

Beauty Premium and Marriage Premium in a Search Equilibrium: Theory and Evidence

Roberto Bonilla, Francis Kiraly, John Wildman
Newcastle University, Newcastle upon Tyne, U.K.

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Abstract

We propose a new theoretical explanation for the existence of the so-called "beauty premium". Our explanation does not rely on labour market heterogeneity. It is based entirely on search frictions and the fact that physical appearance plays an important role in attracting a partner. We analyse the interaction between frictional labour and marriage markets and show the existence of a search equilibrium characterised by wage differentials, with attractive men earning higher wages than their less-attractive rivals. The equilibrium may also display the so-called marriage wage premium, predicted to be lower among more attractive men. The link between beauty premium and marriage wage premium provides a strong falsification test of the model. We carry out the empirical analysis and conclude that we cannot refute the validity of the theory.

1 Introduction

There is widespread evidence that employment outcomes - in particular, wages- are influenced by more than just productivity. Various authors have explored the effect of several seemingly unrelated factors (all linked to physical appearance) that might bias wages, and evidence suggests that beauty, height and - to some extent - weight seem to have an impact on earnings. In a pioneering study, Hamermesh and Biddle (2004) find a "plainness penalty" of 9% and a "beauty premium" of 5%. Persico, Postlewaite and Silverman (2004) attempt to quantify the so-called "height premium" and find that increasing height at age 16 by one inch increased adult wages by 2.6%, on average. In two fairly recent studies using UK data, Case and Paxson (2008) and Case, Paxson and Islam (2009) find that the height premium remains significant after controlling for educational attainment and sorting into higher status jobs. Interestingly, Herpin (2005) also finds that short men are less likely to be married or live in a permanent relationship than their taller counterparts. On the other hand, the impact of weight on male earnings is less clear. Several papers, including Morris (2005) have found no link between wages and weight/obesity. Hamermesh (2011) provides a stimulating up-to-date survey of the entire literature on beauty premium.

The present paper looks at the existence and determinants of male beauty premium and establishes a delicate theoretical link with the so-called marriage wage premium. In order to investigate the two phenomena, we expand the framework introduced in Bonilla and Kiraly (2013). The analysis is carried out in two parts.

First, we propose a new theoretical explanation of beauty premium based on an equilibrium search model of two inter-linked frictional markets: labour and marriage. Single men are heterogeneous in terms of their physical appearance (beauty, height, possibly weight): in the eyes of women, some men are more attractive than others. We model explicitly the job search process of single men who know that earnings (together with looks) determine whether or not they can form marriage partnerships with women. Crucially, although physical appearance may not affect mens' *options* in the labour market, it affects their *decisions* in that market. This is because their marriage prospects are influenced both by their looks *and* their wages. We show that there exists an equilibrium in which less attractive men find it optimal to accept jobs that pay lower wages than the wages of their more attractive rivals. The trade-off is straightforward and comes from the frictional nature of the labour market: although a less attractive man needs a high wage in order to attract a woman, such a well-paid job might just be too difficult to find, so he settles for a lower wage. As a consequence, there will be attractive single (and married) men earning high wages and less attractive single (or married) men on relatively low wages.

The strategies that give rise to the phenomenon of beauty premium are also behind the so-called marriage wage premium, whereby married men earn higher wages than their single rivals. We show that a positive beauty premium is only consistent with a situation where the marriage premium of less attractive men is positive (in which case it is also higher than that of the more attractive ones). Alternatively, a negative or zero beauty premium requires a zero marriage premium for attractive men. These results provide a straightforward way in which one could potentially falsify the theoretical model.

The second half of the paper is empirical. We explore the existence of beauty premium and marriage wage premium across different types of workers who differ in terms of attractiveness (height or weight). More importantly, we aim to test the validity of our theory. We carry out the relevant empirical test and conclude that the model is appropriate for the study of beauty premium and therefore its predictions are relevant.

Throughout our theoretical analysis, the focus is on the reservation wage decisions of male workers. This allows us to ignore the wage policies of firms and issues related to possible discrimination based on looks. We also sidestep the potential (and problematic) link between wages and productivity differences stemming from physical appearance. Overall, productivity heterogeneity plays no role whatsoever in establishing our results. The outcomes which display a beauty premium are a direct consequence of physical appearance and search frictions only. This is in stark contrast with previous explanations of the beauty premium, which are mainly based on some sort of un-measured productivity difference. The existing literature is based on the idea that certain characteristics (such as appearance) might affect job performance in ways that are not as easily measured or as obvious as other factors like education and work experience. For example, it is argued that appearance can affect confidence and communication, and hence productivity. Cawley (2004) finds that productivity is negatively correlated with weight, possibly because of factors such as health or self-esteem. Persico, Postlewaite and Silverman (2004) suggest that height increases the probability that teens participate in social activities (sports and clubs), and in turn these activities help them acquire productivity-enhancing skills. However, in contrast with these results, Hamermesh and Biddle (2004) found that the beauty premium exists even outside of jobs that involve frequent inter-personal contact and communication.

The paper is structured as follows. First, we present our model. Section 3 analyses the optimal search strategies of men and women. Section 4 looks at the search equilibrium characterised by beauty premium and contains the main theoretical results. Section 5 carries out the empirical test of the model. The final section concludes.

2 The model

The economy consists of women and men, all risk neutral. Assume a continuum of men (normalised to 1), and a measure n of single women. Time is continuous and all agents discount the future at discount rate r .

