Beauty Premium and Marriage Premium in Search Equilibrium: Theory and Empirical Test *

Roberto Bonilla
Newcastle University, UK

Francis Z. Kiraly
Newcastle University, UK

John Wildman
Newcastle University, UK

Abstract

We propose a theoretical explanation for the so-called beauty premium. Our approach relies entirely on search frictions and the fact that physical appearance plays an important role in attracting a marriage partner. We analyse the interaction between frictional labour and marriage markets, making use of what we label constrained job search. The optimal strategy entails different reservation wages for different men, and we establish the existence of a search equilibrium characterised by a beauty premium and/or marriage premium. Predicted profiles of premia allow for potential falsification tests and point to relevant empirical evidence in support of our theory.

Keywords: constrained search, beauty premium, marriage premium.
JEL Classification: D83, J12, J31

*We are especially grateful to the editor Guido Menzio for many valuable suggestions. We also thank two anonymous referees for their very helpful comments. Melvyn Coles, Peter Dolton, Daniel Hamermesh, Adrian Masters, Alberto Trejos and Mich Tvede, as well as participants at the 2014 EALE Conference (Ljubljana) and the 2015 Search and Matching (SaM) Annual Meeting (Aix-en-Provence) also contributed with many useful remarks. In addition, R. Bonilla would like to thank CESifo and Universidad de Oviedo for logistical support.

1 Introduction

There is widespread evidence that labour market outcomes are influenced by more than just productivity. Anthropometric characteristics such as beauty, height and - to some extent - weight also appear to have an effect on employment and wages. In particular, individuals perceived as having attractive physical attributes tend to earn higher wages. In the literature, this earnings gap is referred to as the "beauty premium", and has been the subject of extensive empirical research.

We offer an explanation for the existence of the male beauty premium as an equilibrium outcome. Our theoretical model incorporates two crucial features of labour and marriage markets. First, both markets are characterised by search frictions: it takes time, effort and luck to find a suitable job or marital partner. Second, matching in the marriage market seems to involve multi-dimensional preferences which reflect an implicit trade-off between anthropometric and socio-economic characteristics.

The key message of our paper is that labour market decisions and outcomes (including various types of wage premia) may be influenced by expectations and behaviour in the marriage market, and vice versa.

To capture this inter-dependence, we construct a simple equilibrium search model where the two frictional markets are inter-linked.[1] Single men are heterogeneous in terms of their physical appearance: in the eyes of all women, some men are more attractive than others. We consider a two-sided search scenario, where men and women look for each other, and unemployed men search for jobs knowing that earnings, together with physical attributes, determine whether or not they can form marriage partnerships.

In our model, physical appearance does not affect men's options in the labour market. Crucially, however, it does affect their job search decision in that market, as their marriage prospects are influenced by both their looks and wages. We call this type of decision problem *constrained search*, and analyse it in detail.

[1] The literature on inter-linked frictional markets is sparse. For two very interesting recent papers, see Kaplan and Menzio (2016) and Rupert and Wasmer (2012).

If women regard physical characteristics and wages as substitutes and rank men in the same way, we show there exists an equilibrium in which less attractive men find it optimal to accept jobs that pay lower wages than those of their more attractive rivals. The intuition is straightforward and it stems from the frictional nature of the labour market: although a less attractive man needs a relatively high wage in order to be accepted by a woman, such a well-paid job may be too difficult to find, so he settles for a lower wage. As a consequence, more attractive men (single or married) will earn, on average, higher wages than less attractive (single or married) men.

Our approach incorporates some aspects of the marriage market the importance of which was stressed by Chiappori et al. (2012) in the context of assortative matching. They argue that the standard marriage matching framework is too narrow, in the sense that it overlooks the role played by uncertainty and it restricts attention to one-dimensional preferences. That is, it tends to play down the role of search frictions and, in the main, it ignores preferences towards multiple characteristics and the potential trade-offs this implies.[2] We consider explicitly the random nature of matching and include preferences over multi-dimensional (anthropometric and socio-economic) characteristics. Indeed, our results are driven entirely by the very existence of such search frictions and the perceived trade-off between physical attributes and wages. The only other papers we are aware of that consider marital matching with multiple attributes in a search equilibrium framework are Coles and Francesconi (2011 and 2017), which provide fascinating insights into some possible effects of equal opportunities for women.

Interestingly, the strategies that give rise to the beauty premium can also account for the so-called "marriage premium": the puzzling empirical fact

[2] Chiappori et al.(2012) consider marital matching along multi-dimensional characteristics and reduce it to a matching problem with preferences captured by a one-dimensional index. Using PSID data on married couples, they find an interesting trade-off between anthropometric and socio-economic factors affecting marital outcomes: men compensate 1.3 additional units of BMI with a 1% increase in wages.

that on average, married men earn higher wages than single men.[3] We are the first to establish a theoretical link between the two types of premia as equilibrium outcomes.

The potential market equilibria, each characterised by specific patterns of beauty premium and marriage premium, allow for an extensive empirical test of our theoretical predictions. Using UK data, we estimate the two types of wage differentials across male workers who differ in terms of anthropometric characteristics. Following the literature, we use height and weight as proxies for physical attractiveness, and the estimates seem to support our theory. The empirical analysis we carry out is the very first attempt at finding evidence for the search theoretic approach to beauty premium and marriage premium.[4]

Hamermesh (2011) offers a stimulating survey of the literature on beauty premium. Hamermesh and Biddle (1994) find that individuals with below-average attractiveness earn 9% less than the "average-looking" ones, while the wage of individuals with above-average looks is 5% higher. These results are obtained after controlling for educational attainment and experience. Persico et al. (2004) attempt to quantify the so-called height premium and observe that increasing height at age 16 by one inch increases adult wages by 2.6%, on average. In two fairly recent studies using UK data, Case and Paxson (2008) and Case at al.(2009) find that the height premium remains significant after controlling for education and for sorting into higher status jobs. The effect of weight on labour market outcomes seems to be less clear. Garcia and Quintana-Domeque (2007), Cawley (2004) and Han et al.(2009) find a wage penalty coupled with reduced employment probability for the

[3] Numerous studies report that, after controlling for education and other characteristics, the male marriage premium is consistently around 10% or above, while such marital wage differentials are considerably smaller for women, and their sign varies. For excellent surveys of the empirical literature, see Daniel (1995) or Grossbard-Shechtman and Neuman (2003).

[4] In their survey chapter, Ponthieux and Meurs (2014) stress the need for empirical studies aimed at testing the search theoretical approach to marital wage inequalities.

obese. In contrast, Hamermesh and Biddle (1994), Sargent and Blanchflower (1994) and Morris (2006) argue that weight has no effect on male earnings.

Physical attributes (beauty, weight and height) are known to play an important role in the marriage market. Extensive empirical studies from sociology, anthropology, psychology and other fields confirm this. Following the ground-breaking work of Becker (1991) there is also an extensive economics literature that investigates assortative mating. Some studies, such as Choo and Siow (2006) and Weiss and Willis (1997) focus on matching based on age, earnings and education. Others consider the effect of various anthropometric characteristics on marital outcomes. For height, Oreffice and Quintana-Domeque (2010) find that shorter men are more likely to be matched with less educated and heavier partners, while Ponzo and Scoppa (2015) conclude that taller males tend to marry more educated women. Manfredini et al.(2013) observe a negative selection of short men on marriage, while Herpin (2005) finds that short men are less likely to be married or live in a permanent relationship than their taller counterparts. For weight, Oreffice and Quintana-Domeque (2010) find that heavier husbands are matched with shorter wives, while Silventoinen et al.(2003) observe assortative matching along weight as well as height. Finally, Averett et al.(2008) note that spouses tend to pay less attention to their body-mass index (BMI) once they get married.

In this paper we add to the existing literature in two other important ways. First, by ignoring the wage policies of firms, we exclude issues related to possible discrimination based on looks. Second, productivity heterogeneity plays no role whatsoever in establishing our results. All this is in stark contrast with current explanations of beauty premium and marriage premium, which either implicitly assume discrimination in the labour market, or rely on some sort of productivity differences.

Indeed, most of the existing literature on beauty premium is based on the idea that some physical traits might affect job performance in ways that are not as easily measured as other factors such as human capital or work experience. One argument is that physical attractiveness may affect a person's self-esteem or communication skills, and hence their productivity. Cawley (2004) finds that productivity is negatively correlated with weight, possibly because of factors such as health or confidence. Persico et al.(2004) observe that height increases the probability that teens participate in active social interaction, activities which in turn help them acquire productivity-enhancing skills. However, Hamermesh and Biddle (1994) find that the beauty premium exists even outside of jobs that involve frequent inter-personal contact and communication.

In turn, the standard (non search-theoretic) explanations of marriage premium tend to rely on some sort of male productivity heterogeneity. According to the so-called selection theory, some unobservable traits of men that are valued in the marriage market are correlated with productivity. However, the empirical evidence on this is quite weak: for example, Chun and Lee (2001) argue that the selection effect is minimal. Alternatively, the household specialisation approach posits that marriage increases a man's productivity. Although Korenman and Neumark (1991) provide some limited empirical support for this hypothesis, Loh (1996) finds that men whose wives also work earn a larger premium, while Hersch and Stratton (2000) conclude that the marriage premium is not due to household specialisation even if one does not use wives' employment status as a proxy for specialisation. Blackburn and Korenman (1994) assess the relative merits of the two theories mentioned above and argue that the evidence is fairly mixed, so neither selection nor specialisation seem to be sufficient or satisfactory explanations for the existence of the male marriage wage gap.

In this context, the only theoretical work we are aware of that offers an alternative explanation for the existence of marriage premium is Bonilla and Kiraly (2013), who show that the marital earnings gap can arise simply as a result of search frictions.

Next, we set up our theoretical framework. In Section 3 we analyse the optimal strategies of men and women, with focus on the constrained sequential job search problem facing unemployed males. In Section 4 we establish the existence and characterise a search equilibrium with beauty premium. We also explore marriage rates as well as the link between beauty premium and marriage premium in various equilibrium configurations. In Section 5 we carry out an empirical falsification test of the model, and offer additional evidence in support of our theory. In the final section we summarise and discuss our main results and general approach.

2 The model

The economy consists of a continuum of women and men, all risk neutral. Time is continuous and all agents discount the future at rate r. We only consider steady state equilibria.

Men enter the economy unemployed and single. In the labour market, they all face a range of posted wages which are distributed according to the exogenous cumulative distribution function $F(w)$ with support $[\underline{w}, \overline{w}]$. 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 a man's wage remains constant throughout his working life.

In the marriage market, a man is viewed by all women as either attractive (H) or less attractive (L), so men are heterogeneous in terms of their physical appearance, with $i = H, L$ denoting type. One can think of appearance as a composite quality which captures anthropometric traits such as beauty, height and weight - characteristics that are all known to be important in marital matching. Single men look for potential partners. A married man earning wage w enjoys flow payoff $w + y$, where $y > 0$ captures the non-material utility of marriage. Assume there is no possibility of divorce. In the marriage market, meetings occur according to a quadratic matching function, where the number of meetings is proportional to the product of the measure of searchers on each side of the market. This - see Mortensen (1982) - gives rise to a Poisson meeting technology with an arrival rate that is a linear function of the relevant measure of participants on the opposite side of the market. For men, we denote this arrival rate by λ_m.

