: Sichuan share of husband by his age gap, 1990
Sichuan 1990/1982 share of husband by his age gap

Figure 7: Sichuan 1990/1982 share of husband by his age gap

- age 30 female
- age 33 female
- age 27 female
Figure 9: Sichuan total gains by husband's age gap, 1982

Figure 10: Sichuan total gains by husband's age gap, 1990
Figure 11: Sichuan 1990-1982 total gains by husband's age gap

- difference in total gains
- husband's age gap
- dtg_30
- dtg_33
- dtg_27
Figure 3: Predicted and actual 1990 Sichuan male marriage rates

Figure 4: Predicted and actual 1990 Sichuan female marriage rates