Men enter the economy unemployed and single. In the labour market, they face a range of posted wages that are distributed according to the exogenous cumulative distribution function $F(w)$ with support $[\underline{w}, \bar{w}]$.¹ In order to capture productivity homogeneity, we assume that men face exactly the same job prospects - here, the wage distribution F . Men use costless random sequential search to locate firms and contact occurs at rate λ_0 . An employed man has flow wage payoff w . There is no on-the-job search, so his wage remains constant throughout the working life.

Men are heterogeneous in terms of their physical appearance - a composite quality that captures beauty, height, weight, etc. Single men look for potential partners. In the marriage market, a man is viewed as *either* attractive (type H) *or* not-so-attractive (type L) by all women. A married man earning wage w enjoys flow payoff $w + y$, where $y > 0$ captures the non-material utility of marriage. There is no divorce so marriages are for life.

Women are single when they enter the economy and they don't look for jobs. Let x denote the flow payoff of a woman when single. This could also be interpreted as the net value of the difference between being single and being married.² Furthermore, the difference between x and y allows for possible asymmetries in how women and men, respectively, value the benefits of a partnership.³

Anticipating the type of equilibria we are interested in, we assume for now that women do not marry unemployed men.⁴

Women use costless random sequential search to locate single employed men. Let λ_w^i ($i = L, H$) be the rate at which a woman meets such a man. A married woman's flow payoff is equal to her partner's wage w plus a fixed flow payoff z_i , where $z_H > z_L$.⁵ It is important to note that women regard a man's wage and his looks as substitute goods. Physical appearance, together

¹One could of course construct an endogenous wage dispersion in a wage posting game where workers have equal productivities.

²Alternatively, x could capture women's options in the labour market.

³For empirical evidence that, on average, men don't seem to care much about women's wages, see Gould and Paserman (2003).

⁴This will be shown to be true later.

⁵Note that upon marriage, a woman gives up x so we assume that $x < \bar{w}$, as otherwise there would be no potential surplus from marriage.

with wage earnings, determine whether or not a single man is accepted by a woman.

Given sequential search and the fact that utilities are increasing in wages, both men and women use optimal strategies characterised by the reservation value property. Denote these reservation values by R_i and T_i , respectively.

Singles and couples alike leave the economy at an exogenous rate δ and we only consider steady states. Every time an unemployed man of type i accepts a job or leaves the economy, he is replaced by another type i unemployed. This means that the fraction of unemployed men of each type (u_i) can be treated as exogenous. Let N_i denote the number of *marriageable* employed single men of type i and let λ_w^i be the rate at which a woman meets such an eligible bachelor. We assume a quadratic matching function with parameter λ that measures the efficiency of the matching process. Then, $\lambda_w^i = \frac{\lambda(N_H+N_L)n}{n} \frac{N_i}{(N_H+N_L)} = \lambda N_i$. Similarly, assume a new single woman comes into the market every time a single woman gets married or exits the economy. This means that n can be regarded as exogenous and, with quadratic matching, we have $\lambda_m = \frac{\lambda(N_H+N_L)n}{(N_H+N_L)} = \lambda n$. Both N_i and λ_w^i are of course endogenous.

3 Steady state and optimal search

3.1 Steady state:

Marriageable men of type i get married at rate λn and die at rate δ , while unemployed men find marriageable wages at rate $\lambda_0 [1 - F(T_i)]$. The steady-state equation is therefore

$$N_i(\lambda n + \delta) = u_i \lambda_0 [1 - F(T_i)]$$

From here,

$$\lambda N_i = \frac{\lambda u_i \lambda_0 [1 - F(T_i)]}{\lambda n + \delta} (= \lambda_w^i) \quad (1)$$

Before we discuss the optimal behaviour of women and men, it is helpful to note that the distribution of *earned* wages across marriageable employed men of type i is given by $G_i(w) = \frac{F(w)}{1 - F(T_i)}$.

3.2 Women:

Sequential search in the marriage market implies that the optimal strategy has the reservation *value* property. But, since wages and looks are substitutes, and since women regard men as either attractive or not-so-attractive, they use a reservation *wage* strategy $T_i(z_i)$ in the marriage market, rejecting men of type i who earn wage $w < T_i(z_i)$. The key observation is that since the flow utility for a married woman is $w + z_i$, women have a *unique* threshold reservation value that can be fulfilled *differently* by the two types of men. In other words, even a less attractive man can get married as long as he earns enough (a wage higher than his attractive rival). Of course, whether he does that or not will depend on the wages he encounters and chooses to accept.

The *expected* value of being a single woman is denoted by $W^S(w)$. Using (1), standard derivations lead to the following Bellman equation:

$$(r + \delta)W^S(w) = x + \frac{\lambda u_H \lambda_0 [1 - F(T_H)]}{\lambda n + \delta} \int_{T_H}^{\bar{w}} \max \{W_H^M(w) - W^S, 0\} dG_H(w) + \frac{\lambda u_L \lambda_0 [1 - F(T_L)]}{\lambda n + \delta} \int_{T_L}^{\bar{w}} \max \{W_L^M(w) - W^S, 0\} dG_L(w)$$

In the above, $W_i^M(w) = \frac{w+z_i}{r+\delta}$ is the value of being married to an attractive/less attractive man and the equation has a straightforward intuitive interpretation.

Alternatively, using $G_i(w) = \frac{F(w)}{1-F(T_i)}$, we obtain

$$(r + \delta)W^S(w) = x + \frac{\lambda u_H \lambda_0}{(\lambda n + \delta)} \int_{T_H}^{\bar{w}} \max \{W_H^M(w) - W^S, 0\} dF_H(w) + \frac{\lambda u_L \lambda_0}{(\lambda n + \delta)} \int_{T_L}^{\bar{w}} \max \{W_L^M(w) - W^S, 0\} dF_L(w)$$

Lemma 1 $T_H < T_L$.

