

Testing the Role of Unobserved Endowments in Marriage Matching Models:
A Method Based on MZ-DZ Twin Experiment

Online Appendix

Xuyan Lou* Junjian Yi† Junsen Zhang ‡

List of Figures

A1 Parallel analysis for 6 residuals 2

List of Tables

A1 Non-twin Sample: Summary Statistics 3
A2 Couples from China 2000 Census Data and 2005 Mini-Census Data . . 4
A3 OLS Estimates for Twins Sample and Non-twin Sample 5
A4 Endowments and Earnings (IV Models) 6
A5 Endowments and Age at First Marriage (IV1 Model) 7
A6 Endowments and Spousal Age (IV1 Model) 8
A7 Endowments and Spousal Height (IV1 Model) 9
A8 Endowments and Spousal Education (IV1 Model) 10
A9 Endowments and Spousal Wage at Marriage (IV1 Model) 11
A10 Robust Check for Marital Outcomes (IV2 Model) 12
A11 Maximum Likelihood Factor Analysis for One Factor 13

*School of Economics, University of Nottingham Ningbo China; email: Xuyan.Lou@nottingham.edu.cn.

†Department of Economics, National University of Singapore; email: junjian@nus.edu.sg.

‡Department of Economics, Chinese University of Hong Kong; email: jszhang@cuhk.edu.hk.

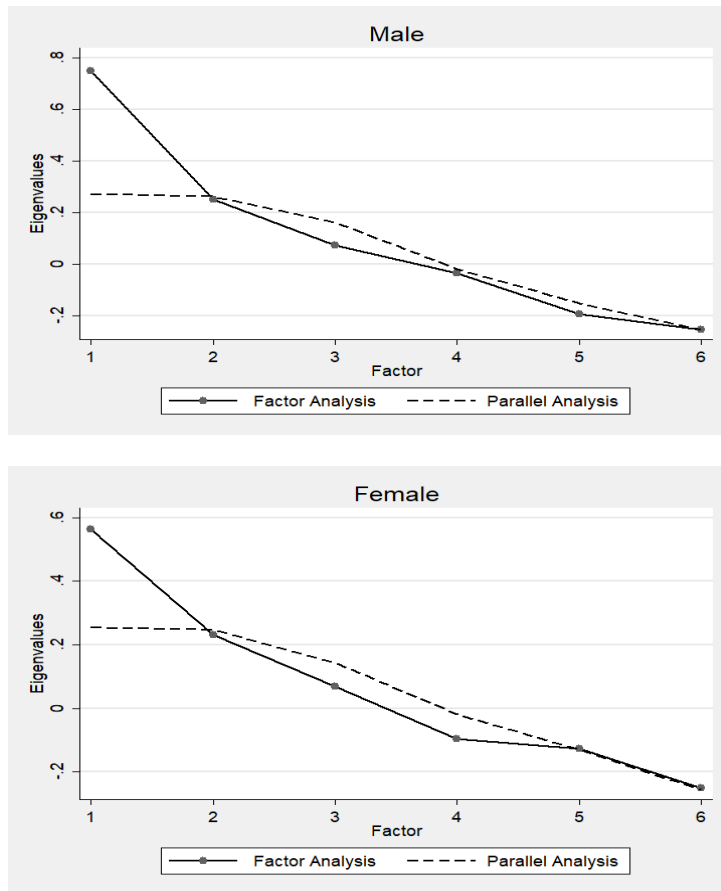


FIGURE A1
Parallel analysis for 6 residuals

Notes: According to Horn (1965), factors whose eigenvalues are larger than the mean of those obtained from random uncorrelated data should be retained. In short, factors above the dashed line should be retained.