Let n denote the measure of single women. While single, women have exogenous flow payoff x, and they do not look for jobs.[5] Women use costless random sequential search to locate single eligible (marriageable) males. A married woman's flow payoff is equal to her partner's wage w plus a fixed flow utility z_i, where $z_H > z_L$. The payoff z_i captures the non-monetary utility a woman gets from marrying a type i man. Let $z \equiv z_H - z_L$, and assume z is non-negligible. This is a crucial ingredient in our model and it captures two important considerations. First, it allows some participants in the marriage matching process (in this case, women) to have preferences about multi-dimensional features of potential marital partners. Second, it

[5] Alternatively, x could be endogenous in a labour market where women are active.

reflects the perceived trade-off between anthropometric characteristics and socio-economic status: here, all women regard a man's wage and his looks as perfect substitutes. Physical appearance, together with earnings, determine whether or not a single man is accepted for marriage. Possible asymmetries in the way women and men value the benefits of marriage are captured by the relationship between parameters x, z_i and y. Upon marriage a woman gives up x, so we assume that $x < \overline{w}$ to ensure that a marital partnership does have a positive potential surplus.

Denote by λ_w^i and λ_w^u the parameters of the Poisson process and hence the rate at which a woman meets an employed man (of type i) or an unemployed, respectively.

Let u_i be the steady state measure of type i single unemployed men. Couples and singles alike leave the economy at an exogenous rate δ. Every time an unemployed single man of type i accepts a job, gets married or leaves the economy, he is replaced by another type i unemployed single man. Hence, u_i can be treated as exogenous. Furthermore, we assume that a new single woman comes into the market every time a single woman gets married or exits the economy, so n can also be regarded as exogenous.

Denote by λ the parameter measuring the efficiency of the meeting process. Let N_i denote the measure of marriageable employed single men of type i. Then, from a single man's point of view, the average instantaneous rate at which meetings occur is $\lambda_m = \frac{\lambda(N_H+N_L)n}{(N_H+N_L)} = \lambda n$. Similarly, from the point of view of single women, the rate at which meetings with unemployed men occur is given by $\lambda_w^u = \frac{\lambda(u_H+u_L)n}{n}$, while the corresponding rate of meeting type i employed men is $\lambda_w^i = \frac{\lambda(N_H+N_L)n}{n}\frac{N_i}{(N_H+N_L)} = \lambda N_i$. The steady state measure N_i is of course endogenous, and therefore so is λ_w^i, together with the steady state measures of unmarriageable men (bachelors - denoted by B_i) and of married men (M_i).

We define the beauty premium (BP) as the difference between the average wage of type H men (married or single) and the average wage of type L men (married or single). Similarly, we define the marriage premium among type i men (MP_i) as the difference between the average wage of type i married men and that of type i single men. Throughout, superscripts S and M stand for "single" and "married".

3 Optimal search

In this section we show that men and women alike use optimal strategies characterised by the reservation property. Women face a standard sequential search problem in the marriage market and, since they regard a man's wage and looks as perfect substitutes, the optimal female strategy amounts to having separate reservation wages T_i - one for each male type. Interestingly, the labour market reservation wage of single unemployed males turns out to be a *function* of the relevant female reservation wage, so we will have $R_i(T_i)$.

3.1 Men

All men, regardless of type, have equal job prospects: they face the same wage distribution, and all other relevant structural parameters (λ_0, r, δ and y) are also common. In contrast, in the marriage market men's prospects do differ across types, and also depend on employment status. Therefore, we first establish the conditions under which unemployed men cannot get married.

3.1.1 Unemployed men and marriage

When considering marriage to a type i unemployed man, a woman needs to take into account this man's behaviour after marriage. Without divorce, he faces a standard sequential job search problem with no marriage market considerations. Accordingly, the reservation wage of a married type i unemployed man (R_i^M) is defined as the (unique) solution to:

$$R_i^M = \frac{\lambda_0}{r+\delta} \int_{R_i^M}^{\overline{w}} [1 - F(w)]\, dw.$$

This familiar (pure labour market) reservation wage compensates for the option of continued search, and is obtained from equating the value of employment at a wage w, and the value of continued search. For a married man, the former is $V_i^M(w) = (w+y)/(r+\delta)$, while the latter is given by:

$$J_i^M = \frac{y}{r+\delta} + \frac{\lambda_0}{r+\delta} \int_{R_i^M}^{\overline{w}} \left[V_i^M - J_i^M\right] dF(w).$$

These values are standard, except that here they both include the discounted utility of marriage $y/(r+\delta)$, which in turn cancels out. Note that the resulting reservation wage R_i^M is a function of type-independent parameters only,[6] and therefore $R_H^M = R_L^M \equiv \underline{R}$.

Given the above, when would a woman marry an unemployed man in the first place? The answer depends of course on her reservation wage T_i, and therefore the relevant comparison is between the value of staying single (W^S) and the value of marrying a type i unemployed ($W_{U_i}^M$). The latter is given by:

$$(r+\delta)W_{U_i}^M = z_i + \lambda_0 \int_{\underline{R}}^{\overline{w}} \left[W_i^M(w) - W_{U_i}^M\right] dF(w),$$

where $W_i^M(w) = (w + z_i)/(r+\delta)$ captures the value of being married to a type i employed man who earns a wage w.

We need to investigate the conditions for which $W_{U_i}^M = W^S$. To that end, note that a female reservation wage T_i solves the standard optimality condition $W^S = W_i^M(T_i) = (T_i + z_i)/(r+\delta)$. Making use of all this in the expression for $W_{U_i}^M$, we obtain the female reservation wage that makes a woman indifferent between remaining single or marrying a type i unemployed:

$$T_i = \frac{\lambda_0}{r+\delta} \int_{\underline{R}}^{\overline{w}} \left[w - T_i\right] dF(w).$$

The unique solution to this is $T_i = \underline{R}$. Now, if a woman's value of being single increases, her reservation wage also increases, while $W_{U_i}^M$ is independent of T_i. Therefore, $W^S \lesseqgtr W_{U_i}^M$ if and only if $T_i \lesseqgtr \underline{R}$, and we are ready to state our first result:

Lemma 1 *If $T_i > \underline{R}$, women reject marriage to a type i unemployed man.*

Once married, and without the possibility of divorce, an unemployed man cannot credibly commit to a reservation wage higher than $\underline{R}$. Consequently, no unemployed man can get married to women who demand more than $\underline{R}$.

[6] To rule out uninteresting equilibria, we also assume $R_i^M \geq \underline{w}$.

3.1.2 Constrained job search

In the labour market, unemployed men are involved in what we call *constrained search*: they look for jobs knowing that the only way they can hope to get married is by earning a wage which is higher or equal to women's reservation wage. Below we show that a type i unemployed man follows an optimal stopping strategy, and his reservation wage is a *function* of the relevant female reservation wage: $R_i(T_i)$.

(A) $T_i \in (\underline{R}, \overline{w}]$. In this range, unemployed men are not accepted by women, but employed men could in principle earn wages that make them acceptable for marriage.

Take a single unemployed man of type i who has just received an offer w that makes him either marriageable or not marriageable. Let $V_i^S(w)$ be the value of accepting this job. Without divorce, a married man earning a wage w has a discounted expected lifetime utility of $(w+y)/(r+\delta)$, and therefore:

$$V_i^S(w) = \left\{ \begin{array}{lll} \frac{w}{r+\delta} + \frac{\lambda n}{(r+\delta+\lambda n)(r+\delta)} y & \text{if} & w \geq T_i \\ \frac{w}{r+\delta} & \text{if} & w < T_i \end{array} \right\} \tag{1}$$

The value of accepting an offer w is a piecewise linear function: it is increasing in wage w and is discontinuous at $w = T_i$, reflecting the additional utility gain from marriage if the female reservation wage constraint is satisfied.

For a type i unemployed, let $\overline{v}_i(w)$ denote the expected value of holding a current offer w that confers marriageability. Similarly, let $\underline{v}_i(w)$ denote the value of holding a wage offer that precludes marriage. This man has to decide whether to accept or reject such an offer. Let J_i denote the value attached to continued job search by a type i unemployed man, and observe that for any current wage offer w, this value is independent of w. Then, the corresponding *two* Bellman equations are:

$$\overline{v}_i(w) = \max\left\{V_i^S(w \mid w \geq T_i), J_i\right\}$$

and

$$\underline{v}_i(w) = \max\left\{V_i^S(w \mid w < T_i), J_i\right\}.$$

Given the utility from marriage, the value of accepting a job that confers marriageability is always higher than the value of accepting a wage that does not. Therefore $\overline{v}_i \geq \underline{v}_i$, with strict inequality if $V_i^S(w) > J_i$, which in turn is true for $T_i > \underline{R}$ (to be shown in the proof of Proposition 1 below).

Regardless of the current wage offer w, and provided there is contact with another firm, continued job search results in a new wage offer w'. The probability with which this new wage is higher or lower than the women's reservation match T_i depends on T_i itself, through the wage distribution F. Crucially, this means that J_i is a *convex combination* of $\overline{v}_i(w)$ and $\underline{v}_i(w)$, and thus a function of T_i. To see all this, note that J_i is given by:

$$J_i(T_i) = \frac{\lambda_0}{r + \delta + \lambda_0} \left[\int_{T_i}^{\overline{w}} \overline{v}_i(w') dF(w') + \int_{\underline{w}}^{T_i} \underline{v}_i(w') dF(w') \right]. \tag{2}$$

The right-hand side captures the expected utility of any change in the value of an unemployed man's state. Here, this amounts to the probability that he receives a wage offer (λ_0), times the expected continuation value associated with the offer w', noting that the offer can be accepted or rejected and, if accepted, it either allows for or precludes the subsequent possibility of marriage.

For $T_i \in (\underline{R}, \overline{w})$, as $0 < F(T_i) < 1$, the value of continued search J_i is continuous; furthermore, as long as $\overline{v}_i > \underline{v}_i$, the value of search is decreasing in T_i. On the other hand, for $T_i > \overline{w}$ we have $1 - F(T_i) = 0$, so no man can get married and J_i is independent of T_i.

It is immediately apparent that constrained search differs from the standard sequential search problem in two important ways:

First, now there is a discontinuity in the value of accepting a job, at a wage equal to T_i. As mentioned, this makes V_i^S a piecewise linear increasing function. Graphically (see Figure 1) the point at which the break occurs moves to the right as the female reservation wage increases.

Second, the value of job search is independent of the current wage offer, and is in fact a convex combination of two continuation values, being therefore a function of T_i. Graphically (see Figure 1) an increase in the female reservation wage leads to a continuous downward shift in J_i.

As a consequence, the way the reservation wage is determined also changes. There is a particular T_i such that the discontinuity in V_i^S starts to bite: for lower female reservation wages the standard equality between the value of continued search and the value of accepting a job does not exist. Denote this threshold female reservation wage by $\widehat{T}_i$.

Figure 1 plots $V_i^S(w)$ and $J_i(T_i)$. It shows that the optimal strategy has the reservation property, and clarifies how the reservation wage R_i is determined for increasing values of T_i.