Proof. By the definition of the reservation value, $(r+\delta)W^S(w) = T_H + z_H = T_L + z_L$. From here, it is clear that $T_H < T_L$ for $z_H > z_L$. ■

Please note that for a woman, the expected value of being single is in fact independent of men's search strategy. This is essentially because wages are exogenous. Firstly, men's search behaviour does not affect the minimum wage in the exogenous distribution $F(\cdot)$. Secondly, men's search behaviour does not affect the rate at which they find marriageable wages either. In turn, from (1) one can see that the measure of marriageable men N_i is independent of R_i .

3.3 Men:

Sequential search and the fact that utilities are increasing in wages imply that the optimal strategy has the reservation *wage* property. Given that an unemployed man faces a wage distribution $F(w)$ and a reservation wage T which makes him acceptable for marriage, he uses a reservation wage *function* $R(T)$. As both L and H type men face the *same* wage distribution, their reservation functions are identical: $R_L(T) = R_H(T) \equiv R(T)$.

Crucially however, the optimal reservation *wages* will of course be different: $R_i = R(T_i)$.

In what follows, we fully characterise the function $R(T)$. Let \underline{R} denote the reservation wage of men in a pure labour market equilibrium when there is no marriage market. Then, \underline{R} is defined as the (unique) solution to

$$\underline{R} = \frac{\lambda_0}{r + \delta} \int_{\underline{R}}^{\bar{w}} [1 - F(w)] dw.$$

We show later that this is the lowest reservation wage in any equilibrium.

Next, we look at the reservation wage function $R(T)$ when the marriage market does have an effect (through T) on the optimal job search.

Define \hat{T} as the threshold wage for which $R(T)$ attains its maximum level. We will show that

$$\hat{T} = \frac{\lambda_0}{r + \delta} \left[\int_{\hat{T}}^{\bar{w}} [1 - F(w)] + \frac{\lambda n [1 - F(\hat{T})]}{r + \delta + \lambda n} y \right]. \quad (2)$$

Clearly, $\hat{T} > \underline{R}$ for $y > 0$ and $F(\hat{T}) < 1$.

Overall, a man (of either type) can be in one of three states: unemployed, employed at wage w and single (S), or employed at wage w and married (M). For any T , denote his value of being unemployed by U , and let $V^S(w, T)$ describe the value of being single and earning a wage w .

Standard derivations lead to the Bellman equation for an unemployed man:

$$(r + \delta)U = \lambda_0 \int_w^{\bar{w}} \max [V^S(w, T) - U] dF(w)$$

Anticipating that $V^S(w, T)$ is not a continuous function (see below), we can define

$$R(T) = \min \{w : V^S(w, T) \geq U\}$$

Since there is no divorce, the value of being married and earning a wage w is $V^M(w) = \frac{w+y}{r+\delta}$. Hence, for any T , we have

$$V^S = \left\{ \begin{array}{ll} \frac{w}{r+\delta} & \text{if } w < T \\ \frac{w}{r+\delta} + \frac{\lambda n}{(r+\delta+\lambda n)(r+\delta)} y & \text{if } w \geq T \end{array} \right\}$$

There are a number of possible cases, and we examine them in turn. In the process, we establish that the reservation wage function is non-monotonic.

(a) The case with $\bar{w} > T \geq \hat{T}$.

Assume for a moment that $R(T) < T$, meaning that the reservation wage chosen by men is too low and therefore the unlucky men who find wages lower than T cannot get married. Then, $R(T)$ is given by

$$R(T) = \frac{\lambda_0}{r+\delta} \int_{R(T)}^{\bar{w}} [1 - F(w)] dw + \frac{\lambda_0 \lambda n [1 - F(T)]}{(r+\delta)(r+\lambda n+\delta)} y \quad (3)$$

From the above, $R(\hat{T}) = \hat{T}$, where \hat{T} as defined in (2). Call this reservation wage \hat{R} . Also note that when $T = \bar{w}$, we have $R(T) = \underline{R}$ (since $F(\bar{w}) = 1$). It is easy to show that $\hat{T} < \bar{w}$, and $R(T)$ is decreasing in T .

By being ready to accept a wage lower than the threshold required by women, a single man risks throwing away the prospect of marriage. In our model, this happens purely because of search frictions and what we might call the "bird in hand effect". Here, a job offer is deemed acceptable by a single man even if it precludes marriage: the wage may be slightly less than the (relatively high) threshold set by women, but it is still high enough not to risk holding out for an even higher offer. For even more demanding threshold wages required by women, the likelihood of encountering such high wages decreases further, and with it the reservation wage of men.

Please note that if $R(T)$ is less than T , then $U < \frac{T}{r+\delta}$. This follows simply from the definition of a reservation wage, whereby $U = V_i^S(w, T) = \frac{R(T)}{r+\delta}$. Note that $R(T) \leq T$ for $T \geq \hat{T}$. Hence, for $T < \hat{T}$, the reservation function as derived above does not survive as an optimal strategy.

(b) The case with $\underline{R} < T < \hat{T}$.

In this range, as long as y is positive, it is clearly never optimal to ignore the marriage market. At the same time one can show that $R(T) > T$ is never a best response whenever $T > \underline{R}$. The logic is as follows. Assume $\underline{R} < T$. If men have an incentive to increase the reservation wage above \underline{R} , that can only be if they would like to get married. As T is the wage that makes one marriageable, there is never any incentive to increase the reservation wage above this T . As a consequence, for the above range we can restrict attention to the case with $R(T) = T$. Here, the marriage threshold wage is relatively low, and hence the prospects of landing a job that matches it are good enough so that men hold out for such a wage.