TABLE A1
Non-twin Sample: Summary Statistics

| | Total (1) | Male (2) | Female (3) |
|--|--------------------|----------------------|--------------------|
| Panel A: Information on individuals' spouse at wedding time | | | |
| Spousal age | 25.79 (2.80) | 24.78 (2.57) | 26.82 (2.65) |
| Spousal schooling years | 11.09 (2.46) | 10.73 (2.27) | 11.46 (2.58) |
| Spousal height (centimeters) | 164.89 (7.51) | 159.44 (4.81) | 170.48 (5.35) |
| Spousal monthly wage (2002 yuan) | 274.09 (311.84) | 235.16 (326.21) | 314.03 (291.28) |
| Panel B: Information on individuals at wedding time | | | |
| Age | 25.76 (2.95) | 26.92 (2.92) | 24.57 (2.47) |
| Education | 11.25 (2.48) | 11.22 (2.59) | 11.29 (2.38) |
| Own height (centimeters) | 164.91 (7.51) | 170.28 (5.38) | 159.39 (4.96) |
| Monthly wage (2002 yuan) | 276.83 (287.82) | 306.40 (325.46) | 246.49 (239.73) |
| Panel C: Information on individuals at the survey time (2002) | | | |
| Age in 2002 | 44.11 (7.96) | 45.28 (7.95) | 42.91 (7.80) |
| Monthly earnings in 2002 | 886.79 (624.32) | 1,031.02 (686.44) | 738.83 (513.39) |
| Panel D: Information on individuals at birth | | | |
| Birth weight (kg) | 3.11 (0.54) | 3.18 (0.56) | 3.04 (0.52) |
| Observations | 1254 | 635 | 619 |

Notes: Mean and standard deviation (in parentheses) are reported in the table.

TABLE A2
Couples from China 2000 Census Data and 2005 Mini-Census Data

| | 2000 Census | | | 2005 mini-Census | | |
|-----------------|-----------------|-----------------|-----------------|------------------|------------------|------------------|
| | Total | Male | Female | Total | Male | Female |
| Age at marriage | 24.74 (3.12) | 25.81 (3.12) | 23.67 (2.73) | 24.64 (3.17) | 25.69 (3.20) | 23.59 (2.77) |
| Education | 10.91 (2.90) | 11.25 (2.90) | 10.58 (2.86) | 10.87 (3.15) | 11.19 (3.13) | 10.54 (3.14) |
| Age at 2002 | 44.25 (9.69) | 45.31 (9.77) | 43.19 (9.49) | 42.39 (10.81) | 43.44 (10.86) | 41.34 (10.66) |
| Observation | 63,488 | 31,744 | 31,744 | 8732 | 4,366 | 4,366 |

Notes: We extracted data from the 1% sampling of the China Population Census in 2000 and 2005 mini Census. These two samples include married couples who are in the same age interval in 2002 and live in urban areas of the same five cities as those twins in the CATS. From 2000 Census data, we have 31,744 pairs of married couples; from 2005 min-Census data, we get 4,366 pairs of married couples. Mean and standard deviation (in parentheses) are reported in the table.

TABLE A3
OLS Estimates for Twins Sample and Non-twin Sample

| | Male Twins Sample | | | | | Female Twins Sample | | | | |
|--------------------------|-----------------------|-----------------------|----------------------|-----------------------|--------------------------|-----------------------|---------------------|-----------------------|-----------------------|--------------------------|
| | Age at first marriage | Spousal age | Spousal height | Spousal education | Spousal wage at marriage | Age at first marriage | Spousal age | Spousal height | Spousal education | Spousal wage at marriage |
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) |
| Education | 0.0993** (0.0388) | 0.0761*** (0.0283) | 0.1240** (0.0608) | 0.4870*** (0.0259) | 0.1707*** (0.0226) | 0.1419*** (0.0330) | -0.0170 (0.0348) | 0.3267*** (0.0655) | 0.5803*** (0.0328) | 0.1015*** (0.0120) |
| Birth Weight At Marriage | YES | YES | YES | YES | YES | YES | YES | YES | YES | YES |
| City Dummy | YES | YES | YES | YES | YES | YES | YES | YES | YES | YES |
| Observations | 852 | 852 | 852 | 852 | 852 | 808 | 808 | 808 | 808 | 808 |
| R ² | 0.04 | 0.33 | 0.08 | 0.30 | 0.08 | 0.05 | 0.35 | 0.11 | 0.31 | 0.24 |

