Height and income attraction: an online dating field experiment[1]

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Many desirable traits are associated with height. However, most studies of marriage or dating do not control for height and these other qualities simultaneously. Other factors may confound the influence of height, or more importantly, height may confound the influence of other factors. We contribute to this literature by randomly assigning heights and incomes to 360 unique artificial profiles on a major online dating website in China. We then recorded nearly 800 "visits"—clicks on abbreviated profiles, which include height and income information, from search engine results. We found that the incomes of our visitors were highly correlated with their heights. Men's incomes increased by 24% while women's by 15% for every inch (2.5 cm) increase in height. Tall men preferred and were preferred by tall women, who were themselves both preferred by medium women and men, respectively. Men were indifferent to women's incomes, but women preferred higher income men. Interestingly, short women were the least likely to visit short men, both among all heights of men they visited and among women of all heights. They also were more willing to trade-off mate income for mate height than medium women. This suggests that women's marginal utility for height may reflect concern for the height of their children's in the context of widespread height discrimination.

Key Words: height, online dating, field experiment, gender differences, matching, marriage

JEL Codes: C93, J01, J12

Introduction

A vast literature on matching has grown out of Becker's (1973) seminal work on the reasons why people form families. Schwartz's (2013) survey of this literature shows that people tend to act as if they prefer those with higher levels of income, education, and

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socioeconomic status. More recently, Becker's theory has given rise to a nascent literature on matching by anthropometric characteristics like body mass (Chiappori, Oreffice, & Quintana-Domeque, 2012; Oreffice & Quintana-Domeque, 2010, 2012) and height. Prior empirical studies suggest that men prefer women who are moderately shorter than themselves, while women prefer men who are moderately taller than themselves in online dating and marriage data in the US (Hitsch, Hortaçsu, & Ariely, 2010b), speed dating data (Stulp, Buunk, Kurzban, & Verhulst, 2013) and marriage data from the UK (Belot & Fidrmuc, 2010).

Height, however, is physical characteristic that is also associated with many other desirable traits for males: cognitive ability (Case & Paxson, 2008), non-cognitive ability (Persico, Postlewaite, & Silverman, 2004), health (Lundborg, Nystedt, & Rooth, 2009), education, occupation and industry (Case, Paxson, & Islam, 2009), career prospects (Herpin, 2005), as well as, ethnicity (Belot & Fidrmuc, 2010), and through these factors, socioeconomic status and income.

The correlation between height and health in men would suggest that taller men are also healthier and thereby, better looking. However, even if that were not the case, mere height in men is considered a part of what makes them attractive, and attractiveness has been found to increase earnings (Hamermesh & Biddle, 1994). Height has less of (Case & Paxson, 2008) or insignificant (Heineck, 2005) effect on women's wages, though. In Asia, mere height raises earnings in Taiwan, controlling for cognitive and non-cognitive abilities, and physical strength (Tao, 2014). Height has been found to be correlated with higher human capital in China (Gao & Smyth, 2010). That correlation with human capital may contribute to or be the consequence of widespread labor market discrimination by height in China (Kuhn & Shen, 2013).

Due to these correlations between height and other desirable traits, the effect of height alone in matches would be difficult to identify. Women (men) could be reacting to those other characteristics of men (women) when they appear to be matching on heights. More important for the social science of matching is the inverse possibility that a preference for height could be exerting a significant but unobserved influence in speed dating or marriage data. Few studies have tried to separate the effect of income and height on matching behavior. Among these, only Hitsch et al. (2010b) identified the effect of height

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and controlled for income in an empirical study of online dating data. Belot & Fidrmuc‘s (2010) empirical study of the effect of height in across ethnicities marriages controlled for education using real marriage data.

There is the further problem of simultaneity from spontaneous characteristics that arise at specific meeting (“chemistry”) which height or confidence from height could contribute to. For example, a woman’s reaction to taller men may make her more attractive to them. Her pupils may dilate (Tombs & Silverman, 2004). Her voice may soften or increase in pitch (Fraccaro et al., 2011). Her hormonal reactions (López, Hay and Conklin, 2009) may build upon his (Roney, Lukaszewski and Simmons, 2007; van der Meij, Buunk and Salvador, 2010) and vis versa, and the feedback may lead to other changes to the quality of their meeting, which are palpable to them, but not necessarily measurable yet to social scientists. There is in fact evidence that such changes increase a woman’s attractiveness (Feinberg, DeBruine, Jones and Perrett, 2008). See Anders and Grey (2007) for an academic and Young and Alexander (2012) for a popular survey of the academic literature. Women’s preference for taller men could then induce a preference in taller men for shorter women. Note that this problem is distinct from men seeming to prefer women who are shorter than themselves because they expect higher rates of rejection from women who are taller than themselves.

Due to the correlation between height and cogitative and non-cognitive ability, height could be the driving factor in women’s apparent preference for more ambitious men, or conversely, height could be the basis for less ambitious men’s dis-preference for more ambitious women (Fisman, Iyengar, Kamenica, & Simonson, 2006).

These simultaneity and omitted variable problems in identifying non-height mate preferences from speed dating experiments would be exacerbated in marriage data. Spontaneous characteristics from chemistry from well matched statures, or the lack thereof from mismatched statures, could in the long run, give rise to permanent relationship advantages or handicaps. Height alone or through its correlation with income, could be a contributing factor to the lower marital satisfaction in couples in which the men had lower reported incomes than their wives (Bertrand, Pan, & Kamenica, 2013; Brown & Roberts, 2014).

Weitzman and Conley (2014) provide initial evidence that the marriages of men who are shorter than their wives are different; they have younger wives, do less housework, and make a greater share of the household income. This difference could be due to the possible handicap that short men may suffer in finding a mate. The fact that they are married at all may reflect other differences like a higher value for traditional families, particularly for children, or ethnic differences (Belot & Fidrmuc, 2010). Ethic differences, for example, could be the cause of both differences in stature and differences in actual and potential incomes.

In mirror fashion, tall women may invest relatively more in the job market, anticipating less satisfaction on the mating market, either because they desire even taller men, who are rare, or because they anticipate under-appreciation from men shorter than themselves. Hence, the marriages of men who are shorter than their wives (but not necessarily short) could be the result of a confluence of unobserved or partially observed factors that make their marriages distinct, and possibly less stable.