Once again, from the definition of the reservation wage, $U = V_i^S(w, T) = \frac{R(T)}{r+\delta}$. Since for $R(T) < T$ we had $U < \frac{T}{r+\delta}$, now it must be the case that $U \geq \frac{T}{r+\delta}$. This is because now $U < V_i^S(w, T)$, which is a result of the fact that R does not solve $U = V_i^S(R, T)$. As a consequence, men will use a reservation wage strategy $R(T) = T$ if and only if

$$\frac{T}{r+\delta} \leq U \leq \frac{T}{r+\delta} + \frac{\lambda n [1 - F(T)]}{(r+\delta)(r+\lambda n+\delta)} y = V_i^S(T)$$

Please note that in both these cases (a) and (b), unemployed men cannot get married - just as we assumed at the very beginning. To show this is true, consider what happens if women do marry unemployed men. Without divorce, a married unemployed man will choose \underline{R} : he can safely ignore the marriage market as he will never go back to it. In other words, men cannot credibly commit to a high reservation wage. Such a promise becomes empty as soon as they tie the knot. With no divorce, women optimally choose to reject single unemployed men.

(c) The case with $T > \bar{w}$ or $T < \underline{R}$.

When $T > \bar{w}$ we have $1 - F(T) = 0$, and therefore no man can ever get married (as the highest available wage is \bar{w}). Men optimally set $R(T) = \underline{R}$. On the other hand, when $T < \underline{R}$, so women accept everybody, men need not worry about the marriage market and so they once again set $R = \underline{R}$. In this case the unemployed are also able to get married.

The optimal reservation wage strategy of men is illustrated in Figure 1. The diagram captures the fact that the best response function is non-monotonic.

For relatively low values of T men find it optimal to hold out for wages that match this constraint. However, for relatively high values of T , men will accept wages that preclude marriage. Such (relatively high) wages will now be preferred to continued search for an increasingly unlikely marriageable wage.

It is important to note that even for a very high (but finite) y , as long as there are search frictions in the labour market, there will always be a range of T 's such that optimal $R(T) < T$ and $\frac{\partial R(T)}{\partial T} < 0$. Recall that in this economy, before they can think of marriage, single men need to find a job first. Then, unless they have a "lexicographic" preference for marriage, the downward-sloping branch of their reservation wage function always exists.

This result is summarised in the following Lemma.

Lemma 2 *Given $\lambda_0 < \infty$, for any $y < \infty$, we have $\widehat{R} < \bar{w}$.*

Proof. *First, if there are no frictions in the labour market ($\lambda_0 \rightarrow \infty$), then $R(T) = \bar{w}$ and hence the $R < T$ region disappears. Second, recall that $R(\widehat{T}) = \widehat{T} = \widehat{R}$ and \widehat{T} is a function of y . Then,*

$$y = \frac{(r + \delta + \lambda) \left\{ (r + \delta)\widehat{T} - \lambda_0 \int_{\widehat{T}}^{\bar{w}} [1 - F(w)] dw \right\}}{\lambda_0 \lambda [F(\widehat{T}) - 1]}.$$

Then, $\lim_{\widehat{T} \rightarrow \bar{w}} y = \infty$ (since the limit of the numerator is a positive constant, while the limit of the denominator is zero). As \widehat{T} is an invertible function, it follows that $\lim_{y \rightarrow \infty} \widehat{T} = \bar{w}$. ■

Furthermore, please note that, since $\frac{\partial F(\widehat{T})}{\partial \widehat{T}} > 0$, we have

$$\frac{\partial \widehat{T}}{\partial y} = \frac{\lambda_0 \lambda [1 - F(\widehat{T})]}{(r + \delta + \lambda) \left\{ r + \delta + \lambda_0 [1 - F(\widehat{T})] \right\} + \lambda_0 \lambda \frac{\partial F(\widehat{T})}{\partial \widehat{T}} y} > 0$$

As one would expect, the higher the non-material utility of a partnership, the smaller the range of T 's for which men accept wages that preclude marriage.

4 Equilibrium

Our main focus is on a search equilibrium characterised by beauty premium, where attractive men earn higher wages than the less-attractive ones. In the context of our model, this means that the H type men set a higher reservation wage than the L type men. Whether or not both types choose reservation wages that may jeopardise their marriage prospects also plays a key role.

From the above, it is apparent that in such an equilibrium the strategies that give rise to the phenomenon of beauty premium are also behind the so-called marriage wage premium, whereby married men earn higher wages than their single rivals. In this section we also explore in detail the delicate link between the two types of premia (including the possibility of a negative beauty premium).

4.1 Definition of search equilibrium:

A search equilibrium with $R_i \leq T_i$ is a system $\{G_i(\cdot), R_i, T_i, N_i, u_i\}$ satisfying the following:

- (i) The distribution of wages earned by marriageable men of type i is

$$G_i(w) = \frac{F(w)}{1 - F(T_i)};$$

- (ii) Men's reservation wage R_i solves

$$R(T_i) = \frac{\lambda_0}{r + \delta} \int_{R_i(T_i)}^{\bar{w}} [1 - F(w)] dw + \frac{\lambda_0 \lambda n [1 - F(T_i)]}{(r + \delta)(r + \lambda n + \delta)} y \quad (< T_i)$$

for $\hat{T} < T < \bar{w}$, and

$$R(T_i) = T_i$$

for $\underline{R} < T < \hat{T}$.

- (iii) Women's reservation match satisfies

$$T_i + z_i = (r + \delta)W^S(w)$$

where $W^S(w)$ as defined.