| | Male Non-twin Sample | | | | | Female Non-twin Sample | | | | |
|--------------------------|-----------------------|---------------------|-----------------------|-----------------------|--------------------------|------------------------|---------------------|-----------------------|-----------------------|--------------------------|
| | Age at first marriage | Spousal age | Spousal height | Spousal education | Spousal wage at marriage | Age at first marriage | Spousal age | Spousal height | Spousal education | Spousal wage at marriage |
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) |
| Education | 0.0838* (0.0454) | 0.0643* (0.0329) | 0.2129*** (0.0658) | 0.3864*** (0.0341) | 0.1395*** (0.0234) | 0.2025*** (0.0463) | -0.0553 (0.0420) | 0.3082*** (0.0934) | 0.5144*** (0.0412) | 0.0714*** (0.0168) |
| Birth Weight At Marriage | YES | YES | YES | YES | YES | YES | YES | YES | YES | YES |
| City Dummy | YES | YES | YES | YES | YES | YES | YES | YES | YES | YES |
| Observations | 635 | 635 | 635 | 635 | 635 | 619 | 619 | 619 | 619 | 619 |
| R ² | 0.06 | 0.30 | 0.13 | 0.20 | 0.07 | 0.06 | 0.29 | 0.11 | 0.24 | 0.03 |

Notes: Robust standard errors are in parentheses. * Significant at the 10% level. ** Significant at the 5% level. *** Significant at the 1% level.

TABLE A4
Endowments and Earnings (IV Models)

| | Dependent variable: $\Delta \text{Log monthly earnings}$ | | | | | | | | | | |
|--|--|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|-------|-----|-------|
| | IV1 Model | | IV2 Model | | IV1 Model | | IV2 Model | | | | |
| | Men | (2) | Men | (3) | Men | (4) | Women | (6) | Women | (7) | Women |
| $\Delta \text{Education}$ | 0.0820** (0.0321) | 0.0818** (0.0321) | 0.0587** (0.0229) | 0.0585** (0.0229) | 0.0967** (0.0467) | 0.0904* (0.0468) | 0.0651** (0.0265) | 0.0603** (0.0266) | | | |
| $\Delta \text{Education} * \text{DZ}$ | 0.1360** (0.0616) | 0.1386** (0.0602) | 0.0887** (0.0425) | 0.0907** (0.0420) | 0.1572* (0.0804) | 0.1714** (0.0810) | 0.0760** (0.0382) | 0.0863** (0.0382) | | | |
| DZ | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | | | |
| $\Delta \text{Birth weight}$ | No | Yes | No | Yes | No | Yes | No | Yes | | | |
| $\Delta \text{Birth weight} * \text{DZ}$ | No | Yes | No | Yes | No | Yes | No | Yes | | | |
| Twin pairs | 426 | 426 | 426 | 426 | 404 | 404 | 504 | 404 | | | |
| Observations | 852 | 852 | 852 | 852 | 808 | 808 | 1,008 | 808 | | | |
| R ² | 0.03 | 0.04 | 0.08 | 0.09 | 0.02 | 0.02 | 0.07 | 0.08 | | | |

Notes: Here Δ is a within-twin difference operator. In Columns (1), (2), (5), and (6), $\Delta \text{Education}$ is $\Delta S'$ and we use $\Delta S''$ as the instrumental variable for $\Delta S'$, where $\Delta S'$ is the difference between the self-reported schooling years of twin 1 and the self-reported schooling years of twin 2; $\Delta S''$ is the difference between the schooling years of twin 1 reported by twin 2 and the schooling years of twin 2 reported by twin 1. In Columns (3), (4), (7), and (8), $\Delta \text{Education}$ is ΔS^* and we use ΔS^{**} as the instrumental variable, where ΔS^* (ΔS^{**}) is the difference between twin 1's (twin 2's) report of his or her own education and his or her (twin 2's) report of the other twin's. Robust standard errors are in parentheses. * Significant at the 10% level. ** Significant at the 5% level. *** Significant at the 1% level.

TABLE A5
Robust Check Endowments and Age at First Marriage (IV1 Model)

| | Dependent variable: Δ Age at first marriage | | | |
|---------------------------|--|-----------------------|-----------------------|-----------------------|
| | Men | Men | Women | Women |
| | (1) | (2) | (3) | (4) |
| Δ Education | 0.2789** (0.1262) | 0.2732** (0.1264) | 0.4083*** (0.1304) | 0.4240*** (0.1322) |
| Δ Education*DZ | -0.5711** (0.2573) | -0.5658** (0.2590) | 0.4647** (0.2152) | 0.4201** (0.2129) |
| DZ | Yes | Yes | Yes | Yes |
| Δ Birth weight | No | Yes | No | Yes |
| Δ Birth weight *DZ | No | Yes | No | Yes |
| Twin pairs | 426 | 426 | 404 | 404 |
| Observations | 852 | 852 | 808 | 808 |
| R ² | 0.02 | 0.02 | 0.05 | 0.06 |