Surveys might seem like a natural remedy to these problems of separating height from non-height preferences. However, there is no reason to expect that people can separate correlated characteristics in their understanding of their own preferences any better than social scientists can from their choices. Surveys can also suffer from subjects' systematic misunderstanding of their own preferences. For example, Hitsch et al. (2010b) found a within race preference revealed by women who in their first contact emails to men, but not revealed in their stated preferences. Surveys have not been predictive in actual interactions (P. Eastwick & Eagly, 2011; P. W. Eastwick & Finkel, 2008; P. W. Eastwick, Luchies, Finkel, & Hunt, 2014; Kurzban & Weeden, 2005; Todd, Penke, Fasolo, & Lenton, 2007).

We overcome these endogeneity and omitted variable issues by identifying gender differences in preferences for mate height *ex-ante* to any interactions in a field experiment on one of China's largest online dating websites. We randomly assigned heights and incomes to 360 unique artificial profiles and recorded the heights and incomes of 839 visits by users. The heights were one standard deviation below, at or

above the medium heights of each gender: 160 cm for women and 172 cm for men (Zhang & Wang, 2011) in the cities of the experiment[3]. These we referred to respectively as "short", "medium" and "tall" heights. We also randomly assigned these profiles "low", "middle" and "high" incomes. We then counted "visits[4]"—clicks on abbreviated profiles, which include these height and income information, from search engine results.

Visits are a credible measure of mate preferences, since they are necessary for any interactions. They are also not free. They involve time and therefore opportunity costs. Thus, we expect people to make calculated trade-offs between profiles to visit. At the same time, they should involve a minimal of amount of strategically motivated choice to avoid the pain of rejection. A revealed preference to see the full profile does not imply a preference to contact the owner and, therefore, an offer to be rejected. Visits are also ex-ante to any interactions; they can only be based upon the information we reveal in the search engine results. Random assignment on these observables can then rule out unobserved factors confounded with height (e.g., health) as causes. Simultaneity and omitted variable cease to be issues in our design.

We found that the incomes of our visitors were highly correlated with their heights. Men's incomes increased by 24 percent while women's by 15 percent for every inch increase in height. There was both horizontal matching and vertical matching: tall and medium men and women visited tall women and men (respectively) the most. Except for short men who weakly preferred higher income women, men were mostly indifferent to women's incomes. Consistent with prior studies, in particular, Ong and Wang (2014), women always preferred higher income men. Men visited women who were 2.8-5.1 inches (7-13 cm) shorter than themselves the most. Women visited men who were 4.3-7 inches (11-18 cm) taller than themselves the most while.

However, we also found evidence that did not support either vertical or horizontal matching. Short men visited women of all heights about equally. Surprisingly, short women were the least likely to visit short men, both among all men that they visited and among women of all heights. In fact, for short women, a one percent increase in male

[3] Average heights in large cities in China are about 5 cm shorter than US 177 cm for men and 3 cm shorter than 163 cm for women for young adults.

[4] Hitsch et al. (2010b) use "browse" for what we call visits.

height was associated with at least a four times greater increase in visits than a one percent increase in male incomes. In contrast, medium women were only twice as likely to visit for the analogous changes.

Thus, our results suggest the novel implication that the intensity of women's demand for mate height, could at some level, be inversely related to their own height. This demand could be driven by short women's desire that their children be taller than themselves and may reflect their own experience with widespread height discrimination in China (Kuhn & Shen, 2013). To our knowledge, this is the first field experimental study of the effect of height and income on mate preferences with random assignment of both.

Experimental Design

We constructed baseline profiles by collecting 360 (180 for each gender) nicknames, pictures, statements from inactive real profiles from another website[5]. We assigned men the age of 27 and women the age of 25, which are the average ages of marriage in China. Birthdays were within 8 days of each other and of the same zodiac sign. Our profiles listed college education and the marital status of "single with no children" and "buy a house after marriage", i.e., did not already own a house.

The main treatment consisted of a random assignment design with three heights and three incomes for each gender. "Short" male profiles are 166 cm in height, one standard deviation below the average of "medium" male profiles, which are 172 cm. "Tall" male profiles are 178 cm, one standard deviation above medium. These men were also block randomly assigned one of three levels incomes of incomes: 3-5, 8-10, 10-20 (1,000 CNY).

[5] To minimize any possible imposition, we used only profiles which this other website was about to automatically hide because of user inactivity. We are not aware of legal restrictions on the use of user created content uploaded to social media websites in China. We assumed that such restrictions, if they exist, were weaker than the US. Consistent with a lack of legal restriction, Facebook explicitly states that users relinquish their copyright of self-made content to Facebook for the time of their posting. We infer that this content becomes public domain since Facebook then distributes this content freely to other users.

The Chinese website in which we did the field experiment has a similar statement to Facebook, though the website from which we borrowed materials to construct the profiles has no such statement. We assumed that their policy is no more restrictive than Facebook's. Random assignment to a different city should, furthermore, minimize the risk of a picture being recognized by friends or colleagues of the people whose profiles we borrowed within the 24hrs of the experiment on this other website.

Chinese Universities do not have IRBs to approve the ethics of experiments. However, to the best of our understanding, our design falls under the "minimal risk" exemption from IRB approval. "Minimal risk means that the probability and magnitude of harm or discomfort anticipated in the research are not greater in and of themselves than those ordinarily encountered in daily life or during the performance of routine physical or psychological examinations or tests."

See here: http://www.virginia.edu/vpr/irb/sbs/resources_regulations_subparta.46.101.html#46.102(i)

At the time of the experiment, one USD was about six CNY. These incomes are slightly higher than the median for this website in order to make our profiles more attractive to potential female visitors.

"Short" female profiles are 155 cm, also one standard deviation below "medium", which are 160 cm, and one standard deviation below tall, which are 165 cm. These female profiles are assigned incomes: 2-3, 3-5, 8-10 (1,000 CNY). 3-5 is the mean income level for women of this age group on this website. Hence, we had 20 profiles for each combination of incomes and heights in our 3×3 design for a total of 180 profiles for each gender.

Users could see our profiles' picture, nicknames, age, city, marital status, height, income, and the first few lines of a free-text statement in their default search results. They could then click a link and visit our full profile. We could see our visitors' full profiles by clicking their link in the history of visitors, which makes a permanent record of the visit without distinguishing among visits for each visitor.

The website offers a number of ways to rank the profiles of other users in its search engine, including: registration time, login time, age, number of photos, "credibility" [6] of the profile, and income. The website also highlights randomly chosen (so far as we can tell) new profiles. Since all of our profiles had statistically identical characteristics, there should have been no systematic effects from the use of different ranking criteria, though being featured may increase the variance of visits among our profiles. We omit details about registration that are standard to social network websites or not relevant to our hypothesis.