- (iv) Steady state turnover conditions $N_i(\lambda_m + \delta) = u_i \lambda_0 [1 - F(T_i)]$.

4.2 Equilibrium with beauty premium

In a search equilibrium characterised by beauty premium the reservation wage of H type men is higher than the reservation wage of the L type men: $R_H > R_L$. As a consequence, in this equilibrium the average wage of H men is also higher than the average wage of L men.

In a search equilibrium with marriage wage premium for type i men, the reservation wage of these men is lower than the reservation wage of women: $R_i < T_i$. This in turn means that the average wage of married type i men is higher than the average wage of single type i men. Also note that the marriage wage premium for i type men increases with $T_i - R_i$.

The following Theorem provides sufficient conditions for the existence of a search equilibrium with beauty premium, and also characterises the marriage wage premia for the two types of men.

Theorem 3 (a) *There always exists a search equilibrium characterised by beauty premium.* (b) *The marriage wage premium of L type men is higher than that of H type men iff the former is positive.*

Proof. *We have described women's reservation match strategy and have established that it is independent of R_i . It is easy to show that $\frac{\partial T_i}{\partial x} > 0$. We have also fully characterised men's optimal reservation wage strategy $R(T)$ and we have shown that it is continuous. Furthermore, by Lemma 2, $R(T)$ is always non-monotonic in T .*

Without loss of generality, assume that $z_L = 0$ and $z = z_H (> 0)$. Let the combination (x, z) be such $T_H = \hat{T}$. Then, by Lemma 1, $T_L > \hat{T}$. Fix $z < \bar{w} - \hat{T}$ so that $T_L (= T_H + z) < \bar{w}$.

Firstly, consider a small increase in x and hence in T_i . Then, $T_L > T_H > \hat{T}$. Using similar continuity arguments, an equilibrium results in $R_H > R_L$, $R_H < T_H$, $R_L < T_L$. Also, $T_H - R_H < T_L - R_L$, so the marriage wage premium of L types is higher than that of H types (which in turn is positive). Now consider a small decrease in z . From $T_L = T_H + z = (r + \delta)W^S(w)$, it is easy to show that $\frac{\partial T_H}{\partial z} < 0$ and $\frac{\partial T_L}{\partial z} > 0$. Then, T_L decreases, T_H increases, and the resulting equilibrium has the same properties as before.

Secondly, consider a small decrease in x , so that T_H becomes lower than $\hat{T} (< T_L)$. Using continuity arguments, an equilibrium results in which $R_H = T_H$, so the marriage wage premium of H types is zero, and $R_L < T_L$, so the marriage wage premium of L types is positive. Once again, $R_H > R_L$. Alternatively, consider a small increase in z . Then, T_L increases, T_H decreases, and the resulting equilibrium outcome has the same characteristics as above. ■

Figure 1 illustrates all the above.

FIGURE 1 (please see at the end of paper)

Theorem 3 is not exhaustive. Indeed, from Figure 1 above, it is easy to see that one can isolate different sets of sufficient conditions (in terms of x and z) for the existence of other equilibria. For example, if the combination of (x, z) is so high that $T_L > \bar{w}$ and $\hat{T} < T_H < \bar{w}$, there is an equilibrium with a positive beauty premium in which the L type men never marry. On the other hand, if the combination of (x, z) is such that both T_L and T_H belong to (\underline{R}, \hat{T}) , the equilibrium displays a *negative* beauty premium.

The following two results establish the delicate relationship between the two types of premia as it emerges from our analysis of the inter-linked frictional markets.

Corollary 4 *A positive beauty premium exists only if the marriage wage premium for L type men is positive.*

Proof. *By contraposition. A positive marriage wage premium for L types requires $\bar{w} > T_L > \hat{T}$. If instead T_L was lower than \hat{T} (but higher than \underline{R}), then we would have the following: $R_L = T_L$, $T_H < \hat{T}$ (and hence $R_H = T_H$ if $T_H > \underline{R}$, or $R_H = \underline{R}$ if $T_H < \underline{R}$). As a consequence, we would have $R_H < R_L$. ■*

Corollary 5 *A negative or zero beauty premium exists only if the marriage wage premium for H type men is zero.*

Proof. *By contraposition. A zero marriage wage premium for H types requires $\underline{R} < T_H < \hat{T}$. If instead T_H was higher than \hat{T} (but lower than \bar{w}), then we would have $R_L < R_H$ (since $T_L > T_H$). ■*

The results above provide clear and unambiguous links between beauty- and marriage wage premia. Given this, observed measures of these two types of premia not only help with empirical estimations, but also provide a very strong validity test of the theoretical model itself.

5 Beauty premium and marriage wage premium - an empirical investigation

In this section we carry out a very strict empirical falsification test of our theory. By making the link between the two types of premia clear, Corollaries 4 and 5 implicitly point to how one could potentially refute our model. In particular, if we were to find a statistically significant positive effect of beauty on wages but no marriage wage premium across L type workers, our theory would not be appropriate in explaining the existence of beauty premium. By the same token, if we observed a zero or negative beauty premium but a positive marriage wage premium for attractive men, the model would be once again refuted.

With this in mind, our empirical investigation is structured as follows. In order to match the assumptions of the model, we need relevant proxies for beauty. We use measures of height and weight. Height is possibly better suited for our purposes as it is time-invariant, whereas weight isn't.⁶ First, we look to find and measure the extent of beauty premium in our sample. Then, we check for the existence and significance of marriage wage premium among different groups of men.

Our results show that when we use height as a measure of attractiveness, both the beauty premium and the relevant marriage wage premium exist, in line with Corollary 4. Further comparison across types also confirms the prediction that the marriage wage premium for attractive (tall) men is lower than that of less attractive (shorter) men.