FIGURE 1 (please see at the end of paper)

Panel (a) shows that for a female reservation wage lower than $\widehat{T}_i$, men prefer employment to continued search when the wage offer is equal or higher than this female reservation wage. Panel (b) shows that $\widehat{T}_i$ is the highest female reservation wage for which this is true - recall that J_i decreases with an increase in T_i, while the discontinuity in V_i^S moves to the right. Finally, panel (c) shows that for female reservation wages higher than $\widehat{T}_i$, the value of employment is now equal to the value of continued search at a wage lower than the one required by women. This is our male reservation wage, and it decreases for increasing female reservation wages (again, because of the effects on J_i and the discontinuity in V_i^S). Thus, $\widehat{T}_i$ is the highest female reservation wage that men choose to match, and is implicitly given by:

$$J_i(\widehat{T}_i) = \frac{\widehat{T}_i}{r + \delta}.$$

One can see straight away that, as the value J_i depends on structural parameters and T_i only, $\widehat{T}_i$ itself will depend on parameters only. This threshold wage $\widehat{T}_i$ is crucial for the non-monotonicity of the male reservation wage function. Next, we characterise in detail the male reservation wage function over female reservation wages for which the marriage market does indeed affect labour market decisions. In doing so, we further clarify the role of $\widehat{T}_i$.

Proposition 1 *For $T_i \in (\underline{R}, \overline{w}]$, the optimal strategy has the reservation property. The reservation wage function R_i solves*

$$R_i(T_i) = \min \left\{ w : V_i^S(w) \geq J_i \right\},$$

it is continuous, piecewise differentiable, and:

(i) $R_i(T_i) = T_i$ *for* $T_i \in (\underline{R}, \widehat{T}_i]$;

(ii) $R_i(T_i) < T_i$ *and decreasing in* T_i *for* $T_i \in (\widehat{T}_i, \overline{w})$;

(iii) $R_i(T_i) = T_i$ *for* $T_i = \overline{w}$.

Proof. First we establish the optimal policy for $T_i = \widehat{T}_i$, then in its neighbourhood. Thereafter, we show that the respective optimal stopping strategies hold for $T_i \in (\underline{R}, \widehat{T}_i\ )$ and $T_i \in (\widehat{T}_i, \overline{w}]$ as well.

Recall that $\widehat{T}_i$ solves $J_i(\widehat{T}_i) = \widehat{T}_i/(r+\delta)$. When $T_i = \widehat{T}_i$, the reservation wage equals T_i, since $V_i^S(w) < J_i$ for wages lower than $\widehat{T}_i$ and $V_i^S(w) > J_i$ otherwise. See Panel (b) in Figure 1.

Consider a small $\varepsilon > 0$. For $T_i = \widehat{T}_i - \varepsilon$, we have $J_i > \widehat{T}_i/(r+\delta)$. Since the discontinuity in V_i^S occurs at a wage lower than $\widehat{T}_i$, it follows that $V_i^S(w) < J_i$ for any wage lower than T_i, and $V_i^S(w) > J_i$ otherwise. It is easy to show (see Appendix 1) that the latter inequality holds for all $T_i \in (\underline{R}, \widehat{T}_i)$. As a result, in that range the reservation wage is T_i. See Panel (a) in Figure 1.

For $T_i = \widehat{T}_i + \varepsilon$, we have $J_i < \widehat{T}_i/(r+\delta)$. Since the discontinuity in V_i^S occurs now at a wage higher than $\widehat{T}_i$, it follows that $V_i^S(w) = J_i$ for some wage lower than $\widehat{T}_i$. This is our reservation wage, and it decreases as T_i increases (since J_i decreases in T_i). See Panel (c) in Figure 1. When $T_i = \overline{w}$, we have $F(T_i) = 1$ and the problem reverts to one of standard job search, so $R_i = \underline{R}$. ■

The male reservation wage function is non-monotonic, reflecting the fact that men face an interesting trade-off for various levels of female reservation wages. When the marriage problem is not trivial, an increase in the male reservation wage confers marriageability - provided it satisfies women's reservation wage. On the other hand, any increase in the male reservation wage above $\underline{R}$ comes at the cost of limiting one's job prospects by rejecting wages that would have been accepted otherwise (i.e. in the absence of a marriage market). If the female reservation wage is relatively low (but still above $\underline{R}$), the above cost is not too high, and therefore men hold out for such a wage - settling for anything lower is sub-optimal.

However, if the female reservation wage increases and men match it, this further limits a man's job prospects, and - as men need a job to get married - may therefore also delay marriage. Given this, there is a threshold female reservation wage (our $\widehat{T}_i$) such that men refuse to match anything higher.

For $T_i \in (\widehat{T}_i, \overline{w})$, the reservation wage is lower than the wage demanded by women, so men "chance" it. A single man may still be able to get married if he is lucky and lands a good job. But now he is willing to throw away the prospect of marriage - purely because of search frictions and what one might call the "bird in hand" effect. An acceptable wage may indeed be lower than the (relatively high) threshold set by women; nonetheless, it can still be sufficiently high so that an unemployed accepts it and turns down the option of holding out for the wage required for marriage. For higher and higher female reservation wages the likelihood of encountering such high wages decreases further, and with it, the value of continued search and hence men's reservation wage.

We are particularly interested in the male reservation wage function for $T_i \in (\widehat{T}_i, \overline{w}]$. Dropping the argument to ease notation, we obtain:

Claim 1 *For $T_i \in (\widehat{T}_i, \overline{w}]$,*

$$R_i = \frac{\lambda_0}{r+\delta}\left[\int_{R_i}^{\overline{w}} [1-F(w)]\,dw + \frac{[1-F(T_i)]\,\lambda n}{r+\delta+\lambda n} y\right] \qquad (< T_i). \qquad (3)$$

Proof. See Appendix 2. ■

The first term inside the brackets is standard: the reservation wage must compensate for the loss of the option of continued search for better job offers. The second term pertains to the man's options in the marriage market: the possibility of contacting a firm that offers a wage which confers marriageability, and subsequently meeting a woman would lead to flow payoff y. If a type i unemployed man were to accept a wage less than T_i, he would be giving up the option of utility from marriage, so the reservation wage must compensate for this also. Note that, other than the relevant female reservation wage T_i, the male reservation wage only depends on type-independent parameters. Also, $dR_i/dT_i < 0$ indeed.

For $T_i > \widehat{T}_i$, the optimal reservation wage given by (3) solves $R_i/(r+\delta) = J_i$. Intuitively, the value of working at the reservation wage (which here precludes marriage) must be equal to the value of continued job search. This is not the case at $T_i = \widehat{T}_i$ since then, as shown in Proposition 1, the optimal strategy is to set R_i equal to T_i, meaning that working at this reservation wage does not now preclude marriage. Despite the fact that (3) does not describe the optimal strategy in this latter case, we can obtain $\widehat{T}_i$ by imposing $R_i = T_i$ in this equation. The reason one can do this is that the reservation wage function R_i implicitly defined by (3) is in fact continuous at $T_i = R_i$. Because of this, we can also obtain:

$$\widehat{T}_i = \frac{\lambda_0}{r+\delta}\left[\int_{\widehat{T}_i}^{\overline{w}} [1-F(w)]\,dw + \frac{[1-F(\widehat{T}_i)]\lambda n}{r+\delta+\lambda n} y\right] \qquad (> \underline{R}).$$

Note that $\widehat{T}_i$ is indeed a function of type-independent parameters only, and therefore $\widehat{T}_H = \widehat{T}_L \equiv \widehat{T}$. It then also becomes clear that the two male reservation wage functions $R_H(T_H)$ and $R_L(T_L)$ are identical as well for the respective $T_i \in (\underline{R}, \overline{w}]$, and we can denote this common reservation wage function by $R(T_i)$.

Throughout, we have implicitly assumed that $\widehat{T} < \overline{w}$. Using the expression above, we now show this is indeed true.

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

Proof. See Appendix 3. ■

As long as the utility from marriage is finite, there always exists a female reservation wage in the support of F that men refuse to match. This is due to the increasing cost of choosing a male reservation wage above $\underline{R}$ in a frictional labour market.

(B) $T_i \leq \underline{R}$ and $T_i > \overline{w}$. We complete the characterisation of the reservation wage function by looking at the optimal policy in the face of female reservation wages that are either too low or too high to matter for decisions in the labour market. The former pertains to a situation where all men (employed or unemployed) can get married, while the latter covers the scenario where no man is ever acceptable to women.

Proposition 2 *For $T_i \leq \underline{R}$ and for $T_i > \overline{w}$ the optimal strategy has the reservation property, and the reservation wage is $\underline{R}$.*

Proof. See Appendix 4. ■

Intuitively, if men do not have to, or cannot, affect their marital prospects through their job search decisions, they simply ignore the marriage market.

We conclude that, given $\widehat{T}$ and $\underline{R}$, unemployed men of either type have identical reservation wage functions for all female reservation wage values.

3.2 Women

Women are active only in the marriage market where they take into account the measure of marriageable men and the distribution of wages earned by them: together, these determine the arrival rates of acceptable marriage partners and the available wage prospects. For this reason, we start this section by looking at the steady state conditions for our economy.

3.2.1 Steady state

Type i unemployed men find marriageable wages at rate $\lambda_0[1 - F(T_i)]$, while type i marriageable men (N_i) get married at rate λn and exit the economy at rate δ. Hence, in the steady state we have:

$$N_i = \frac{u_i \lambda_0 \left[1 - F(T_i)\right]}{\lambda n + \delta}.$$

Denote by $G_i(w)$ the distribution of wages earned by marriageable men. It is obtained by combining the expression for N_i with the steady-state equation $u_i\lambda_0 \left[F(w) - F(T_i)\right] = N_i G_i(w)[\lambda n + \delta]$, which equates the flow into employment at wages lower than w but higher than T_i, and the outflow (through marriage or exit) from this stock of men. We obtain:

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

For completeness, we also solve for measures of bachelors (B_i) and of married men (M_i), together with the distribution of wages amongst these two groups. If R_i denotes a chosen reservation wage, B_i solves $u_i\lambda_0[F(T_i) - F(R_i)] = \delta B_i$.These are the men who accepted jobs with wages lower than T_i, who exit this pool at rate δ. Let $H_i(w)$ be the distribution of wages amongst these bachelors. Then, $u_i\lambda_0[F(w) - F(R_i)] = \delta B_i H_i(w)$, and:

$$H_i(w) = \frac{F(w) - F(R_i)}{F(T_i) - F(R_i)}.$$

In turn, M_i solves $\lambda n N_i = \delta M_i$. Since the rate at which marriageable single men (N_i) get married is independent of their wage, and the rate at which married men (M_i) leave the economy is also independent of the wage they earn, the distribution of wages for the latter group is also $G_i(w)$.

3.2.2 Female reservation wages

Given sequential search in the marriage market, the optimal strategy for women has the reservation property. But, as wages and looks are viewed as perfect substitutes, and since women regard men as either attractive or less attractive, their reservation match strategy boils down to a simple reservation *wage* strategy T_i: reject men of type i who earn a wage less than T_i.