We created 36 profiles (of the same gender) the day before to allow the website time to register them. Each day had four profiles from each of the nine income and height combinations. We logged in these 36 profiles in a random order, with about five minutes between each, to leave at least one page between each of our profiles, for five days during

[6] The credibility of the profile is indicated by a positive score. There are many ways to increase this score: phone verification of the registered phone number earns 2 points, the use of the Chinese national ID to register earns 4 points, each uploaded photo earns 1 point, email verification earns 1 point up to 2 points, video verification earns 2 points, a paid membership earns 10 points, etc. Users without a paid membership can browse profiles, while users with a paid membership can, among other things, send first-contact emails to each other. All our profiles just have phone verification and one photo. Thus, our credibility score was 3. But, that would not affect visits, because the score does not appear in search results. To affect visits, users would have to search specifically for short credibility profiles.

the period of September 11-17, 2013 for the male profile treatments and September 24-29, 2013 for the female profiles. Each account was open for only 24 hours. We alternated between logging in the next day's profiles in between collections of data on the previous day's visit data. The total login/collection time was 1-3 hours per day depending upon the computer speed and number of visits.

Data Results

We received and recorded all 1516 female visitors[7] to our male profiles. We recorded 2310 male visitors to our female profiles, which was a fifth of the total number of visitors to our 180 profiles over the five days of the experiment[8]. We test for heterogeneity in the response to mate height as a function of own eight at three levels: short, medium, tall. 529 of the 1516 female visitors were at the three levels we are interested in. 310 of the 2310 male visitors that we counted were at these three levels. Thus, the total number of visits we used to test our analysis is 839. We used the remaining data for robustness checks, which yielded similar results. These are available on request.

The graphs of men's visits to female profiles are summarized in Figure 1 below. The horizontal axis indicates the heights of our female profiles. The vertical axis indicates the average daily visits. The number in brackets in the legend is the total average number of visits per day for that height. For example, the average number of medium men who visited our 165 cm female profiles with reported incomes of 3-5 (in 1,000CNY) was about 6 per day. The total of the average visits per day from medium men was 36, the number in bracket in Figure 1. The actual total for all such men for the 15 days of the experiment was 181, the number in bracket in Figure 2.

We next normalize the graphs by dividing each average daily visit by all of the visits at each of the height levels of the visitors so that we might see the probability of visits from each height level of the visitors to each height and income levels of the visited profile. For example, Figure 1 shows that there was an average of 6 visits by medium men to tall

[7] This website does not allow users to report a same sex preference, though users can view anyone else's profile.

[8] The approximately fivefold greater number of visits by men could have been due to several factors. Men may have been clicking more profiles than women. The men who visited our female profiles tend to also belong to a larger range of ages than the women who visited our male profiles. Hitsch et al. (2010b) found that men visited female profiles at 2-3 times the rate of women in the US. Chinese men may be visiting more women also because of the shortage of women in China.

women who made the median income. This becomes 6/36 ≅ 17 percent in Figure 2. We see no discernable trend by income for these lines. However, except for short men, these graphs are all increasing on the height of the women. This pattern is confirmed in the regression results in Table 2.

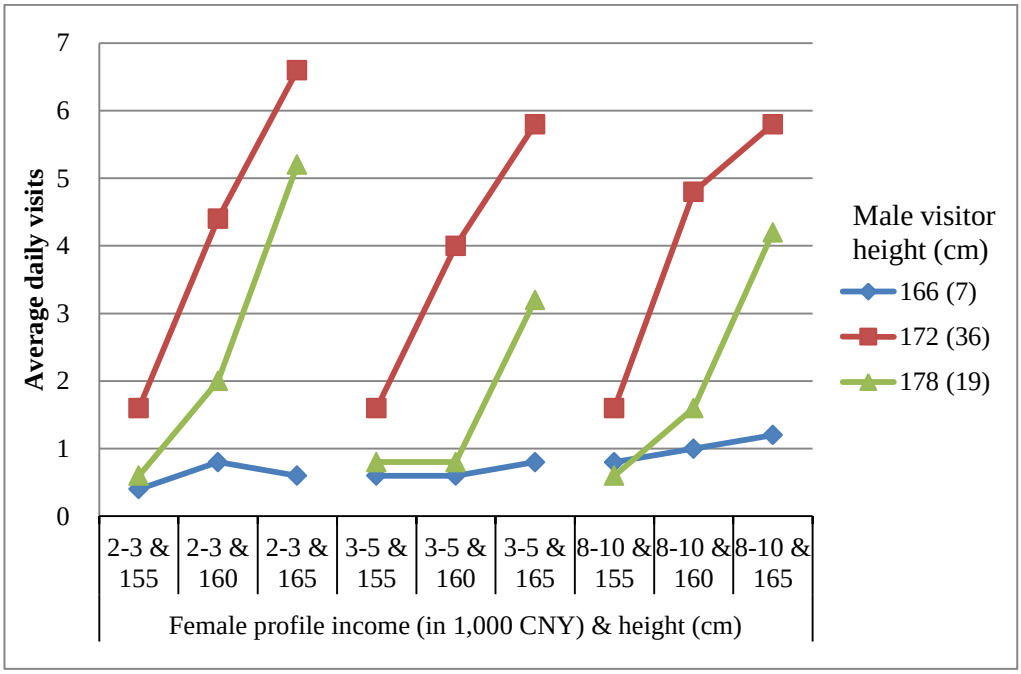

FIGURE 1: MALE AVERAGE DAILY VISITS TO FEMALE PROFILES VS FEMALE PROFILE INCOMES AND HEIGHTS

Notes: 160 and 172 cm are average heights for females and males on the website and in the five cities of experiment, respectively. Other heights are either one standard deviation above or below for their respective sexes. Numbers in brackets are total average daily visits. 3-5 (in 1,000 CNY) is the median income for women on the website.

It is clear from Figure 2 that both 178 and 172 cm men visited women who were 165 cm the most. These were 13-7 cm shorter than themselves. We see no pattern for the few 166 cm men who visited our profiles. This skew in the distribution away from short men indicates that men on this website may tend to be taller than the rest of the population or they are misreporting their height when short. However, the average reported height of men on this online dating website was 175 cm in Beijing and 174 cm Shanghai, which was identical to that found in a representative survey (Zhang & Wang, 2011). The average reported heights of women on this website were about 1.5 cm taller for women in Beijing and 1 cm taller in Shanghai. Even if there was misreporting, that should not affect our results because we condition on the height of the visiting men. We address the possibility of misreporting further below.