Notes: Here Δ is a within-twin difference operator. Δ Education is $\Delta S'$ and we use $\Delta S''$ as the instrumental variable for $\Delta S'$, where $\Delta S'$ is the difference between the self-reported schooling years of twin 1 and the self-reported schooling years of twin 2; $\Delta S''$ is the difference between the schooling years of twin 1 reported by twin 2 and the schooling years of twin 2 reported by twin 1. Robust standard errors are in parentheses. * Significant at the 10% level. ** Significant at the 5% level. *** Significant at the 1% level.

TABLE A6
Robust Check Endowments and Spousal Age (IV1 Model)

| | Dependent variable: Δ Spousal age | | | | | | | |
|-----------------------------------|--|------------------------|----------------------|-----------------------|--------------------|--------------------|--------------------|--------------------|
| | Men | Men | Men | Men | Women | Women | Women | Women |
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
| Δ Education | 0.1207 (0.1150) | 0.1233 (0.1156) | 0.0206 (0.1147) | 0.0234 (0.1146) | 0.2256 (0.1800) | 0.2505 (0.1803) | 0.1143 (0.1980) | 0.1375 (0.2001) |
| Δ Education*DZ | -0.6001*** (0.1853) | -0.6155*** (0.1798) | -0.4088* (0.2204) | -0.4246** (0.2124) | 0.1702 (0.2413) | 0.1401 (0.2415) | 0.1745 (0.3095) | 0.1497 (0.3086) |
| DZ | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Δ Birth weight | No | Yes | No | Yes | No | Yes | No | Yes |
| Δ Birth weight*DZ | No | Yes | No | Yes | No | Yes | No | Yes |
| Δ Age at first marriage | No | No | Yes | Yes | No | No | Yes | Yes |
| Δ Age at first marriage*DZ | No | No | Yes | Yes | No | No | Yes | Yes |
| Twin pairs | 426 | 426 | 426 | 426 | 404 | 404 | 404 | 404 |
| Observations | 852 | 852 | 852 | 852 | 808 | 808 | 808 | 808 |
| R ² | 0.01 | 0.02 | 0.15 | 0.16 | 0.02 | 0.02 | 0.05 | 0.05 |

Notes: Here Δ is a within-twin difference operator. Δ Education is $\Delta S'$ and we use $\Delta S''$ as the instrumental variable for $\Delta S'$, where $\Delta S'$ is the difference between the self-reported schooling years of twin 1 and the self-reported schooling years of twin 2; $\Delta S''$ is the difference between the schooling years of twin 1 reported by twin 2 and the schooling years of twin 2 reported by twin 1. Robust standard errors are in parentheses. * Significant at the 10% level. ** Significant at the 5% level. *** Significant at the 1% level.

TABLE A7
Robust Check Endowments and Spousal Height (IV1 Model)

| | Dependent variable: ΔS spousal height | | | | | | | |
|-----------------------------------|---|----------------------|----------------------|----------------------|---------------------|---------------------|---------------------|---------------------|
| | Men | Men | Men | Men | Women | Women | Women | Women |
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
| Δ Education | 0.2492 (0.2357) | 0.2534 (0.2360) | 0.2635 (0.2379) | 0.2658 (0.2380) | 0.3215 (0.4018) | 0.2966 (0.4040) | 0.3112 (0.4150) | 0.2828 (0.4167) |
| Δ Education*DZ | 0.8932** (0.4039) | 0.8729** (0.4098) | 0.8609** (0.4120) | 0.8421** (0.4190) | -0.2834 (0.5619) | -0.2532 (0.5512) | -0.0412 (0.6493) | -0.0158 (0.6403) |
| DZ | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Δ Own height | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Δ Own height*DZ | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Δ Birth weight | No | Yes | No | Yes | No | Yes | No | Yes |
| Δ Birth weight*DZ | No | Yes | No | Yes | No | Yes | No | Yes |
| Δ Age at first marriage | No | No | Yes | Yes | No | No | Yes | Yes |
| Δ Age at first marriage*DZ | No | No | Yes | Yes | No | No | Yes | Yes |
| Twin pairs | 426 | 426 | 426 | 426 | 404 | 404 | 404 | 404 |
| Observations | 852 | 852 | 852 | 852 | 808 | 808 | 808 | 808 |
| R ² | 0.03 | 0.03 | 0.03 | 0.03 | 0.02 | 0.02 | 0.02 | 0.02 |