Recall that the value of being married to a type i man who earns a wage w is $W_i^M(w) = (w + z_i)/(r + \delta)$. This value is continuous and increasing for any wage. Also recall that W^S denotes the expected value of being a single woman. Since this is independent of any w, women's reservation match is obtained in the standard way. With Lemma 1 in mind, we focus on the scenario where women do not marry unemployed men. Assume T_H and T_L are two female reservation wages. Then, using $\lambda_w^i = \lambda N_i$, the steady state condition for N_i, and the steady state expression for $G_i(w)$, we obtain:

$$(r+\delta)W^S = x + \frac{\lambda u_H \lambda_0}{(\lambda n + \delta)} \int_{T_H}^{\overline{w}} \left[W_H^M(w) - W^S\right] dF(w) +$$

$$+ \frac{\lambda u_L \lambda_0}{(\lambda n + \delta)} \int_{T_L}^{\overline{w}} \left[W_L^M(w) - W^S\right] dF(w). \tag{4}$$

The value of being a single woman consists of the flow payoff x plus the expected increase in utility that obtains from any change in the value of her state, which in this case is the probability that she meets a marriageable type i employed man times the expected increase in value. Note that W^S and therefore T_i are independent of R since men's reservation wage strategy does not affect the wage distribution F. The relationship between the two female reservation wages follows immediately:

Lemma 3 $T_H < T_L$.

Proof. From $z_H > z_L$ combined with the definition of the reservation match: $(r + \delta)W^S = T_H + z_H = T_L + z_L$. ■

Women have a unique reservation match, but this can be fulfilled *differently* by the two types of men, and the difference between the two female reservation wages is z.

4 Equilibrium

Next, we establish the existence and provide a full characterisation of the potential search equilibria, with focus on the beauty premium. We show that the reservation wage strategies of unemployed men can also lead to equilibrium marriage premium, and summarise the link between the two types of premia for our equilibrium profiles.

A search equilibrium is a strategy pair $\{R_i^*, T_i\}$, together with N_i, B_i, M_i, $G_i(.)$, $H_i(.)$. The female reservation wages T_i are obtained from (4) and $(r+\delta)W^S = T_i + z_i$. The male reservation wages R_i^* are simply the reservation wage function from Proposition 1 and Claim 1 evaluated at T_i. In turn, the various steady state measures of men, together with distributions of earned wages result from the relevant inflow-outflow equations above.

We have defined the marriage premium amongst type i men (MP_i) as the difference between the average wage of married type i men and that of single type i men. Denoting these average wages by $\widetilde{w}_i^M$ and $\widetilde{w}_i^S$, we have $MP_i \equiv \widetilde{w}_i^M - \widetilde{w}_i^S$. Similarly, we have defined the beauty premium (BP) as the difference between the average wage of all (married and single) type H men and that of all type L men. That is, $BP \equiv \widetilde{w}_H - \widetilde{w}_L$. The two types of premia are linked to equilibrium male reservation wages as follows:

Remark 1 *$MP_i > 0$ for $R_i^* < T_i$, and $MP_i = 0$ for $R_i^* = T_i$. Furthermore, MP_i increases in $T_i - R_i^*$.*

Proof. Note that

$$\widetilde{w}_i^S = \frac{B_i}{B_i + N_i} \int_{R_i^*}^{T_i} w dH_i(w) + \frac{N_i}{B_i + N_i} \int_{T_i}^{\overline{w}} w dG_i(w)$$

and

$$\widetilde{w}_i^M = \int_{T_i}^{\overline{w}} w dG_i(w).$$

For $R_i^* = T_i$ we have $B_i = 0$, and hence $\widetilde{w}_i^M = \widetilde{w}_i^S$. For $R_i^* < T_i$ we have $B_i > 0$ and, using $G_i(w)$ and $H_i(w)$, we get $\widetilde{w}_i^M > \widetilde{w}_i^S$. Easy to check that MP_i increases in $T_i - R_i^*$. ■

If men (of either type) accept wages below what women require, the average wage of single males will be lower than that of their married colleagues.

Remark 2 *$BP \gtreqless 0$ iff $R^*_H \gtreqless R^*_L$. Furthermore, BP increases in $R^*_H - R^*_L$.*

Proof. We have

$$\widetilde{w}_i = \frac{(B_i + N_i)}{B_i + N_i + M_i}\widetilde{w}_i^S + \frac{M_i}{B_i + N_i + M_i}\widetilde{w}_i^M.$$

Next, substitute B_i, N_i, M_i, $G_i(w)$ and $H_i(w)$ into the definition of BP. ■

Naturally, if different types of men choose different reservation wages, this will affect their respective average earnings.

The above Remarks further highlight the crucial role of search frictions. Clearly, a meaningful female reservation wage is only possible if there are search frictions in the marriage market. In turn, a positive male marriage premium is possible only if the region in which the male reservation wage function is decreasing in T_i exists - and this can happen only if there are search frictions in the labour market (see Lemma 2). Finally, the beauty premium occurs only if less attractive men give up on matching the female wage demand when finding suitable jobs is unlikely.

As we are interested in outcomes that can only occur when men do not ignore the marriage market, we restrict our attention to the case where $T_i \geq \underline{R}$ for $i = H, L$. This is also the core hypothesis in our empirical analysis.[7] Recall that $z \equiv z_H - z_L$ $(= T_L - T_H)$. We consider the range of parameters x and z for which the set of possible search equilibrium configurations is largest. Assume that $z < \overline{w} - \underline{R}$, so it is indeed possible that the labour market behaviour of *both* types of men is affected by their prospects in the marriage market.

Next, we establish the existence of an equilibrium with beauty premium and characterise it in terms of marriage premium patterns. First, note that although $\underline{R}$ and $\widehat{T}$ are both endogenous, they are in fact independent of x and z: the only thing men need to take into account is the wage required to get married. We are now ready to state our main result:

[7] Extending our results and proving existence of an equilibrium for $T_i < \underline{R}$ is not difficult. However, it involves a tedious derivation of W^S, and then T_i (for T_i supposedly lower than $\underline{R}$), while the equilibrium itself is uninteresting.

Theorem 1 *Let* $\underline{x}$ *such that* $R_L^* = R_H^*$*, and* $\overline{x}$ *such that* $T_H = \overline{w}$*. A unique equilibrium with positive beauty premium exists for* $x \in (\underline{x}, \overline{x})$*.*

(i) *If* $z < \overline{w} - \widehat{T}$*, this equilibrium is characterised by:*

(a) $MP_H = 0$*,* $MP_L > 0$ *for* $x \in (\underline{x}, x_1]$*;*

(b) $MP_L > MP_H > 0$ *for* $x \in (x_1, x_2]$*;*

(c) $MP_H > 0$ *and no married L type men for* $x \in (x_2, \overline{x})$*,*

where x_1 *such that* $T_H = \widehat{T}$*, and* x_2 *such that* $T_L = \overline{w}$*.*

(ii) *If* $z \geq \overline{w} - \widehat{T}$*, profile* (b) *disappears.*

Proof. (Please also consult Figure 2).

For existence, note that T_i are increasing in x. If $z < \overline{w} - \underline{R}$, since $\widehat{T} < \overline{w}$ (Lemma 2) and $T_H < T_L$ (Lemma 3), there is a unique $\underline{x}$ ($< \overline{x}$), with $T_H \in (\underline{R}, \widehat{T})$ and $T_L \in (\widehat{T}, \overline{w})$ for $x = \underline{x}$. With $R(T_i)$ continuous and T_i independent of male reservation wages, a unique equilibrium exists for $x \in (\underline{x}, \overline{x})$. Given the definition of $\underline{x}$, in this equilibrium $R_H^* > R_L^*$ and therefore $BP > 0$ (Remark 2).

To characterise further, note that if $z < \overline{w} - \widehat{T}$, we have $\underline{x} < x_1 < x_2 < \overline{x}$ since, in addition, $T_L < \overline{w}$ when $T_H = \widehat{T}$ and $T_H > \widehat{T}$ when $T_L = \overline{w}$. Then, from Propositions 1 and 2, as well as Remark 1: For $x \in (\underline{x}, x_1]$ we have $T_H \in (\underline{R}, \widehat{T}]$ and $T_L \in (\widehat{T}, \overline{w})$, so (a) follows. For $x \in (x_1, x_2]$, T_H and T_L both belong to $(\widehat{T}, \overline{w}]$, so (b) follows. For $x \in (x_2, \overline{x})$ we have $T_H \in (\widehat{T}, \overline{w})$ and $T_L > \overline{w}$, so (c) follows.

For $z \geq \overline{w} - \widehat{T}$, T_H and T_L cannot both belong to $(\widehat{T}, \overline{w})$, so $x_1 > x_2$. ■

Women's demands in the marriage market are essentially determined by the flow value x of being single. Also, females require a higher wage from less attractive men - higher by an amount z. Given this, males differ in two important ways: i) less attractive men always find it more difficult to encounter wages that allow marriage, and ii) consequently, these men become discouraged (i.e. set a reservation wage lower than the female reservation wage) sooner. When both types are discouraged, $R_H^* > R_L^*$ and there is a beauty premium as well as marriage premia for both types. For lower values of x, the wages required by women decrease while the difference z remains unchanged, so now it is possible that the two types of men use different strategies, with only the less attractive males being discouraged. If the wage women demand from attractive men is relatively high (close to $\widehat{T}$), a beauty premium still obtains; however, now the marriage premium for attractive men vanishes.

Figure 2 depicts an equilibrium with a positive beauty premium and positive marriage premia for both types of men (higher for the L type):[8]

FIGURE 2 (please see at the end of paper)

Other equilibria exist. If $x = \underline{x}$ the equilibrium exhibits $BP = 0$, $MP_H = 0$ and $MP_L > 0$. If $x < \underline{x}$ (but not too low), an equilibrium with $BP < 0$ obtains, also characterised by $MP_H = 0$ and $MP_L > 0$. However, this negative beauty premium outcome appears to be empirically irrelevant (see also Section 5). For even lower values of x (both T_H, T_L decrease), and provided $z \leq \widehat{T} - \underline{R}$ (so it is possible that T_H, T_L both belong to the interval $[\underline{R}, \widehat{T}]$), an equilibrium with $MP_H = MP_L = 0$ obtains. Again, this equilibrium is empirically irrelevant, as it not only implies a negative beauty premium, but also an overall zero marriage premium.

Finally, for $x > \overline{x}$, both female reservation wages are higher than the maximum wage available on the labour market, so nobody is able to get married. This is also a highly unrealistic result.

Anticipating our empirical analysis, below we establish some further results. In Corollary 1 we discuss equilibrium marriage rates, while in Corollary 2 we highlight the subtle relationship between the two types of premia (BP and MP) across different equilibrium configurations.

Corollary 1 *(i) For $T_i \in (\underline{R}, \widehat{T}]$, the marriage rate of type i unemployed men is zero, while the marriage rate of type i employed men is independent of their wage.*

(ii) For $T_i \in (\widehat{T}, \overline{w}]$ the marriage rate of type i unemployed men is zero, while the marriage rate of type i employed men is an increasing step function of their wage.

Proof. From Lemma 1, type i unemployed cannot get married if $T_i > \underline{R}$. From Proposition 1, if $T_i \in (\underline{R}, \widehat{T}]$, we have equilibrium $R_i^* = T_i$ and all employed men get married at rate λn. In turn, if $T_i \in (\widehat{T}, \overline{w}]$, we have equilibrium $R_i^* < T_i$, and therefore only employed men with wage higher than T_i (or equal) get married, and do so at rate λn. ■

[8]Since R is common across types, while T_i are vertical lines, we can depict all this in *one* diagram.