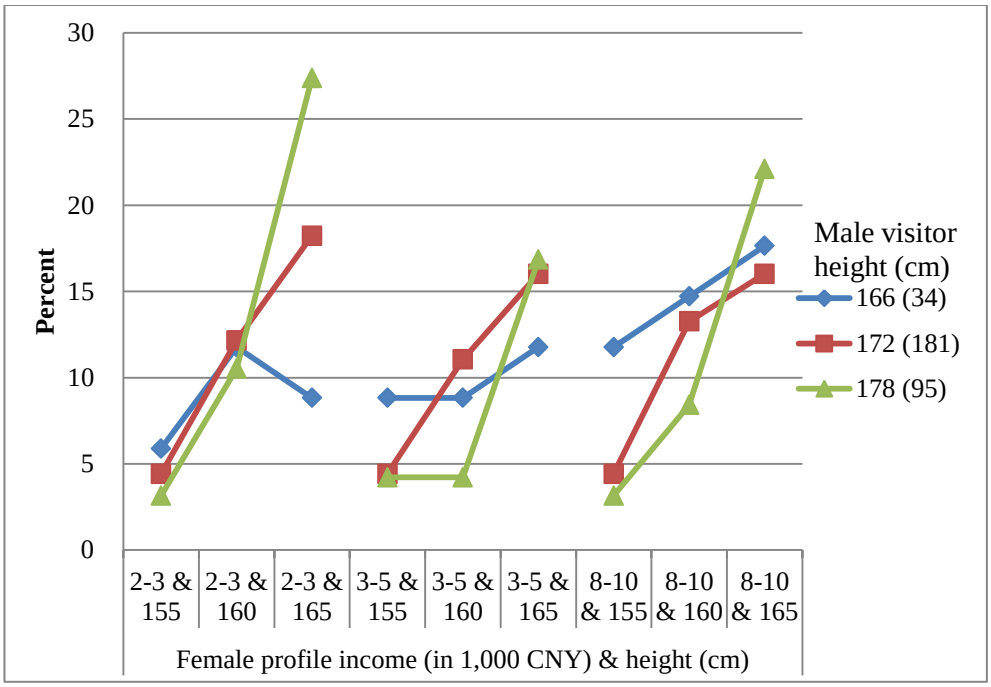

FIGURE 2: PERCENT OF MALE VISITS TO FEMALE PROFILES VS FEMALE PROFILE INCOMES AND HEIGHTS

Notes: 160 and 172 cm are average heights for females and males on the website and in the five cities of experiment, respectively. Other heights are either one standard deviation above or below for their respective sexes. Numbers in brackets are total daily visits. 3-5 (in 1,000 CNY) is the median income for women on the website.

In stark contrast, Figure 3 illustrates how women's average daily visits increase for higher income men. This pattern is even more salient when we normalize by the height of the visitors in Figure 4.

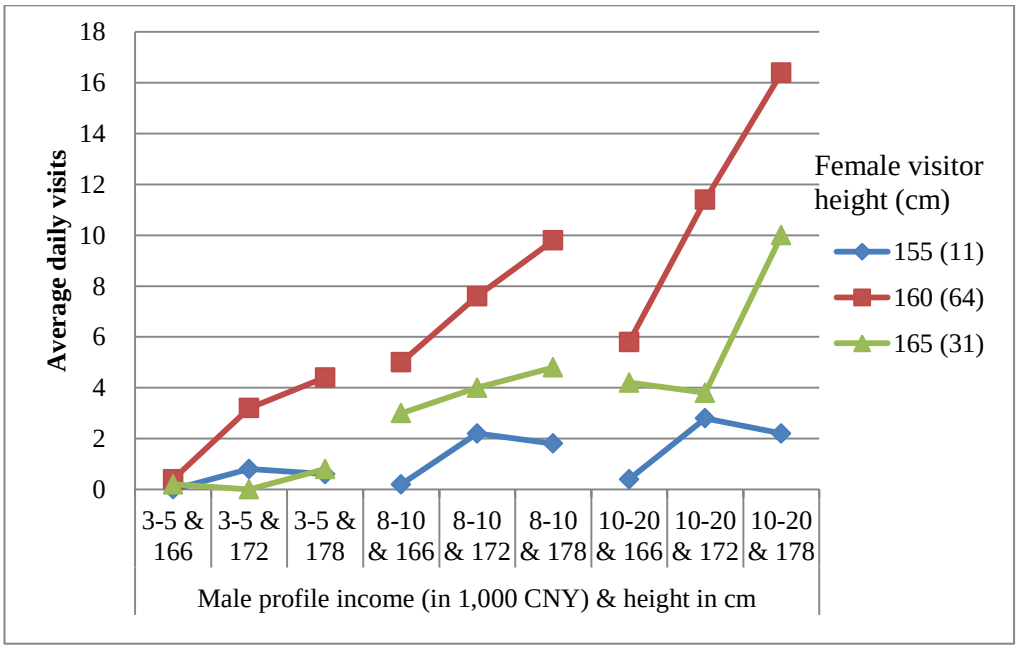

FIGURE 3: FEMALE AVERAGE DAILY VISITS TO MALE PROFILES VS MALE PROFILE INCOMES AND HEIGHTS

Notes: 160 and 172 cm are average heights for females and males on the website and in the five cities of experiment, respectively. Other heights are either one standard deviation above or below for their respective sexes. Numbers in brackets are total average daily visits. 8-10 (in 1,000 CNY) is the median income for women on the website.

Figure 4 further reveals variation in the women's responses to our male profile's heights. Medium women always visited taller men more at all income levels. Interestingly, short women visited short men the least among all of the men they visited. They visited short men the least among all women, while they visited medium men the most of all women. We calculate the intensity of their preference for height in terms of their marginal rate of substitution for money below in Table 4.