When we use weight as a proxy for beauty, our results are consistent with Corollary 5. We observe a zero beauty premium together with a positive marriage premium for the less attractive (obese) men and a zero marriage premium for the attractive (non-obese) men.

5.1 Data

We use data from the British Household Panel Survey (BHPS) from Great Britain. The BHPS is a longitudinal panel survey that was first collected in 1991, with the last wave collected in 2008.⁷ Initially the BHPS interviewed 5,000 households, providing around 10,000 interviews. The same

⁶Furthermore, individuals with very low or very high weight (in absolute terms or relative to a given height) may be penalised in the labour market, while individuals of normal weight are not.

⁷The BHPS respondents have subsequently been included in the Understanding Society longitudinal study that is currently three waves old. BHPS respondents were not included in the first wave and the attrition has been particularly high.

individuals are interviewed each year, and if individuals split off from their original household into a new household then the other members of the new household are also interviewed. The data is supplemented by extra samples covering geographical areas of Great Britain. The BHPS includes rich information on income and socio-economic status, making it ideal for estimating wage equations.

To classify individual physical attractiveness we use data on height (all waves) and weight as measured by body mass index BMI (from waves 14 in 2004 and 16 in 2006). Only waves 14 and 16 collected data on both BMI and height, but we treat height as time invariant. Hence, when classifying individuals by height we are able to use the height measurements for each individual in waves 14 and 16 and apply those heights to all waves in which the individuals appear, providing a much larger sample size. Heights and weights were measured in either metric or imperial units. However, for this paper all measures were converted to metric units.

For all the empirical models below the dependent variable is the log of hourly wages. While this variable does not occur within the BHPS it is possible to construct it using hours normally worked per month, and usual monthly take-home pay. We only include men in employment, removing those in self-employment or out of the labour force. Our focus is on men who are either married or have not yet married.

Initially, individuals are classified as "not tall" if their height of 1.70 metres or less. The average height of our estimation sample is 1.78 metres, which is approximately average height for men in Great Britain. The bottom 10% is 1.70 metres tall or less. To check for robustness we alter the threshold height of "not tall" to include taller individuals and then repeat the empirical exercise.

For BMI again we split the sample into two groups: "obese" (BMI greater than or equal to 30) and "not obese" (BMI below 30).⁸ For the sample in 2004 the average BMI was 26.51 and by 2006 it had increased to 26.8.

We focus on men aged between 20-50, where we believe the marriage premium will be most relevant, although we investigate the impact of using different age groups as well. As other regressors we include controls for education, number of children, household size, self-reported health (potentially another source of productivity), a regional dummy, year dummies and a range of job specific factors such as: experience, part-time vs full-time

⁸There are potential difficulties in how to classify individuals with very low BMI, whether they are they attractive or not. For our models we removed individuals who are considered to be 'underweight' (BMI of less than 18.5).

dummy, a dummy identifying sector of employment, social class occupational classification, number of employees at place of work and markers of union status, and whether there is a union at the place of work. We only report results for the dummy indicating married or not, all other variables are included as controls and the results are available on request.

After the deletion of missing values on variables we are left with 1767 individuals (11,463 observations) for the height regressions and 1763 individuals (2498 observations) for the weight regressions. The summary statistics for the samples are given in Table 1 below:

TABLE 1 Summary Statistics

Variable	Obs (N*T)	Mean	Std. Dev.	Obs (N*T)	Mean	Std. Dev.
Height sample			BMI sample			
Log hourly wage	11370	-2.896	0.490	2498	-2.866	0.490
Married	11370	0.622	0.485	2498	0.557	0.497
Age	11370	34.451	7.782	2498	35.893	8.684
Household size	11370	3.276	1.324	2498	3.206	1.407
Number of children	11370	0.926	1.070	2498	0.825	1.041
Excellent health	11370	0.333	0.471	2498	0.327	0.469
Good health	11370	0.488	0.473	2498	0.499	0.500
Fair health	11370	0.146	0.354	2498	0.141	0.348
Poor health	11370	0.030	0.169	2498	0.030	0.172
Very poor health	11370	0.003	0.056	2498	0.003	0.057
London region	11370	0.053	0.224	2498	0.043	0.203
Job sector	11370	0.826	0.380	2498	0.845	0.362
Job part-time	11370	0.022	0.147	2498	0.027	0.162
Social class 1	11370	0.080	0.271	2498	0.069	0.254
Social class 2	11370	0.337	0.473	2498	0.356	0.479
Social class 3	11370	0.158	0.364	2498	0.160	0.366
Social class 4	11370	0.263	0.440	2498	0.253	0.435
Social class 5	11370	0.132	0.338	2498	0.131	0.337
Social class 6	11370	0.032	0.175	2498	0.031	0.174
Experience (days)	11370	1723.571	2038.133	2498	1828.580	2199.623
Union member	11370	0.434	0.496	2498	0.436	0.496
Union at workplace	11370	0.647	0.478	2498	0.669	0.471
Height (metric)	11370	1.784	0.072			
Body Mass Index				2498	26.626	4.454

Looking at our samples grouped by height and by BMI, one can identify distinct differences in the characteristics of individuals. Table 2 below summarises this.