Corollary 2 (i) *In any equilibrium, $MP_H \leq MP_L$, with strict inequality if $MP_L > 0$.*

(ii) *In any equilibrium with $BP > 0$, we have that either $MP_L > 0$ or L type men never marry.*

(iii) *In any equilibrium with marriage and $BP = 0$, we have $MP_H = 0$.*

Proof. All follow from the description of equilibrium configurations in Theorem 1 and the subsequent observations about other equilibria. ■

5 Empirical test

In this section we carry out a falsification test of the theory and consider further evidence in support of our search theoretic approach. To do this, we exploit the links between marriage premia, beauty premium and marriage rates as summarised in Corollaries 1 and 2. Using UK data, we estimate the two types of wage differentials across male workers who differ in terms of anthropometric characteristics. Following the literature, we use height and weight (body mass index BMI) as proxies for attractiveness.

Strictly speaking, if we found evidence in favour of *any* of the three tests below, our theory would be refuted. In particular, our theoretical approach would fail the strict falsification test if, when using height or weight (BMI) as proxy for beauty...

Test 1: ...we find that either (a) the marriage premium for short (obese) men is zero while the marriage premium for tall (non-obese) men is positive, or (b) the marriage premium for short (obese) men is positive and the marriage premium for tall (non-obese) is not lower. Either of these findings would contradict Corollary 2(i).

Test 2: ...we find that (given that *some* less attractive men are married), the beauty premium is positive and the marriage premium for short (obese) men is not positive. This would contradict Corollary 2(ii).

Test 3: ...we find a zero beauty premium, but the marriage premium for tall (non obese) men is different from zero. This would contradict Corollary 2(iii).

We first estimate the beauty premium in our samples, then check for the existence and pattern of marriage premia among different groups of men. Results are presented in detail and discussed below, but we note here that the estimates (especially when using height) are very much in line with the theoretical predictions. They also seem to confirm the inter-dependence of decisions across the two markets. Further evidence in support of the search theoretical approach is provided by estimates for marriage rates as a function of employment status and wages.

5.1 Data and summary statistics

We use data from the British Household Panel Survey (BHPS) from the UK. The BHPS is a longitudinal panel survey that was first collected in 1991, with the last wave obtained in 2008.[9] Initially the BHPS interviewed 5,000 households, providing around 10,000 interviews. The same individuals are interviewed each year, and if individuals split off from their original household into a new household then all members of the new household are also interviewed. The data is supplemented by extra samples covering geographical areas of the UK. The BHPS includes rich information on income and socio-economic status, making it ideal for estimating wage equations.

For all the empirical models below the dependent variable is the log of monthly labour income from the previous month. There is no variable in the BHPS for the hourly wage and while it is possible to construct such a variable, doing so risks reducing the sample size and introducing error in the measurement. We only include men who had labour income in the last month before their interview. Our focus is on men who are either in their first marriage or have not yet married. Individuals described as "living as a couple" are considered as non-married. Results from alternative specifications of the models that have these individuals dropped from the sample are very similar.

As relevant proxies for beauty (attractiveness), we use measures of height and weight (body mass index BMI). Our preferred measure is height due to

[9] The 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.

its time invariant nature and the fact that a large empirical literature supports the idea that height is positively correlated with earnings and marital outcomes. In contrast, weight is not time invariant and so it is possible that the BMI at the time of matching is different to the BMI recorded in the data. This is to be expected to a certain extent if men pay less attention to their BMI once married - see Averett et al. (2008). As a consequence, the empirically observed relationship between weight and marriage rates is less robust. In addition, the existing empirical literature shows that the correlation between BMI and wage is ambiguous.

The BHPS only collected data on weight and height in waves 14 and 16. Height and weight were measured in either metric or imperial units, but for this paper all measures were converted to metric units. We treat height as time invariant. 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, leading to a much larger sample. For each measure of beauty we categorize two groups: the attractive (tall or not obese) and the not attractive (not tall or obese). Initially, individuals are classified as not tall if their height is 1.70 metres or less. The average height of our estimation sample is 1.78 metres, which is roughly the average height for men in the UK. To check for robustness we alter the threshold height of not tall men to include taller individuals and then repeat the empirical exercise. For BMI, we split the sample into obese (BMI greater than or equal to 30) and not obese (BMI below 30).[10] For the sample in 2004 the average BMI was 26.51, but by 2006 it had increased to 26.8. We focus on men aged between 20-50, although we investigate the impact of using different age groups as well. After the deletion of missing values on variables we are left with 3,001 individuals (17,060 observations) for the height regressions and 1,706 individuals (2,454 observations) for the weight regressions.

All models include controls for age, education, self-reported health (potentially another source of productivity), race, a regional dummy, year dum-

[10]There 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 with a BMI of less than 20.

mies and a range of job specific factors such as: experience, a dummy identifying sector of employment, social class, occupational classification, number of employees and markers of union status. We only report results for the dummies related to marital status and anthropometric characteristics (height and weight). All other variables are included as controls and the results are available on request. The summary statistics for our samples are given in Table 1 below:

TABLE 1 ABOUT HERE (please see at the end of paper)

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

TABLE 2a) and 2b) ABOUT HERE (please see at the end of paper)

From the two tables above one can see that the tall and the not obese are, on average, younger and more likely to report good health. 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. The latter may be down 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 63%. However, there are larger differences in the proportion of married men when they are categorised by weight: 57% of not obese men are married, compared to 70% of obese men. Again, this may be the effect of age.

5.2 Analysis and results

Next, we present in detail the empirical analysis and results for wage differentials and marriage rates observed in our data.

5.2.1 Empirical results for beauty premium

Using our sample (men aged 20-50)[11] we estimate models that are similar to the ones in Case et al.(2009). The dependent variable is the log of monthly labour income and on the right-hand side we include measures of height and weight, together with our control variables. For height we estimate pooled OLS models because height is time-invariant and hence fixed effects models would not produce an estimate. In contrast, for weight we estimate both pooled OLS and fixed effects models. Robust standard errors, clustered on the individual, are estimated in each case.

Our results show a significant and robust positive height premium. On the other hand, the sign of the non-obesity premium depends on the specification of our model; nonetheless, it is in general found to be quite small in magnitude and not significant. Given the aforementioned shortcomings of weight as a proxy for attractiveness, as well as the well-documented ambiguous nature of empirical results pertaining to the link between BMI and wages, this is not really surprising. The results are shown in Table 3 below:

TABLE 3 ABOUT HERE (please see at the end of paper)

Model 1 shows a clear and significant height premium.[12] For weight we estimate three separate models. Using Model 2 we find that increasing weight significantly affects wages, and therefore suggests a weight premium. However, once we use the augmented Model 3 which includes height as well as weight, the estimate on weight halves and becomes insignificant, while the height premium remains. Finally, we estimate Model 4 using fixed effects and in this case the impact of increases in weight is once again found not significant.

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

[12] Case et al. (2009) also find a positive height premium using the BHPS. Their estimated coefficients are different to the ones in this paper because they (i) include fewer control variables, (ii) create an hourly wage variable, (iii) use fewer waves of data, and (iv) measure height in inches rather than meters.

5.2.2 Empirical results for marriage premium

We estimate the marriage premium for our groups controlling for unobservable heterogeneity. The theoretical model assumes that productivity is homogenous, but the data is almost certainly affected by productivity differences. In order to produce robust estimates it is vital that productivity differences are controlled for. We do this using two methods: first, we include education as a regressor and second, we use fixed effects estimation - a more robust approach.

The basic regression equation is:

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

In the above, the dependent variable w_{it} is the log of monthly income, X_{it} is a matrix of controls, α_i captures the individual specific time-invariant heterogeneity (including productivity), M_{it} is an indicator of an individual's marital status and ε_{it} is the standard idiosyncratic error term. 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. As already mentioned, it may be possible to control for potential productivity effects by including measures of education in the matrix of controls X_{it}. Since this may not completely eradicate the problem of unobservable heterogeneity, a more robust estimation is carried out, one that involves a within-individual transformation of the data, which in turn sweeps out the fixed effects. This is in fact the standard model for estimating marriage premia.[13] Table 4 below presents the regression results.

TABLE 4 ABOUT HERE (please see at the end of paper)

First, we estimate the OLS model that includes education dummies as extra regressors. The pooled OLS results on height show that the estimated marriage premium is positive and larger for men classified as tall than for the not tall men. On its own, ignoring the fact that the OLS does not account for unobserved heterogeneity, this result would contradict the predictions of our model.

[13] See Cornwell and Rupert (1995).

To overcome the problem of unobservable heterogeneity, we use fixed effects and find that the relationship is in fact reversed. The estimate for the not tall (less than 1.70m) group is positive, large and significant, while the coefficient for the tall (above 1.70m) group is close to zero and not significant. These results on marriage wage differentials appear to satisfy Test 1 part (b) which pertains to the ranking of marriage premia. Together with the evidence of a positive height premium reported above, the other relevant test is Test 2, which is also satisfied.

When we relax the threshold to 1.75m the estimated marriage premium for the not tall group remains positive and significant and is, as expected, lower. The corresponding estimate for the tall group is still close to zero and not significant. As some men - previously categorised as tall - move into the not tall group, their effect is to decrease the marriage premium for this group.

What is the effect of weight on wages? Once again, the pooled OLS yields a larger (and significant) wage premium for the attractive (not obese) group. As before, in order to address the shortcomings of OLS, we estimate a fixed effects regression. The estimate for the obese is large.[14] In contrast, the estimate for the not obese is low in magnitude and not significant. Again, on their own, these results on marriage premia appear to satisfy Test 1 part (b). Coupled with the evidence of a zero beauty premium as reported above, they also pass Test 3.

5.2.3 Empirical results for marriage rates

To investigate the effects of employment status and wages on marriage, we use various model specifications. The results are summarised in Table 5:

TABLE 5 ABOUT HERE (please see at the end of paper)

The left-hand side frame shows the estimated average partial effects (APE) from a random effects Probit, modelling the probability of marriage as a function of employment. The results show that being employed increases the probability of marriage for the whole sample, as well as for talls and not talls respectively. The estimated effect is positive and significant for both types.

[14] Although not significant, this is likely to be the result of the small sample size.

This is also true for the weight sample. These results for both height and weight add support to the predictions in Corollary 1.

The right-hand side frame of Table 5 reports APE from random effects Probits, modelling the probability of marriage for individuals who are employed. The key explanatory variable of interest is the log of monthly income. Model 1 reports results using current wages, while model 2 uses lagged wages. For the height sample, the effect is positive and significant in all cases, and higher for the not tall men. This is in line with Corollary 1(ii). For the weight sample, wages seem to affect the probability of marriage for the not obese more than for the obese. Although the actual ranking of these effects does not seem to fit entirely, their sign is once again in accordance with the predictions of Corollary 1(ii).

5.2.4 Age Robustness Checks

To see if the above results are sensitive to the defined age-groups, we re-estimated the marriage premium for age-groups 20-60 and 20-40, with the findings reported in Table 6 below.[15]

TABLE 6 ABOUT HERE (please see at the end of paper)

The 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.