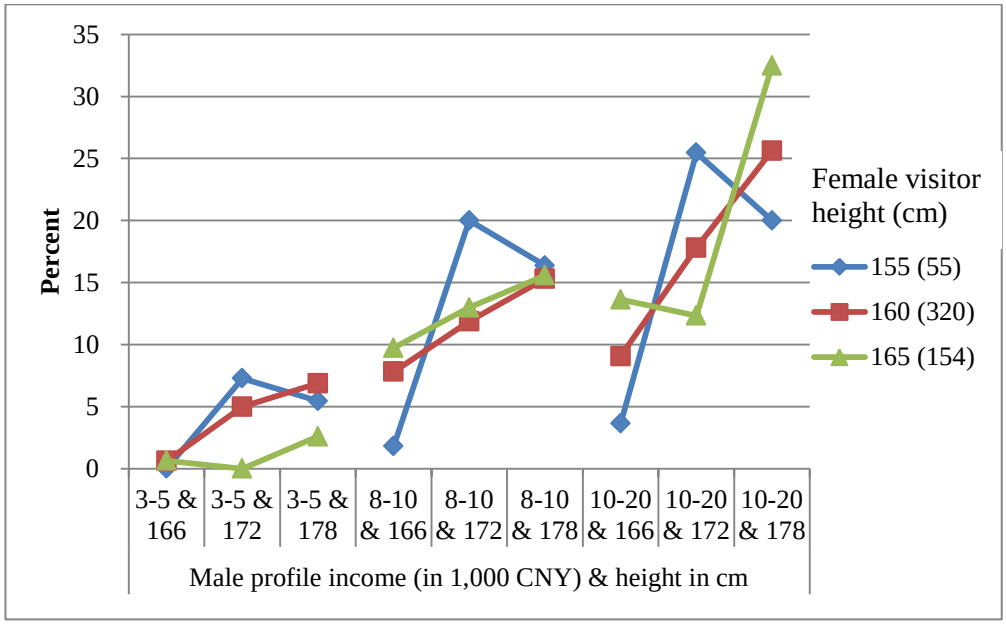

FIGURE 4: PERCENT OF FEMALE VISITS TO MALE PROFILES VS MALE PROFILE INCOMES AND HEIGHTS

Notes: 160 and 172 cm are average heights for females and males on the website and in the five cities of experiment, respectively. Other heights are either one standard deviation above or below for their respective sexes. Numbers in brackets are total daily visits. 8-10 (in 1,000 CNY) is the median income for women on the website.

Regressions

We want to first capture the raw association between height and income in order to give a sense and how height may be used to statistically discriminate for other less observable qualities like health or less immediately observable qualities like education, both of which might influence income. Note that the correlation between height and income may reflect distinct motivations to seek height in the other gender. Men may desire height in women because it indicates health or fertility. Women many seek it in men because it indicates genetic quality and ability to control resources.

Model (1) in Table 1 shows that a one cm increase in height from 172 cm for men results in a 0.672·1000 = 672 CNY increase in wages. Since the constant term is -106.9, the average income is 8.34 = -106.9 + 172·0.67 (1,000 CNY). Thus, a one cm increase in height is associated with a 0.08 = 672/ (8.34·1000) increase in income for men. Model (2) in Table 1 shows that a one cm increase in height from 160 cm for women resulted in a 0.194·1000 = 194 CNY increase in wages. Since the constant term is -27.15, the average income is 3.89 = -27.15 + 160·0.194. Thus, a one cm increase in height is associated with a 0.049 = 194/ (3.89·1000) increase in income for women.

TABLE 1: REGRESSION OF VISITOR INCOMES ON VISITOR HEIGHTS

	Income in 1,000 CNY	
	(1)	(2)
Height	0.67***	0.19***
	(0.197)	(0.038)
Constant	-106.9**	-27.15***
	(34.12)	(6.13)
N	310	529

Notes: Numbers in brackets are standard errors. We include three or more decimals when rounding might change interpretation of the numbers. Model (1) shows that a one cm increase in height from 172 cm for men results in a 0.672*1000 = 672 CNY increase in wages. Model (2) shows that a one cm increase in height from 160 cm for women results in a 0.194*1000 = 194 CNY increase in wages.

We now test econometrically for the effect of income and height on visits. First, we explain our data in words, then mathematically. Each of our 180 profiles for each gender is at one of three income and height levels resulting in 3×3 = 9 treatment levels with 20 profiles in each. Each of our visitors also comes from three height levels. Thus, the N = 540 at the bottom of the our regression results in Tables 1 and 2 is perhaps better thought of as potential states which could be realized by our 529 visits from women and 310 visits from men. Thus, a data point among our 540 data points is quintuple (number of visits from each of three height levels; a profile at a height and income level). We normalized the number of visits to a female profile at each height level of the visitors by dividing by the total number of visits at a height level. We then assigned a dummy variable to each of the visitors' three height levels.

The percent of visits to profile i = 1, 2, …, 20

- at income level w = 4 (for 3-5), 9 (for 8-10), 15 (for 10-20) in 1,000 CNY and
- height level h = 166 (short), 172 (medium), and 178 cm (tall) for male profiles and
- income level w = 2.5 (for 2-3), 4 (for 3-5), 9 (for 8-10) in 1,000 CNY and

- height h = 155 (short), 160 (medium), and 165 cm (tall) for female profiles from visitors of height h' is
  - $percent\ of\ visits_{\ i}^{\ h'} = \frac{N_{i,h,w}^{h'}}{\sum_{w\in\{4,9,15\}}\sum_{h\in\{166,172,178\}}\sum_{i=1}^{20} N_{i,h,w}^{h'}}$ to male profiles
  - $percent\ of\ visits_{\ i}^{\ h'} = \frac{N_{i,h,w}^{h'}}{\sum_{w\in\{2.5,4,9\}}\sum_{h\in\{155,160,165\}}\sum_{i=1}^{20} N_{i,h,w}^{h'}}$ to female profiles

Thus, the equation that we estimate is:

- $percent\ of\ visits_{\ i}^{\ h'} = \alpha_1 + \alpha_2 \cdot (h' = medium\ dummy) + \alpha_3 \cdot (h' = tall\ dummy) + \beta_1 \cdot w_i + \beta_2 \cdot (h' = medium\ dummy) \cdot w_i + \beta_3 \cdot (h' = tall\ dummy) \cdot w_i + \beta_4 \cdot (h' = medium\ dummy) \cdot h_i + \beta_5 (h' = tall\ dummy) \cdot h_i + \varepsilon_{i,h}^{h'}$

Table 2 has the regression of the percent of men's visits to female profiles. Men never responded to our female profile's incomes, which is consistent with Ong and Wang's (2014). However, they did respond to female height. However, they did respond to female height. Model (1) in Table 2 uses short men as the benchmark, while Model (2) in Table 2 uses medium men. To see how this regression result relates to Figure 2, note that in Figure 2, men's visits increase about five percent for each five cm increase in the reported height of our female profiles, which scales down to a one percent increase for every one cm increase in height. Since there are 20 profiles for each of our $3 \cdot 3$ height and income combinations, that one percent increase translates into a 0.06 percent increase per profile increase in height of one cm, which is the coefficient 0.062 for Female profiles' height in Model (2) in Table 2. The response of tall men to our female profile's increasing height is not significantly different from that of the medium. Curiously, the response of short men is significantly greater than that of medium men (-0.047) though Figures 1 and 2 reveal that their slopes are in general flatter. We also introduced quadratic heights into these regressions and found no significant coefficients. These results are available on request.