Notes: Here Δ is a within-twin difference operator. $\Delta Education$ is $\Delta S'$ and we use $\Delta S''$ as the instrumental variable for $\Delta S'$, where $\Delta S'$ is the difference between the self-reported schooling years of twin 1 and the self-reported schooling years of twin 2; $\Delta S''$ is the difference between the schooling years of twin 1 reported by twin 2 and the schooling years of twin 2 reported by twin 1. Robust standard errors are in parentheses. * Significant at the 10% level. ** Significant at the 5% level. *** Significant at the 1% level.

TABLE A8
Robust Check Endowments and Spousal Education (IV1 Model)

| | Dependent variable: Δ Spousal education | | | | | | | |
|-----------------------------------|--|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| | Men | Men | Men | Men | Women | Women | Women | Women |
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
| Δ Education | 0.3225*** (0.0921) | 0.3216*** (0.0924) | 0.3040*** (0.0946) | 0.3037*** (0.0949) | 0.4875*** (0.1970) | 0.4954*** (0.1980) | 0.5268*** (0.2079) | 0.5374*** (0.2097) |
| Δ Education*DZ | -0.0892 (0.1764) | -0.0893 (0.1767) | -0.0602 (0.1838) | -0.0610 (0.1840) | 0.5912*** (0.2828) | 0.5819*** (0.2833) | 0.6706* (0.3566) | 0.6552* (0.3557) |
| DZ | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Δ Birth weight | No | Yes | No | Yes | No | Yes | No | Yes |
| Δ Birth weight*DZ | No | Yes | No | Yes | No | Yes | No | Yes |
| Δ Age at first marriage | No | No | Yes | Yes | No | No | Yes | Yes |
| Δ Age at first marriage*DZ | No | No | Yes | Yes | No | No | Yes | Yes |
| Twin pairs | 426 | 426 | 426 | 426 | 404 | 404 | 404 | 404 |
| Observations | 852 | 852 | 852 | 852 | 808 | 808 | 808 | 808 |
| R ² | 0.05 | 0.06 | 0.06 | 0.08 | 0.09 | 0.09 | 0.09 | 0.09 |

Notes: Here Δ is a within-twin difference operator. Δ Education is $\Delta S'$ and we use $\Delta S''$ as the instrumental variable for $\Delta S'$, where $\Delta S'$ is the difference between the self-reported schooling years of twin 1 and the self-reported schooling years of twin 2; $\Delta S''$ is the difference between the schooling years of twin 1 reported by twin 2 and the schooling years of twin 2 reported by twin 1. Robust standard errors are in parentheses. * Significant at the 10% level. ** Significant at the 5% level. *** Significant at the 1% level.

TABLE A9
Robust Check Endowments and Spousal Wage at Marriage (IV1 Model)

| | Dependent variable: $\Delta \text{Log spousal wage}$ | | | | | | | |
|---|--|---------------------|---------------------|---------------------|----------------------|----------------------|-----------------------|-----------------------|
| | Men | Men | Men | Men | Women | Women | Women | Women |
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
| $\Delta \text{Education}$ | 0.0566 (0.0523) | 0.0575 (0.0526) | 0.0779* (0.0417) | 0.0782* (0.0418) | 0.0736** (0.0368) | 0.0731** (0.0361) | 0.0730*** (0.0175) | 0.0724*** (0.0178) |
| $\Delta \text{Education} * \text{DZ}$ | -0.0541 (0.1269) | -0.0565 (0.1264) | -0.0746 (0.1321) | -0.0763 (0.1313) | 0.1146** (0.0516) | 0.1128** (0.0510) | 0.1584*** (0.0503) | 0.1556*** (0.0488) |
| DZ | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| $\Delta \text{Birth weight}$ | No | Yes | No | Yes | No | Yes | No | Yes |
| $\Delta \text{Birth weight} * \text{DZ}$ | No | Yes | No | Yes | No | Yes | No | Yes |
| $\Delta \text{Age at first marriage}$ | No | No | Yes | Yes | No | No | Yes | Yes |
| $\Delta \text{Age at first marriage} * \text{DZ}$ | No | No | Yes | Yes | No | No | Yes | Yes |
| Twin pairs | 426 | 426 | 426 | 426 | 404 | 404 | 404 | 404 |
| Observations | 852 | 852 | 852 | 852 | 808 | 808 | 808 | 808 |
| R ² | 0.01 | 0.01 | 0.01 | 0.01 | 0.05 | 0.05 | 0.04 | 0.04 |