As an additional robustness check we re-estimated both the beauty premium and the marriage premium using two different age samples for height: a younger sample (age 20-29) and an older sample (40-49).[16] This is relevant because individuals in the older sample may well be different to the men in the younger sample in terms of some other, potentially important, characteristics. Mature men are probably more relevant to our model, as their position

[15] It was not possible to obtain estimates for the 20-40 year old obese group because of the reduced sample size.

[16] It was not possible to do this for weight, as the sample size is too small.

in the life cycle implies lower expectations concerning divorce and relatively more stable marriages. We find that the results (summarised in Table 7) are largely the same: there is a beauty premium for both age groups, although not necessarily significant. The marriage premium is present for the not talls in both samples and there is no marriage premium for the talls.

TABLE 7 ABOUT HERE (please see at the end of paper)

5.3 Discussion

We first address the results for the height sample. In terms of marriage premium only, we have found that the marriage premium of short men is positive, while the marriage premium for tall men is zero. This passes Test 1. We have also found a positive beauty premium. Potentially, the pattern of marriage premia could falsify the model according to Test 2 above. Nevertheless, it passes that test because the marriage premium of short men was found to be positive.

As further evidence in support of our theory, we have found that employment status does indeed affect marriage rates both for tall and not tall men. Given our results on marriage premia, these findings are all in line with the predictions of Corollary 1. We have also found that the effect of wages on marriage rates is positive for both types of men, and lower for tall men than for not tall men. Strictly speaking, again based on our findings on marriage premia, the effect of wages on marriage for tall men should not only be lower than that for not tall men, but should in fact be equal to zero.

Next, we address the weight sample. In terms of marriage premium only, the most complete model specification (with fixed effects) shows a much larger marriage premium for the obese than for the not obese. These results therefore pass Test 1. The marriage premium for obese is indeed quite large, and although not significant, this is likely to be the result of the small sample size. We also find that employment status and wages affect the probability of marriage for the obese, which is line with Corollary 1 (recall that we have found a positive marriage premium for obese men). Similarly, employment status affects the probability of marriage of not obese men, and this is also in line with Corollary 1. However, contrary to the theoretical predictions, wages appear to affect the probability of marriage for these men as well.

Our paper is the first to consider the theoretical link between the beauty premium and the marriage premium, so it would be informative to also briefly consider how our empirical results relate to alternative theories of these two premia, as well as the potential relationship between the two. In particular, the existence of a positive beauty premium would be consistent with theories relating beauty to selection, whereby beauty and wages are correlated through unobservable productivity. Discrimination could be another explanation.

In the case of height, where we do find a positive beauty premium, this result - in isolation - could be seen as consistent with the alternative theories. In principle, the use of fixed effects estimation for the beauty premium should enable us to control for both productivity and discrimination assuming, not unreasonably, that they are both time invariant. However, height is also time invariant and therefore such a strategy is not open to us. We do control for education, which may proxy for productivity but it does not fully control for unobservable heterogeneity.

Since we cannot estimate fixed effects models using height, we consider instead the extent to which our results for marriage premium (obtained using fixed effects) would offer support to alternative explanations of the beauty premium. As there are no other theoretical models investigating the link between beauty premium and marriage premium, we are required to make some assumptions relating either productivity or discrimination to marriage. Our working assumptions are that individuals who are more productive or not discriminated against, are more attractive in the marriage market. We also assume that productivity and discrimination status are time-invariant. These are reasonable assumptions and they allow us to make predictions regarding the marriage premium when the beauty premium is due to productivity differences or discrimination.

With this in mind, we argue that our empirical results support the search theoretical approach, rather than the selection or discrimination based explanations. To see this, note that using OLS we obtain a positive marriage premium (see Table 3). If productivity differences or discrimination based on looks played a role in these results, OLS would be contaminated by unobservable heterogeneity. This is because the OLS cannot control for time invariant productivity status and discrimination status. Using a fixed effects model would sweep out the influence of productivity differences and/or discrimination. Consequently, there should be a zero marriage premium for any type of individual: there is no mechanism through which married individuals should earn more than unmarried individuals (controlling for other factors such as age). Since we observe a positive marriage premium for not tall men and no marriage premium for tall men, this pattern cannot be due to productivity heterogeneity or looks-based discrimination only.

6 Conclusion

In this paper we make several contributions. First, we explain the so-called beauty premium as an equilibrium outcome. The key to our theory is the frictional nature of labour- and marriage markets, together with the natural assumption that marital partnership formation is affected by the combination of wages and physical attraction. If earnings and looks are perceived as substitutes, less attractive males need higher wages to marry. However, their reservation wage (and hence average earnings) may in fact end up being lower than that of their more attractive rivals.

Second, we show that the behaviour which leads to the male beauty premium can also give rise to the male marriage premium, and we establish the link between the two types of premia.

Third, using height and weight as proxies for attractiveness, we carry out a strong falsification test of our theory, and offer further supporting evidence in favour of our approach.

The model can be extended in several ways. Focusing exclusively on the marriage premium, Bonilla and Kiraly (2016) relax the assumption of no divorce, while Bonilla, Kiraly and Wildman (2017) look at marital wage differentials across male productivity types and endogenous assortative matching in a setup with two-sided heterogeneity.

Like the ongoing work mentioned above, the present paper focuses on a couple of very specific labour and marriage market outcomes. However, it should be considered in the more general context of models with *any* interlinked frictional markets. We regard our contribution primarily as an illustration of such models as applied to the particular questions of beauty premium and marriage premium, two topics where no other previous approach seemed to us completely satisfactory. In this context, we would like to emphasise the importance of the generic decision problem we call *constrained search*, which captures the trade-offs that arise from having to search in one market in order to access another market (frictional or not). In particular, the non-monotonicity of the optimal strategy is crucial for our results. Since this property is quite robust,[17] we hope that other potential applications of constrained search in the context of inter-linked markets will stimulate further research.

References

[1] Averett, S., A. Sikora, and L.M. Argys, "For Better or Worse: Relationship Status and Body Mass Index," *Economics and Human Biology* 6(3) (2008), 330-349.

[2] Becker, G., *A Treatise on the Family*, 3rd edition (Cambridge, MA: Harvard University Press, 1991).

[3] Blackburn, M., and S. Korenman, "The Declining Marital-Status Earnings Differential," *Journal of Population Economics* 7 (1994), 249-270.

[4] Bonilla, R., and F. Kiraly, "Marriage Wage Premium in a Search Equilibrium," *Labour Economics* 24 (2013), 107-115.

[5] Bonilla, R., and F. Kiraly, "Constrained Price Search", *Newcastle University Discussion Paper* (2014).

[6] Bonilla, R., and F. Kiraly, "Divorce and Marriage Premium", *Newcastle University Discussion Paper* (2016).

[7] Bonilla, R., F. Kiraly, and J. Wildman, "Marriage Premium and Class", CESifo Working Paper No. 6550 (2017).

[8] Case, A., and C. Paxson, "Stature and Status: Height, Ability and Labor Market Outcomes," *Journal of Political Economy* 112(5) (2008), 499-532.

[17] Bonilla and Kiraly (2014) consider the version with fixed sample search and show that the optimal strategy is again non-monotonic.

[9] Case, A., C. Paxson, and M. Islam, "Making Sense of the Labor Market Height Premium: Evidence from the British Household Panel Survey," *Economics Letters* 102(3) (2009), 174-176.

[10] Cawley, J., "The Impact of Obesity on Wages," *Journal of Human Resources* 39(2) (2004), 451-474.

[11] Chiappori, P-A., S. Oreffice, and C. Quintana-Domeque, "Fatter Attraction: Anthropometric and Socioeconomic Matching on the Marriage Market," *Journal of Political Economy* 120(4) (2012), 659-695.

[12] Choo, E., and A. Siow, "Who Marries Whom and Why," *Journal of Political Economy* 114(1) (2006), 172-201.

[13] Chun, H., and I. Lee, "Why Do Married Men Earn More: Productivity or Marriage Selection?" *Economic Inquiry* 39 (2001) 307-319.

[14] Coles, M.G., and M. Francesconi, "On the Emergence of Toyboys: the Timing of Marriage with Aging and Uncertain Careers," *International Economic Review* 52(3) (2011), 825-853.

[15] Coles, M.G., and M. Francesconi, "Equilibrium Search and the Impact of Equal Opportunities for Women," *University of Essex Discussion Paper* No.19960 (2017).

[16] Cornwell, C., and P. Rupert, "Marriage and Earnings," *Economic Review, Federal Reserve Bank of Cleveland* issue Q IV (1995), 10-20.

[17] Daniel, K., "The Marriage Premium," in M. Tomassi and K. Ierulli, ed., *The New Economics of Human Behavior* (Cambridge, UK: Cambridge University Press, 1995).

[18] Garcia, J., and C. Quintana-Domeque, "Obesity, Employment, and Wages in Europe," in K. Bolin and J. Cawley, ed., *Advances in Health Economics and Health Services Research*, vol. 17, *The Economics of Obesity* (Amsterdam: Elsevier, 2007).

[19] Grossbard-Shechtman, S.A., and S. Neuman, "Marriage and Work for Pay," in Grossbard-Shechtman, S.A., ed., *Marriage and the Economy* (Cambridge, UK: Cambridge University Press, 2003).

[20] Hamermesh, D., *Beauty Pays: Why Attractive People Are More Successful* (Princeton, NJ: Princeton University Press, 2011).

[21] Hamermesh, D., and J. Biddle, "Beauty and the Labor Market," *American Economic Review* 84(5) (1994), 1174-1194.

[22] Han, E., E. Norton, and S. Stearns, "Weight and Wages: Fat versus Lean Paychecks," *Health Economics* 18 (2009), 535-548.

[23] Herpin, N., "Love, Careers and Heights in France," *Economics and Human Biology* 3 (2005), 420-449.

[24] Hersch, J., and L.S. Stratton, "Household Specialization and the Male Marriage Wage Premium," *Industrial and Labor Relations Review* 54(1) (2000), 78-94.

[25] Kaplan, G. and G. Menzio, "Shopping Externalities and Self-fulfilling Employment Fluctuations," *Journal of Political Economy* 124(3) (2016), 771-825.

[26] Korenman, S., and D. Neumark, "Does Marriage Really Make Men More Productive?" *Journal of Human Resources* 26(2) (1991), 282-307.

[27] Loh, E. S., "Productivity Differences and the Marriage Wage Premium for White Males," *Journal of Human Resources* 31(3) (1996), 566-589.

[28] Manfredini, M., M. Breschi, A. Fornasin, and C. Seguieri, "Height, Socioeconomic Status and Marriage in Italy Around 1900," *Economics and Human Biology* 11 (2013), 465-473.

[29] Morris, S., "Body Mass Index and Occupational Attainment," *Journal of Health Economics* 25(2) (2006), 347-364.

[30] Mortensen, D.T., "The Matching Process as a Noncooperative Bargaining Game," in J.J. McCall, ed., *The Economics of Information and Uncertainty* (Chicago: University of Chicago Press, 1982).

[31] Oreffice, S., and C. Quintana-Domeque, "Anthropometry and Socioeconomics Among Couples: Evidence in the United States," *Economics and Human Biology* 8(3) (2010), 373-384.

[32] Persico, N., A. Postlewaite and D. Silverman, "The Effect of Adolescent Experience on Labor Market Outcomes: the Case of Height," *Journal of Political Economy* 112(5) (2004), 1019-1053.