TABLE 2: REGRESSION OF PERCENT OF MEN'S VISITS TO FEMALE PROFILES

	(1)	(2)
Male visitors' height short dummy		6.45* (3.89)
Male visitors' height medium dummy	-6.49*(3.89)	
Male visitors' height tall dummy	-11.46**(3.89)	-4.97(3.89)
Female profiles' income	0.046(0.025)	-0.0003(0.025)
Female profiles' height	0.0196(0.017)	0.062***(0.017)
(Female profiles' income) · (Male visitors' height short dummy)		0.047 (0.035)*
(Female profiles' income height) · ((Male visitors' height short dummy)		-0.0421(0.024)
(Female profiles' income) · (Male visitors' height medium dummy)	-0.047(0.035)	

(Female profiles' height) · (Male visitors' height medium dummy)	0.042*(0.024)	
(Female profiles' income) · (Male visitors' height tall dummy)	-0.05(0.036)	-0.0068(0.035)
(Female profiles' height) · (Male visitors' height tall dummy)	0.073**(0.02)	0.0313(0.024)
Constant	-2.82(2.75)	-9.31***(2.75)
R^2	0.08	0.08
P-value of F-stat	0.000	0.000
N	540	540

Notes: * $p<0.1$, ** $p<0.05$; *** $p<0.01$. Numbers in brackets are standard errors. We include three or more decimals when rounding might change interpretation of the numbers. Model (1) and (2) includes allows for difference effects of female profiles' incomes on male visitor heights. Model (1) uses short men the benchmark, while Model (2) uses medium men. We include three or more decimals when rounding might change interpretation of the numbers.

Note that 540 is not the same number as our count of visits for either gender. A visit is to a particular profile among our 180 profiles for each gender. Each of our profiles is from 1 of 9 height and income levels. The visitor is from 1 of 3 height levels. 540 = 180·3 is perhaps better thought of as potential states which could be realized by a visit.

The regression of the percent of women's visits to male profiles is in Table 3. Model (1) in Table 3 has short women visitors as the benchmark. Model (2) in Table 3 has medium women visitors as the benchmark. Model (1) in Table 3 shows that the linear coefficient of short women on male profiles' height (4.684) is higher than the linear coefficient for medium women (-4.318) and higher than that of tall women's (-6.560). Model (2) in Table 3 also shows that the medium women visitors are not significantly different from tall women visitors. Neither the intercepts nor the slopes of the coefficients of women's height dummies interacted with male profile's incomes were significant. This suggests that women's responsiveness to male incomes was not different across different heights of women.

TABLE 3: REGRESSION OF PERCENT OF WOMEN'S VISITS TO MALE PROFILES

	Percent visits per profile	
	(1)	(2)
Female visitors' height short dummy		-371.7**(138.7)
Female visitors' height medium dummy	371.7**(138.7)	
Female visitors' height tall dummy	564.6***(138.7)	192.9(138.7)
Male profiles' income	0.0543***(0.0125)	0.0602***(0.0125)
Male profiles' height	4.684***(1.141)	0.366(1.14)
Male profiles' height^2	-0.0135***(0.00332)	-0.0009(0.003)
(Male profiles' income) · (Female visitors' height short dummy)		-0.0059(0.0177)
(Male profiles' height) · (Female visitors' height short dummy)		4.318**(1.61)
(Male profiles' height)^2· (Female visitors' height short dummy)		-0.0125*(0.0047)
(Male profiles' income) · (Female visitors' height medium dummy)	0.00593(0.0177)	
(Male profiles' height) · (Female visitors' height medium dummy)	-4.318**(1.61)	
(Male profiles' height)^2 · (Female visitors' height medium dummy)	0.0125**(0.00469)	
(Male profiles' income) · (Female visitors' height tall dummy)	0.0284(0.0177)	0.0225(0.018)
(Male profiles' height) · (Female visitors' height tall dummy)	-6.56***(1.614)	-2.242(1.614)

(Male height)^2 · (Female visitors' height tall dummy)	0.0190***(0.00469)	0.0065(0.0047)
Constant	-406.8***(98.08)	-35.05(98.08)
R^2	0.22	0.22
P-value of F-stat	0.000	0.000
N	540	540

Notes: * $p<0.1$, ** $p<0.05$; *** $p<0.01$. Numbers in brackets are standard errors. We include three or more decimals when rounding might change interpretation of the numbers. Model (1) has short women visitors as the benchmark. Model (2) has medium women visitors as the benchmark.

The levels of the probability of visits from different heights are as we would have expected. The height that maximizes the percent of visits from short women is -406.8 + 0.0543 · Male income + 4.684 · Male height − 0.0135 · Male height^2. This has a peak at male profiles of 173.5 cm = -4.684/(-0.0135 · 2) height, which is 173.5-155 = 18.5 cm taller than the women themselves. Income here is in 1,000 CNY units. The peak for medium women is 11cm[9]. Tall women have no peak, but they have a trough at 13cm[10].

Table 4 also shows that the coefficient for the male profiles' incomes multiplied by the dummies for female heights are never significant. This suggests that women of different heights do not have different marginal utilities for mate income. Then, the marginal rates of substitution between mate height and mate income for these women would depend upon their coefficient for the male profile heights. Thus, the marginal rate of substitution for mate height and mate income is lower for short women than for medium women.

We can see this greater responsiveness of short women to our male profile's heights already in Figure 4. The slopes of the percent of visits for short women are always above that of the medium women for all income levels of the male profiles.

To more easily compare across women, we now normalize these changes in percentages of visits by dividing by the average change in percentages of visits per height

[9] The height that maximizes the percent of visits from medium women is (-406.8 + 371.7) + (0.0543 + 0.00593) · Male income + (4.684-4.318) · Male height + (-0.0135 + 0.0125) · Male height^2 = -35.1 + 0.06023 · Male income + 0.366 · Male height − 0.001 · Male height^2. This has a peak at male profiles of 183 cm = (-0.366)/(-0.001 · 2) height, which is 183 − 160 = 11 cm taller than the women themselves.