Notes: Here Δ is a within-twin difference operator. $\Delta \text{Education}$ is $\Delta S'$ and we use $\Delta S''$ as the instrumental variable for $\Delta S'$, where $\Delta S'$ is the difference between the self-reported schooling years of twin 1 and the self-reported schooling years of twin 2; $\Delta S''$ is the difference between the schooling years of twin 1 reported by twin 2 and the schooling years of twin 2 reported by twin 1. Robust standard errors are in parentheses. * Significant at the 10% level. ** Significant at the 5% level. *** Significant at the 1% level.

TABLE A10
Robust Check for Marital Outcomes (IV2 Model)

| | Dependent variable: | | | | |
|------------------------------|------------------------|-----------------------|------------------------|---------------------------|--------------------------|
| | ΔOwn age (1) | ΔSpousal age (2) | ΔSpousal height (3) | ΔSpousal education (4) | ΔLog spousal wage (5) |
| Panel A: Male twins | | | | | |
| ΔEducation*DZ | -0.5579*** (0.1747) | -0.2395** (0.1183) | 0.6839** (0.3325) | -0.0448 (0.1371) | -0.0024 (0.0939) |
| Twin pairs | 426 | 426 | 426 | 426 | 426 |
| Observations | 852 | 852 | 852 | 852 | 852 |
| R ² | 0.01 | 0.17 | 0.04 | 0.04 | 0.01 |
| Panel B: Female twins | | | | | |
| ΔEducation*DZ | 0.2808** (0.1228) | 0.0238 (0.1688) | -0.0950 (0.3578) | 0.3417** (0.1552) | 0.0746*** (0.0232) |
| Twin pairs | 404 | 404 | 404 | 404 | 404 |
| Observations | 808 | 808 | 808 | 808 | 808 |
| R ² | 0.12 | 0.05 | 0.02 | 0.15 | 0.08 |

Notes: Here Δ is a within-twin difference operator. We report the estimates of model IV2, using ΔS^* as the regressor and ΔS^{**} as the instrumental variable. ΔS^* is the difference between twin 1-reported schooling years of twin 1 and twin 1-reported schooling years of twin 2; ΔS^{**} is the difference between schooling years of twin 1 reported by twin 2 and schooling years of twin 2 reported by twin 2. We report only estimates of the coefficient on the interaction term. We omit estimates of the coefficient on $\Delta Education$. All regressions include DZ dummy and their interaction terms, within-twin difference of birth weight, and its interaction term with DZ dummy. In Columns (2)-(5), additional controls include within-twin difference of age at first marriage and its interaction term with DZ dummy. In Column (3), we further control for the within-twin difference of own height and its interaction term with DZ dummy. Robust standard errors are in parentheses.

* Significant at the 10% level. ** Significant at the 5% level. *** Significant at the 1% level.

TABLE A11
Maximum Likelihood Factor Analysis for One Factor

| Test | H_0 : No common factors H_1 : At least one common factor | | | H_0 : One factor is sufficient H_1 : More factors are needed | | |
|--------|---|------------|---------|---|------------|---------|
| | Df | Chi-square | Pr>Chsq | Df | Chi-square | Pr>Chsq |
| Male | 15 | 45.88 | 0.0000 | 9 | 8.77 | 0.4592 |
| Female | 15 | 29.37 | 0.0144 | 9 | 10.89 | 0.2835 |

TABLE A12
Maximum Likelihood Factor Analysis for Multiple Factors

| Number of factors | Male | | Female | |
|-------------------|-------|-------|--------|-------|
| | AIC | BIC | AIC | BIC |
| 1 | 20.98 | 38.76 | 23.15 | 41.02 |
| 2 | 23.72 | 56.31 | 26.25 | 58.99 |
| 3 | 30.08 | 74.52 | 30.07 | 74.71 |