TABLE 2 Summary Statistics by Group

Variable	Tall			Not Obese		
	Obs	Mean	Std. Dev.	Obs	Mean	Std. Dev.
Log hourly wage	10374	-2.885	0.491	2041	-2.879	0.496
Married	10374	0.619	0.486	2041	0.530	0.499
Age	10374	34.398	7.797	2041	35.294	8.810
Excellent health	10374	0.337	0.473	2041	0.344	0.475
Good health	10374	0.487	0.500	2041	0.497	0.500
Fair health	10374	0.142	0.349	2041	0.125	0.331
Poor health	10374	0.030	0.170	2041	0.030	0.172
Very poor health	10374	0.003	0.056	2041	0.004	0.062
Height (metric)	10374	1.797	0.060			
BMI				2041	25.066	2.673
	Not tall			Obese		
Log hourly wage	996	-3.005	0.464	457	-2.807	0.456
Married	996	0.652	0.477	457	0.676	0.468
Age	996	34.995	7.604	457	38.565	7.548
Excellent health	996	0.292	0.455	457	0.249	0.433
Good health	996	0.488	0.500	457	0.510	0.500
Fair health	996	0.190	0.392	457	0.210	0.408
Poor health	996	0.028	0.165	457	0.031	0.173
Very poor health	996	0.003	0.055	457	0.000	0.000
Height (metric)	996	1.650	0.037			
BMI				457	33.595	4.135

From the table we can see that the two "attractive" groups (the tall and the not obese) are, on average, younger and more likely to report excellent health than individuals in the "not attractive" groups. The average height for the "tall" group is nearly 1.80 metres.

Tall individuals earn, on average, more than those who are not tall. On the other hand, the average wage for the obese and not obese are quite similar. However, the latter may be due to the fact that the obese are typically older than the not obese men.

There are interesting differences in the proportion of married men. When comparing tall with not-tall the proportion of married men is quite similar at around 62% and 65%. However, there are larger differences in the proportion of married men when they are categorised by weight: 53% of not-obese men are married, compared to 68% of obese men. Again, this may be the effect of age.

5.2 Empirical results for beauty premium

In this section, we examine the wage differentials observed in our data. Our results show a significant and robust positive height premium.⁹ On the other hand, the sign of the non-obesity premium depends on the specification of our model. Nonetheless, in general it is found to be quite small in magnitude and not significant. Given the afore-mentioned shortcomings of weight as a proxy for attractiveness, this is not surprising.

Using our sample (men aged 20-50)¹⁰ we estimate models that are similar to the ones in Case et al. (2009). Our dependent variable is the log of wages and on the right-hand side we include measures of height and weight, together with controls for age, region of residence, race, education and year dummies. For height we estimate pooled OLS models because height is time-invariant. For weight we estimate both pooled OLS and fixed effect models. Robust standard errors, clustered on the individual, are estimated in each case.

The results are shown in Table 3 below:

TABLE 3 Effect of Height and Weight on Wages

		n		Coefficient	Std. Err.
Height, metres Model 1	OLS	11,370	Height, metres	0.4256***	0.1424
Weight, KGs Model 2	OLS	2,551	Weight, KGs	0.0016***	0.0006
Model 3	OLS	2,551	Weight, KGs	0.0009	0.0007
			Height, metres	0.3719**	0.1641
Model 4	Fixed Effects	2,551	Weight, KGs	-0.0003	0.0011

*, **, ***: 10%, 5% and 1% level of significance

The dependent variable in all models is log monthly wages.

All models include controls for age, region of residence, race, education and year dummies.

Data on weight is only collected in waves 14 and 16 meaning that the sample sizes are lower.

⁹This results is similar to Case et al. (2009) who obtain, using the BHPS (waves 1996-2005), a wage premium for height for individuals aged between 21 and 60.

¹⁰We also estimate the models with men aged 20-40 and 20-60 and we find similar results.

Model 1 shows a clear and significant premium for height.¹¹ For weight we estimate three separate models. Model 2 finds that increasing weight significantly increases wages, and therefore suggests a weight premium. However, once we use the augmented Model 3 that includes height as well as weight, the estimate on weight halves and becomes insignificant, while the height premium remains. Finally, Model 4 is estimated using fixed effects and in this case the impact of increases in weight is negative, although not significant.

Given that the coefficient for height was found to be significant, results consistent with Corollary 4 would have a positive observed marriage wage premium for not tall individuals and a lower marriage wage premium (possibly zero) for tall individuals. That is, a zero observed marriage premium for the shorter men would refute the theoretical model. Similarly, given the non-significant effect of weight on wages, if we then observe a zero marriage premium for the not obese men, that would in turn support Corollary 5. Hence, a positive observed marriage premium for this group of men would invalidate our theory. We carry out these checks in the section below.

5.3 Empirical results for marriage wage premium

In order to estimate the marriage wage premium it is important to control for unobservable heterogeneity. Here, it is particularly important that we control for productivity. This is because productivity homogeneity was a crucial implicit assumption of our theoretical model. We control for productivity differences by including education as a regressor and using fixed effects estimation.

The basic regression equation is therefore:

$$\ln(w_{it}) = \beta M_{it} + \gamma' X_{it} + \alpha_i + \varepsilon_{it},$$

where the dependent variable is the log of hourly wages, X_{it} is a matrix of controls, α_i captures the individual's specific time-invariant heterogeneity, M_{it} is an indicator of an individual's marital status and ε_{it} is the standard idiosyncratic error term. In this case the coefficient of interest is β as this provides the estimate of the marriage premium.

Estimating this regression using pooled OLS assumes that α_i is zero, especially in our case where there are no productivity differences between

¹¹The estimated coefficient is different to that found in Case et al. (2009) because we use a larger sample and measure height in metres and centimetres rather than inches.

individuals. It may be possible to control for potential productivity effects by including measures of education in the matrix of controls X_{it} . However, this may not completely ameliorate the problem of unobservable heterogeneity. Fixed effects estimation involves a within-individual transformation of the data that sweeps out the fixed effects and is the standard model for estimating marriage wage premium.¹²

First, we estimate the OLS model that includes education dummies as extra regressors. Table 4 below presents the regression results.