[33] Ponthieux, S., and D. Meurs, "Gender Inequality," in: Atkinson, A.B. and F. Bourgouignon (Eds.), *Handbook of Income Distribution* (Vol. 2A). North Holland, Amsterdam, 2014.

[34] Ponzo, M., and V. Scoppa, "Trading Height for Education in the Marriage Market," *American Journal of Human Biology* 27 (2015), 164-174.

[35] Rupert, P., and E. Wasmer, "Housing and the Labor Market: Time to Move and Aggregate Unemployment," *Journal of Monetary Economics* 59 (2012), 24-36.

[36] Sargent, J.D., and D.G. Blanchflower, "Obesity and Stature in Adolescence and Earnings in Young Adulthood: Analysis of a British Birth Cohort," *Archives of Pediatrics and Adolescent Medicine* 148 (1994), 681-687.

[37] Silventoinen, K., J. Kaprio, E. Lahelma, R.J. Viken, and R.J. Rose, "Assortative Mating by Body Height and BMI: Finnish Twins and Their Spouses," *American Journal of Human Biology* 15(5) (2003), 620-627.

[38] Weiss, Y., and R. Willis, "Match Quality, New Information, and Marital Dissolution," *Journal of Labor Economics* 15 (1997), 293-329.

TABLE 1 Summary Statistics

Variable	Obs (N*T)	Mean	Std. Dev.	Obs (N*T)	Mean	Std. Dev.
		Height sample			BMI sample	
Log monthly income	17060	6.836	0.565	2454	6.861	0.589
Married	17060	0.627	0.484	2454	0.597	0.491
Age	17060	35.335	8.520	2454	35.638	8.682
Household size	17060	3.324	1.343	2454	3.326	1.379
Number of children	17060	0.897	1.076	2454	0.873	1.065
Good health	17060	0.821	0.383	2454	0.833	0.373
Degree or above	17060	0.229	0.420	2454	0.244	0.429
Higher school qualification	17060	0.343	0.475	2454	0.330	0.470
Lower school qualification	17060	0..318	0.466	2454	0.329	0.470
No qualifications	17060	0.110	0.313	2454	0.097	0.296
London region	17060	0.060	0.238	2454	0.043	0.203
Job sector	17060	0.733	0.442	2454	0.771	0.420
Social class 1	17060	0.080	0.271	2454	0.067	0.250
Social class 2	17060	0.344	0.475	2454	0.361	0.481
Social class 3	17060	0.152	0.359	2454	0.157	0.364
Social class 4	17060	0.271	0.445	2454	0.255	0.436
Social class 5	17060	0.124	0.329	2454	0.125	0.331
Social class 6	17060	0.030	0.170	2454	0.034	0.182
Experience (days)	17060	1722.46	2104.909	2454	1822.136	2193.266
Union member	17060	0.439	0.496	2454	0.436	0.496
Size of work place large	17060	0.539	0.499	2454	0.553	0.497
Height (metric)	17060	1.782	0.071		1.784	0.070
Body Mass Index				2454	26.791	4.290

TABLE 2a Summary Statistics: Height

		Tall			Not Tall	
Variable	Obs	Mean	Std. Dev.	Obs	Mean	Std. Dev.
Log monthly income	15465	6.847	0.560	1595	6.724	0.596
Married	15465	0.627	0.484	1595	0.629	0.483
Age	15465	35.269	8.513	1595	35.97	8.555
Household size	15465	3.324	1.341	1595	3.321	1.371
Number of children	15465	0.907	1.083	1595	0.797	1.002
Good health	15465	0.825	0.380	1595	0.782	0.413
Degree or above	15465	0.240	0.427	1595	0.124	0.330
Higher school qualification	15465	0.347	0.476	1595	0.310	0.463
Lower school qualification	15465	0.309	0.462	1595	0.405	0.491
No qualifications	15465	0.105	0.306	1595	0.161	0.368
London region	15465	0.060	0.238	1595	0.063	0.244
Job sector	15465	0.732	0.443	1595	0.739	0.439
Social class 1	15465	.082	0.274	1595	0.55	0.228
Social class 2	15465	0.351	0.477	1595	0.267	0.443
Social class 3	15465	0.158	0.365	1595	0.092	0.289
Social class 4	15465	0.261	0.439	1595	0.369	0.483
Social class 5	15465	0.119	0.324	1595	0.171	0.377
Social class 6	15465	0.028	0.165	1595	0.046	0.209
Experience (days)	15465	1779.917	2105.814	1595	1914.082	2092.872
Union member	15465	0.437	0.496	1595	0.460	0.499
Size of work place large	15465	0.535	0.499	1595	0.577	0.494
Height (metric)	15465	1.795	0.060	1595	1.652	0.035

TABLE 2b Summary Statistics: Obesity

	Not Obese			Obese		
Variable	Obs	Mean	Std. Dev.	Obs	Mean	Std. Dev.
Log monthly income	1988	6.850	0.568	446	6.907	0.669
Married	1988	0.572	0.495	446	0.704	0.457
Age	1988	35.077	8.764	446	38.032	7.892
Household size	1988	3.285	1.409	446	3.500	1.229
Number of children	1988	0.846	1.074	446	0.987	1.020
Good health	1988	0.849	0.359	446	0.766	0.424
Degree or above	1988	0.246	0.431	446	0.232	0.422
Higher school qualification	1988	0.325	0.467	446	0.350	0.477
Lower school qualification	1988	0.335	0.472	446	0.305	0.461
No qualifications	1988	0.093	0.291	446	0.114	0.318
London region	1988	0.043	0.203	446	0.043	0.203
Job sector	1988	0.772	0.420	446	0.770	0.421
Social class 1	1988	0.065	0.246	446	0.0773	0.267
Social class 2	1988	0.366	0.482	446	0.343	0.475
Social class 3	1988	0.160	0.367	446	0.146	0.353
Social class 4	1988	0.251	0.434	446	0.270	0.445
Social class 5	1988	0.121	0.326	446	0.142	0.349
Social class 6	1988	0.037	0.189	446	0.021	0.145
Experience (days)	1988	1782.900	2157.076	446	1989.519	2336.423
Union member	1988	0.429	0.494	446	0.504	0.501
Size of work place large	1988	0.563	0.496	446	0.511	0.500
Height (metric)	1988	1.796	0.069	446	1.779	0.070
Body Mass Index	1988	25.22	2.493	446	33.493	3.869

TABLE 3 Effect of Height and Weight on Wages

		N		Coefficient	Std. Err.
Height (m)					
Model 1	OLS	17,060	Height (m)	0.404***	(0.109)
Weight (kg)					
Model 2	OLS	2,425	Weight (kg)	0.0013*	(0.0007)
Model 3	OLS	2,425	Weight (kg)	0.0007	(0.0009)
			Height (m)	0.302*	(0.182)
Model 4	Fixed Effects	2,454	Weight (kg)	0.001	(0.0012)

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

The dependent variable in all models is log monthly wages.

The models all show the estimates attached to the 'Married' variable. All models include a full range of controls: age, health, race, region, job sector, size of employer, occupational social class, experience, union membership, experience and year dummies. Clustered standard errors are presented in brackets.

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

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	0.148^{***}	0.190^{***}	0.198^{***}	0.181^{***}
		(0.055)	(0.020)	(0.033)	(0.024)
Fixed Effects	Married	0.386^{***}	-0.011	0.241^{***}	-0.021
		(0.111)	(0.045)	(0.071)	(0.052)
N		1595	15465	4877	12183
		Obese	**Not obese**		
OLS (including education)	Married	0.087	0.173^{***}		
		(0.091)	(0.032)		
Fixed Effects	Married	0.215	0.018		
		(0.248)	(0.184)		
N		466	1988		

*, **, ***: 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, race, region, job sector, size of employer, occupational social class, experience, union membership, experience and year dummies.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.

TABLE 5 Probability of marriage

	Employed		
	All	Tall	Not Tall
APE	0.053***	0.064***	0.061**
	(0.010)	(0.012)	(0.017)
N	23398	21042	2356
	All	Not obese	Obese
APE	0.082***	0.157***	0.122**
	(0.011)	(0.033)	(0.082)
N	3454	2837	617

	Model		Log monthly income		Log monthly income lagged one year	
			Tall	Not Tall	Tall	Not Tall
	1	APE	0.048***	0.102***		
			(0.008)	(0.027)		
Height		N	15307	1575		
	2	APE			0.032***	0.073***
					(0.008)	(0.027)
		N			13016	1329
			Not Obese	Obese	Not Obese	Obese
	1	APE	0.071***	0.030**		
			(0.025)	(0.013)		
Weight		N	1963	462		
	2	APE			0.098***	0.031
					(0.020)	(0.023)
		N			1762	447

*, **, ***: 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, region, education, and year dummies. Standard errors are presented in brackets.

TABLE 6 Effect of Marital Status on Wages, by Age Groups

20-60		**Not tall**		**Tall**	
FE	Married	0.389***	(0.103)	0.004	(0.041)
N		2279		19423	
		Obese		**Not obese**	
FE	Married	0.09	(0.151)	-0.01	(0.177)
N		649		2580	
20-40		**Not tall**		**Tall**	
FE	Married	0.264***	(0.071)	-0.040	(0.047)
N		960		9824	
		Obese		**Not obese**	
FE	Married	1.276	(1.229)	0.231***	(0.054)
N		244		1244	

*, **, ***: 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, race, region, job sector, size of employer, occupational social class, experience, union membership, experience and year dummies. Clustered standard errors are presented in brackets.

TABLE 7 Beauty Premium and Marriage Premium, by Age Groups

	Beauty Premium		Marriage Premium			
Age 20-29			Not Tall		Tall	
Height	0.195	(0.121)				
Married			0.345***	(0.163)	-0.012	(0.041)
N	4882		415		4467	
Age 40-49						
Height	0.654***	(0.184)				
Married			0.298***	(0.112)	-0.188***	(0.094)
N	6276		635		5641	

*, **, ***: 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, race, region, job sector, size of employer, occupational social class, experience, union membership, experience and year dummies. Clustered standard errors are presented in brackets.

Appendix 1: For $T_i \in [\underline{R}, \widehat{T}_i)$, we have $J_i(T_i) < V_i^S(w \mid w \geq T_i)$.

Recall that $J_i(T_i) < V_i^S(w \mid w \geq T_i)$ for $T_i = \widehat{T}_i - \varepsilon$. Also, $J_i(T_i)$ is monotonic in T_i while $V_i^S(w \mid w \geq T_i)$ is independent of T_i. Hence, we only need to show that $J_i(T_i) < V_i^S(w \mid w \geq T_i)$ also holds for some $T_i < \underline{R}$.