[10] Tall women have no male profile height which maximizes their percent of visits. The height that minimizes the percent of visits from tall women is (-406.8 + 564.6) + (0.0543 + 0.0284) · Male income + (4.684-6.560) · Male height + (-0.0135 + 0.0190) · Male height^2 = 97.14 + 0.0827 · Male income − 1.876 · Male height + 0.0055 · Male height^2. This has a trough at male profiles of 170.5 cm = -(-1.876)/(0.0055 · 2). Since they exhibited no maximum within the variation in our profile heights, we infer that they preferred men who were at least the difference between the maximal male height and their own height 178 − 165 = 13 cm above themselves.

of women. The rate at which each height of women is willing to trade-off male income for male height at the medium male height of 172 cm is in Table 4[11].

The average income of our male profiles is 28/3 = (4 + 9 + 15)/3 (in 1,000 CNY). The change in percent of visits (Δ% in Table 4) for an individual male profile's unit increase in income is 0.0543 for short women. Since there are 60 male profiles per income level, the change in the percent of visits for these women is 3.26 = 0.0543·60. The change in percent of visits per cm change in height for individual profiles is $4.684 - 2 \cdot 0.0135$, where 4.684 is the coefficient for height and the -0.0135 is the coefficient for height^2. Again, since there are 60 male profiles per income level, the change in percent of visits per cm change in height is $0.78 = [4.684 - 0.0135(2 \cdot (172 + 1))] \cdot 60$ when evaluated at the medium height of male profiles 172 + 1 cm.

The ratio of the change in percent of visits for short women is thus 0.186 = 3.26/[(7.27 + 20 + 25.45)/3], where 7.27, 20, and 25.45 are the percentages of visits for short women to 172 cm men who make 4, 9, and 15 (in 1,000 CNY), respectively. The ratio of the change in income is 1.73 = 0.186/[1/(28/3)]. The change in ratio of the change in percent of visit is then 0.04 = 0.78/[(7.27 + 20 + 25.45)/3]. Thus, the ratio of the percent change in the percent of visits over the ratio of the percent change in height is 6.88 = 0.04/(1/172). Then, the change in the percent of visits of short women for a one percent change in male profile height over the ratio of the change in the percent of visits for a one percent change in male profile income is 3.97= 6.88/1.73. We detail similar calculations for the medium and tall women in the Appendix.

[11] Normalizing divides each coefficient by a constant. Rescaling the coefficient amounts to rescaling the independent variable for which the coefficient was estimated. Hence, the significance of the coefficient is persevered.

TABLE 4: TRADE-OFF BETWEEN HEIGHT AND INCOME FOR WOMEN

	Regression coefficients for Δ% in visits for male profiles for			Total Δ% visit for 60 profiles per				
	Δincome	Δheight	Δheight^2	Δincome	cm Δheight at 172cm	$\frac{\text{Ratio Δ\% visits}}{\text{Ratio Δ\% income}}$	$\frac{\text{Ratio Δ\% visits}}{\text{Ratio Δheight at 172cm}}$	$\frac{\left(\frac{\Delta\%\text{visits}}{1\%\ \Delta\text{height}}\right)}{\left(\frac{\Delta\%\text{ visits}}{1\%\ \Delta\ \text{income}e}\right)}$
Short	0.0543***	4.68***	-0.0135***	3.26	0.78	$\frac{3.26}{\left(\frac{7.27+20+25.45}{3}\right)} = 0.186$ $\frac{0.186}{\left(\frac{1}{\left(\frac{28}{3}\right)}\right)} = 1.73$	$\frac{0.78}{\left(\frac{7.27+20+25.45}{3}\right)} = 0.04$ $\frac{0.04}{\left(\frac{1}{172}\right)} = 6.88$	$\frac{6.88}{1.73} = 3.97$
Medium	0.054 +0.0059 = 0.06	4.68*** -4.32** = 0.37	-0.0135*** +0.0125** = -0.001	3.61	0.36	$\frac{3.61}{\left(\frac{5+11.88+17.81}{3}\right)} = 0.31$ $\frac{0.31}{\left(\frac{1}{\left(\frac{28}{3}\right)}\right)} = 2.91$	$\frac{0.36}{\left(\frac{5+11.88+17.81}{3}\right)} = 0.031$ $\frac{0.031}{\left(\frac{1}{172}\right)} = 5.33$	$\frac{5.33}{2.91} = 1.83$
Tall	0.054 +0.028 = 0.082	4.68*** -6.56*** =-1.88	-0.0135*** +0.019*** =0.006	4.92	1.38	$\frac{4.92}{\left(\frac{12.99+12.34+0}{3}\right)} = 0.58$ $\frac{0.58}{\left(\frac{1}{\left(\frac{28}{3}\right)}\right)} = 5.41$	$\frac{1.38}{\left(\frac{12.99+12.34+0}{3}\right)} = 0.163$ $\frac{0.163}{\left(\frac{1}{172}\right)} = 28.04$	$\frac{28.04}{5.41} = 5.18$

Notes: * p<0.1, ** p<0.05; *** p<0.01. Δ% = change in percentage. Income in 1,000 CNY. We include three or more decimals when rounding might change interpretation of the numbers.

Discussion

We have shown that men and women prefer taller members of the opposite sex independently of income, education, and even beauty and health, at least as revealed through profile pictures. We confirm the findings of prior studies but rule out the possible confounds of omitted variables, endogeneity and simultaneity. Our findings contribute to growing motivation for the inclusion of height controls in matching studies that attempt to identify the effect of other match characteristics like income or education.

We have also shown that the marginal rate of substitution between short women's preference for mate height and mate income may be inversely related to their own height. This would suggest that one reason why Belot and Fidrmuc (2010) found a gender difference in the marriage rates of Chinese men and women of White women and men, respectively, could be due to Chinese women's possibly greater intensity of preference for height due to their relatively small stature, especially in Britain, the location of their population. Indeed, though British men and women are about 2 cm taller than men and

women in our study, the average height of the Chinese women in their study is 158 cm, 2 cm lower than the average height of women in our study.

Heterogeneity in preference for height could also be the reason why Weitzman and Conely (2014) found that short men contribute a greater share to household incomes. Those men could be married to shorter wives, who as our analysis in Table 5 suggest, may require a higher premium for shorter stature. Our finding suggests the intriguing possibility that mate height could be complementary for tall or medium individuals, but a substitute for short individuals, in particular for short women. Their preference for height conceivably could be related to their desire for children.

We found that height is highly correlated with incomes in China for both genders. This raw correlation between height and income is likely to contain other factors merely correlated with height, e.g., health or discrimination, and hence does not demonstrate the pure effect of height on income. However, the strength of this correlation could anticipate the importance of height to women, who might use height as an indicator of income trajectory or earning potential, as proposed by Herpin (2005).