TABLE 4 Effect of Marital Status on Wages

Results		Not tall	Tall	Not tall	Tall
AGE 20-50		(<1.70m)		(<1.75m)	
OLS (including education)	married	0.102**	0.193***	0.179***	0.187***
		(0.061)	(0.023)	(0.038)	(0.027)
Fixed Effects	married	0.557***	0.010	0.187*	0.020
		(0.101)	(0.035)	(0.113)	(0.043)
N		996	10374	3138	8232
		Obese	Not obese		
OLS (including education)	married	0.123**	0.140***		
		(0.055)	(0.029)		
Fixed Effects	married	0.445*	-0.018		
		(0.235)	(0.115)		
N		457	2041		

*, **, ***: 10%, 5% and 1% level of significance

The models all show the estimates attached to the 'Married' variable. All models include a full range of controls: age, health, number of kids, household size, job sector, size of employer, job part-time, experience, union membership, whether there is a union at place of work and experience. The education dummies are degrees, higher school leaving qualifications (aged 18 A-levels or equivalents), lower school lever qualifications (aged 16 O-Level or equivalents) and no qualifications. Clustered standard errors are presented in brackets. Full results are available on request.

The pooled OLS height result show that the estimated marriage premium is positive and larger for men classified as 'tall' than for 'not tall' men. This would contradict the predictions of our model, but it may well be simply due to the fact that the OLS does not account for unobserved heterogeneity.

To overcome this problem, we estimate using fixed effects. The estimates for marriage wage premium are again positive. However, this time the relationship is reversed. The coefficient for the "tall" (above 1.70m) group is

¹²See Cornwell and Rupert (1995).

close to zero and insignificant, whereas the estimate for the "not tall" (less than 1.70m) group is positive, large and significant. This result is in line with the Theorem (part b) and - given the positive height premium - with Corollary 4.

When we relax the threshold to 1.75m the estimated marriage premium for the "not tall" group is now positive (but lower), and almost significant at the 10% level, whereas the corresponding estimate for the "tall" group is still close to zero (but higher) and insignificant. This again is in line with the predictions of the theoretical model. As some men - previously categorised as "tall"- move into the "not tall" group, their effect is to decrease the marriage premium of this group.

Next, we turn our attention to the effect of weight on wages. Once again, the pooled OLS yields a larger wage premium for the attractive ("not obese") group. As before, in order to overcome the shortcomings of OLS, we estimate a fixed effects regression. We obtain a positive and significant marriage wage premium for the not attractive ("obese") category and a non-significant coefficient for the attractive ("not obese") men. These results are again in line with the Theorem (Part b) and - given the zero weight premium - with Corollary 5 as well.

In order to investigate whether the above results are sensitive to the defined age-groups we re-estimated the models for age-groups 20-60 and 20-40, with the findings reported in Table 5 below.¹³

TABLE 5 Effect of Marital Status on Wages by Age Group

20-60		Not tall			Tall
FE	Married	0.436***	(0.126)		-0.004 (0.039)
N		1650			13907
		obese			Not obese
FE	Married	0.296**	(0.126)		-0.048 (0.102)
N		635			2628
20-40		Not tall			Tall
FE	Married	0.385***	(0.087)		-0.036 (0.040)
N		541			5486
		Obese			Not obese
FE	Married	NA			0.078 (0.215)
N					1250

¹³It was not possible to obtain estimates for the 20-40 year old obese groups because of the reduced sample size.

*, **, ***: 10%, 5% and 1% level of significance

The models all show the estimates attached to the ‘Married’ variable. All models include a full range of controls: age, health, number of kids, household size, job sector, size of employer, job part-time, experience, union membership, whether there is a union at place of work and experience. Clustered standard errors are presented in brackets. There were insufficient observations to estimate the model on the 20-40 year old obese group.

These results confirm our earlier findings. Although there is some variation in the estimated marriage premium the magnitude is always larger (and often significant) for the unattractive group. For the attractive group the estimates are close to zero and not significant. These estimates demonstrate that our earlier results are robust to changes in the age-groups.

6 Conclusion

We have constructed a theoretical search model that examines how marriage market incentives affect labour market outcomes (and vice versa). We have established the existence and analysed in detail a search equilibrium characterised by wage differentials and the so-called "beauty premium".

Our results rely entirely on the frictional nature of the two markets and on the plausible assumption that physical attraction is important for successful marriage partnership formation. With women being selective about whom they marry (both in terms of looks and wages), men might struggle to find wages that are high enough to be deemed acceptable by females. As looks and wages are perceived by women as substitutes, this effect is stronger for less attractive men, so their reservation wage can end up being lower than that of their more attractive rivals. This leads to a gap between the average wages of the two types of men.

These results allow us to conclude that male heterogeneity vis-a-vis the labour market is not necessary for the explanation of beauty premium as an equilibrium outcome.

We also show that the behaviour which leads to beauty premium lies also at the heart of another phenomenon: the marriage wage premium. We find an intimate link between the two types of premia. A positive beauty premium is only compatible with an outcome where attractive men have a lower marriage premium than that of the less attractive men. Conversely, a negative or zero observed beauty premium is only possible if there is no marriage premium for attractive men.

This unambiguous relationship between beauty premium and marriage wage premium provides a strong falsification test of the model. We carry out an empirical analysis that confirms our theoretical predictions and as a result we are able to conclude that the data cannot refute the validity of the theory proposed.

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