To that end, define $\widetilde{T}_i$ as the T_i so low that $J_i(\widetilde{T}_i) = V_i^S(w \mid w = \widetilde{T}_i) = \frac{\widetilde{T}_i}{r+\delta} + \frac{\lambda n}{(r+\delta)(r+\delta+\lambda n)} y$. This makes $\widetilde{T}_i$ the reservation wage which solves:

$$\frac{\widetilde{T}_i}{r+\delta} + \frac{\lambda n}{(r+\delta)(r+\delta+\lambda n)} y =$$

$$= \frac{\lambda_0}{r+\delta+\lambda_0} F(\widetilde{T}_i) \int_{\underline{w}}^{\widetilde{T}_i} \left[\frac{\widetilde{T}_i}{r+\delta} + \frac{\lambda n}{(r+\delta)(r+\delta+\lambda n)} y \right] dF(w' \mid w' < \widetilde{T}_i) +$$

$$+ \frac{\lambda_0}{r+\delta+\lambda_0} [1 - F(\widetilde{T}_i)] \int_{\widetilde{T}_i}^{\overline{w}} \left[\frac{w}{r+\delta} + \frac{\lambda n}{(r+\delta)(r+\delta+\lambda n)} y \right] dF(w' \mid w' > \widetilde{T}_i).$$

The worker rejects any wage below $\widetilde{T}_i$ and stays on $J_i(\widetilde{T}_i) = V_i^S(\widetilde{T}_i) = \frac{\widetilde{T}_i}{r+\delta} + \frac{\lambda n}{(r+\delta)(r+\delta+\lambda n)} y$. The worker accepts any wage offer above $\widetilde{T}_i$ and gets $\frac{w}{r+\delta} + \frac{\lambda n}{(r+\delta)(r+\delta+\lambda n)} y$. Note that, although the worker is marriageable when earning a wage $w \geq \widetilde{T}_i$, he is not marriageable while unemployed.

Remove the conditionals in the distributions, take $\frac{\lambda n}{(r+\delta)(r+\delta+\lambda n)} y$ out of the integrals, then add and substract $\frac{\lambda_0}{r+\delta+\lambda_0} \int_{\widetilde{T}_i}^{\overline{w}} \frac{\widetilde{T}_i}{r+\delta} dF(w')$ to obtain:

$$\begin{aligned} \frac{\widetilde{T}_i}{r+\delta} + \frac{\lambda n}{(r+\delta)(r+\delta+\lambda n)} y \quad &= \quad \frac{\lambda_0}{r+\delta+\lambda_0} \left[\frac{\widetilde{T}_i}{r+\delta} + \int_{\widetilde{T}_i}^{\overline{w}} \left[\frac{w - \widetilde{T}_i}{r+\delta} \right] dF(w') \right] + \\ &+ \frac{\lambda_0}{r+\delta+\lambda_0} \frac{\lambda n}{(r+\delta)(r+\delta+\lambda n)} y. \end{aligned}$$

Finally, simplify to get:

$$\widetilde{T}_i = \frac{\lambda_0}{r+\delta} \int_{\widetilde{T}_i}^{\overline{w}} \left[w - \widetilde{T}_i \right] dF(w') - \frac{\lambda n}{(r+\delta+\lambda n)} y < \underline{R}.$$

Appendix 2: Proof of Claim 1.

From Proposition 1, we know that $R_i(T_i) < T_i$ in that range. Hence, $V_i^S(R_i) = R_i/(r+\delta)$. From the proof of Proposition 1, $J_i = V_i^S(R_i)\ (= R_i/(r+\delta))$, so the reservation wage solves:

$$\frac{R_i}{r+\delta} = \frac{\lambda_0}{r+\delta+\lambda_0} F(R_i) \int_{\underline{w}}^{R_i} \left[\frac{R_i}{r+\delta}\right] dF(w \mid w < R_i) +$$

$$+\frac{\lambda_0}{r+\delta+\lambda_0}[F(T_i) - F(R_i)] \int_{R_i}^{T_i} \left[\frac{w}{r+\delta}\right] dF(w \mid R_i < w < T_i) +$$

$$+\frac{\lambda_0}{r+\delta+\lambda_0}[1 - F(T_i)] \int_{T_i}^{\overline{w}} \left[\frac{w}{r+\delta} + \frac{\lambda n}{(r+\delta)(r+\delta+\lambda n)} y\right] dF(w \mid w > T_i).$$

Bringing $\frac{\lambda n}{(r+\delta)(r+\delta+\lambda n)} y$ out of the integral, adding and substracting $\int_{R_i}^{\overline{w}} \frac{R_i}{r+\delta} dF(w)$, and then simplifying yields:

$$\frac{R_i}{r+\delta} = \frac{\lambda_0}{r+\delta+\lambda_0}\left[\frac{R_i}{r+\delta} + \int_{R_i}^{\overline{w}} \left[\frac{w - R_i}{r+\delta}\right] dF(w) + \frac{[1 - F(T_i)]\lambda n}{(r+\delta)(r+\delta+\lambda n)} y\right].$$

Simplification and integration by parts lead to the R_i from Claim 1.

Appendix 3: Proof of Lemma 2

If there are no search frictions in the labour market ($\lambda_0 \to \infty$), then $R_i(T_i) = \overline{w}$. Note that $\widehat{T}$ is a function of y. Since $\partial F(\widehat{T})/\partial \widehat{T} > 0$, we have:

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

Solving for y we obtain:

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

Then, $\lim_{\widehat{T} \to \overline{w}} y = \infty$, 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 immediately that $\lim_{y \to \infty} \widehat{T} = \overline{w}$.

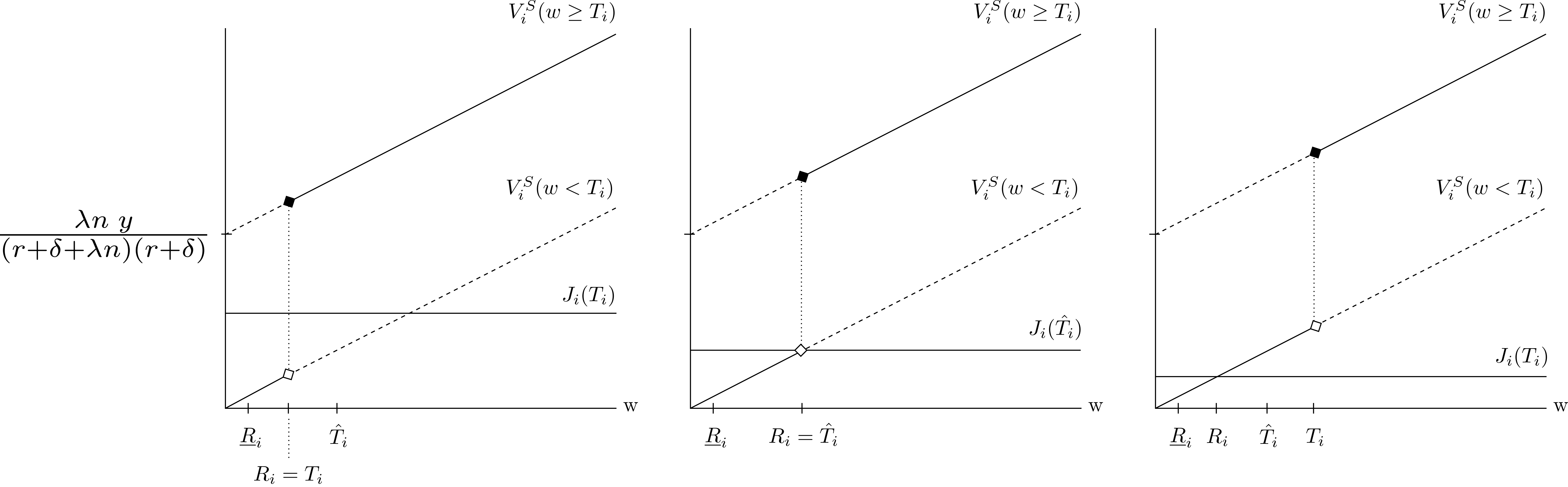
Appendix 4: Proof of Proposition 2

Once married, an unemployed man would drop his reservation wage to $\underline{R}$, but if $T_i \leq \underline{R}$ a woman is willing to marry such a man anyway. Recall that $J_i^M = (\underline{R}+y)/(r+\delta)$ and let $J_i^{'}$ denote the value of a single unemployed man in this scenario.

For any optimally chosen reservation wage R_i' that is higher than T_i (or equal) we have $V_i^S(w \mid w \geq T_i)$ for any acceptable offer. This value is continuous in w, we can therefore write $J_i^{'}$ using the standard asset pricing equation:

$$(r+\delta)\, J_i' = \lambda n \left[J_i^M - J_i'\right] + \lambda_0 \int_{R_i'}^{\overline{w}} \left[\frac{w}{r+\delta} + \frac{\lambda n}{(r+\delta)(r+\delta+\lambda n)} y - J_i'\right] dF(w),$$

with the reservation wage $R_i^{'}$ solving $V_i^S(R_i^{'}) = J_i'$. It is easy to show that $\underline{R}$ is indeed higher than T_i and satisfies $V_i^S(\underline{R}) = J_i'$, so $R_i^{'} = \underline{R}$. Finally, for $T_i > \overline{w}$, we have $F(T_i) = 1$ and the problem reverts to one of standard job search.



(a) $\underline{R}_i < T_i < \hat{T}_i$

(b) $T_i = \hat{T}_i$

(c) $\hat{T}_i < T_i \leq \overline{w}$

Figure 1

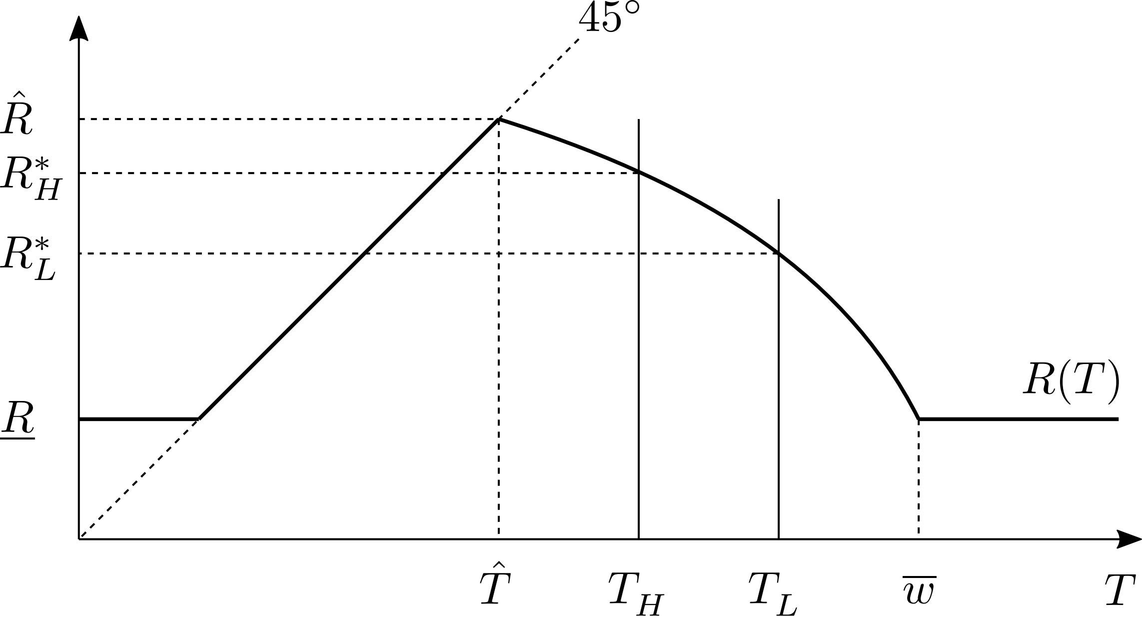


Figure 2