As a comparison, Hitsch et al. (2010b) found with US online dating data, where they controlled for other factors like education, that a one inch increase in men's heights is related to a 1.4 percent increase in their earnings, while for women the corresponding is smaller (0.9 percent) and not statistically significant. We found with a simple regression with no other controls that a one cm increase in height was associated with an 8 percent increase in income for our male visitors and a 5 percent increase in income for our female visitors. Since each inch is 2.54 cm, a one inch increase in height for men would be associated with a 24 percent increase in income. A one inch increase in height for women would be associated with a 15 percent increase in income.

Our effect size must be larger than Hitsch et al. (2010b) in part because we have no controls and because the race of our visitors are fixed due to the fact that the populations of the cities in our study are almost entirely (above 96 percent) of the Han ethnicity. Thus, we measure the pure *association* of height with income, while Hitsch et al. (2010b) measure the *impact* of height and possibly ethnicity on income, controlling for other factors like education. Despite this, the ratio of the sizes of the effects across genders (24/15 = 1.6 vs theirs 1.4/0.9 = 1.6) are identical with theirs. The effect sizes we find are

in line with the estimates of Gao and Smyth's (2010) study of the association of height, wages, and human capital in China. They point out that height is an indicator of human capital and that the returns to human capital are higher in developing countries. We also note that height can also an indicator of rural or urban background (Zhang & Wang, 2011), which may also contribute to the height wage gap.

Hitsch et al. (2010b) also found that women prefer men who are taller than themselves, whereas men prefer women shorter than themselves. We found that women visited men who were 4.3-7 inches (11-18cm) taller than themselves the most while men visited women who were 2.8-5.1 inches (7-13cm) shorter than themselves the most. We can take these visit patterns for preferences because each gender visited the taller members of the other gender, who were fewer. They therefore faced a lower probability of getting a date with those members. Our findings of a higher intensity preference for height among short women complements Stulp, Buunk, and Pollet's (2013) and Stulp, Buunk, Kurzban, et al.'s (2013) finding of a more pronounced preference for height among women than among men.

One important limitation of our data is our tall women were shorter than our short men. We therefore cannot confirm Hitsch et al.'s (2010b) finding that men dis-prefer women who were taller than themselves, nor that women dis-prefer men who are shorter than themselves. We avoided using extreme heights among our profiles in order preserve the representative preferences that might be revealed through our treatments, while maximizing the sample sizes for those treatments.

It is possible that the users were not being truthful in their reports of their heights and incomes and that the gender differences that we found may reflect gender differences in truthfulness rather than gender differences in the correlation between heights and incomes. This possibility would not affect our finding that medium and tall men and tall and medium women similarly preferred the tallest members of the other gender. Short men and women must both be honest if height is desirable.

The correlation that we found between height and income would be exaggerated if those who would be most likely to lie about income are also more likely to lie about height. However, one would expect that misreporting would be along the lines of substitution between heights and income, which would make their correlation less

positive. We would also expect that men should have a greater rate of substitution between height and income if women cared more about those things. However, we find just the opposite; the correlation between height and income was greater for men than for women. In any case, our findings are of a similar magnitude to Gao and Smyth (2010) who used data from the China Urban Labor Survey.

Thus, the possibility of misreporting would seem to strengthen rather than weaken the significance of our positive correlation between heights and incomes, as well as, the gender difference in their correlations. Furthermore, it would be a remarkable coincidence for ratio of coefficients in the US and China to be the same by chance or by misreporting.

There was a question in previous studies (Ong & Wang, 2014) as to whether men on this website are actually interested in dating or were "just looking". We demonstrate here that men were attentive to the female profiles' heights, suggesting that they were interested in dating.

It is important to emphasize that though we identify *ex-ante* incentives that may influence dates, relationships, and marriages. We cannot rule out other preferences or strategic interaction effects dominating these *ex-ante* preferences *ex-post*. We do not have data on actual dates, relationships, or marriages. However, Hitsch et al. (2010a) do however also compare the match characteristics from the online dating data in Hitsch et al. (2010b) to actual marriage data. They found that preferences revealed in marriages were consistent with preferences revealed using first contact emails, but were more intense. In light of this, our findings would suggest that matching by height would be even more intense in marriages for tall and medium men and women. We would also predict, that short women might have lower income mates and larger dispersion in the heights of the men they marry.

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Appendix

For medium women, the change in percent of visits is 0.31 = 3.61/[(5 + 11.88 + 17.81)/3]. The change in percent of visits per cm change in height is [(4.68-4.32) + (-0.0135 + 0.0125) · (2 (172 + 1))] · 60 = (0.37 − 0.001· 364) · 60 = 0.36. Again, we want to normalize these changes. The ratio of the change in percent of visits is thus 0.11 = 1.261/[(5 + 11.88 + 17.81)/3], where 5, 11.88, and 17.81 are the percentages of visits of medium women to 172 cm men who make 4, 9, and 15 (in 1,000 CNY), respectively. The

ratio of the change in income is 2.91 = 0.31/[1/(28/3)]. The change in the ratio of the change percent in visit is then 0.11 = 2.91//[(5 + 11.88 + 17.81)/3]. The ratio of the percent change in visits over the ratio of the percent change in height is now 18.76 = 0.11/(1/172). Thus, the change in percent of visits of medium women for a one percent change in male profile height over the ratio of change in percent of visits for a one percent change in male profile income is 6.4 = 18.76/2.91.

For tall women, the change in percent of visits is 0.59 = 4.96/[(12.99 + 12.34 + 0)/3]. The change in percent of visits per cm change in height is [(4.68-6.56) + (-0.0135 + +0.019) · (2 (172 + 1))] ·60 = 1.38. Again, we want to normalize these changes. The ratio of the change in percent of visits is thus 0.163 = 1.38/[(12.99 + 12.34 + 0)/3], where 0, 12.99, and 12.34 are the percentages of visits for tall women to 172 cm men who make 4, 9, and 15 (in 1,000 CNY), respectively. The ratio of the change in income is 5.41 = 0.58/[1/(28/3)]. The change in the ratio of change of percent in visit is then 0.153 = 1.29/[(12.99 + 12.34 + 0)/3]. The ratio of the percent change in visits over the ratio of the percent change in height is now 28.04 = 0.163/(1/172). Thus, the change in percent of visits of tall women for a one percent change in male profile height over the ratio of change in percent of visits for a one percent change in male profile income is 5.18 = 28.04/5.41.