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**Conference Paper**

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Beiträge zur Jahrestagung des Vereins für Socialpolitik 2014: Evidenzbasierte Wirtschaftspolitik  
- Session: Marriage and Children, No. B02-V3

**Provided in Cooperation with:**

Verein für Socialpolitik / German Economic Association

*Suggested Citation:* Bronsert, Anne-Kathrin; Glazer, Amihai; Konrad, Kai A. (2014) : Old Money, the Nouveau Riche and Brunhilde's Marriage Dilemma, Beiträge zur Jahrestagung des Vereins für Socialpolitik 2014: Evidenzbasierte Wirtschaftspolitik - Session: Marriage and Children, No. B02-V3, ZBW - Deutsche Zentralbibliothek für Wirtschaftswissenschaften, Leibniz-Informationszentrum Wirtschaft, Kiel und Hamburg

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# Old Money, the Nouveau Riche and Brunhilde’s Marriage Dilemma

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February 13, 2014

## Abstract

This paper proposes a screening approach to explain why dating is associated with purchasing status products and conspicuous gift giving. A potential bride searching for a husband may seek to screen candidates whose income is only partially observable. Taking into account that she also bears part of the screening costs, she can sort candidates by offering a menu of contracts that triggers but also constrains conspicuous consumption.

Keywords: marriage, screening, search, conspicuous consumption, status

JEL Classification: J12, D82

## 1 Introduction

Courting Mrs. or Mr. Right may be an intricate experience in reality. In the epic poem “The Song of the Nibelungs,” courtship rules are straightforward and simply announced by the potential bride: Brunhilde will only accept to marry a man who emerges victorious in a fight with her. This makes Brunhilde one of the most famous examples for a behavior that we address in this paper: screening in marriage markets. The Brunhildes of modern times are not looking for a good fighter. The virtues that make a good husband or a husband who can support her and their offspring have

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changed. Material wealth, earnings ability, and career prospects are more crucial today. However, the information problem that Brunhilde faces is very similar today. A candidate's wealth or, more generally, material potential, may be better known to the candidate than what is directly observable. Some relevant characteristics may be easy to observe, such as family background, inherited wealth or educational achievements. But other components such as the candidate's ambition or dedication to work hard may be known only to the candidate. This causes a situation in which candidates differ along several relevant dimensions some of which are private information. The modern world Brunhilde may then use a screening mechanism to make sure that the respective candidate offers sufficient potential. Such a proof may involve an engagement ring (Ng 1987); or such a proof may involve a Rolex watch, a Ferrari, a Hermès handbag, Cartier jewelry or other conspicuous consumption products which the candidate displays or gives to Brunhilde.

The intensity of such activities differs widely, even within the same society. Candidates with a strong family background ("old money") seemingly engage less heavily in status activities than the new rich. Differences in their observable wealth may indeed explain some of these differences. We ask how Brunhilde's equilibrium demands depend on the observable characteristics of candidates and whether the equilibrium has a distinction between what could be called "old money" and the "new rich."

Conspicuous consumption such as expensive gifts of status goods in the courtship process is at least partially wasteful. It eats up valuable resources and the candidate and the bride could make better use of these resources by spending them on what could be called genuine consumption. However, the status goods play an important role in overcoming an information problem about a candidate's quality. A screening approach can yield more parsimonious resource use than what may occur in a signaling equilibrium. Further, it turns out that this approach has features that have their empirical counterpart in the higher amount of wasteful status spending among the "nouveau riche" in comparison to "old money" people. The latter can be described as candidates endowed with observable characteristics, which already guarantee a high lower bound for their possible income or wealth generating abilities. Such observable characteristics, which make the true income of candidates partially observable, reduce status spending in the screening equilibrium.

Marriage may not only be about money, income or wealth. However, the resource motive finds a great deal of support, not least by evolutionary biologists (e.g., Trivers

1972). They emphasize the resource capacity that the male partner may bring into a marriage and which benefits the couple's offspring. We follow this majority tradition and disregard love and affection as marriage motives for our analysis here. The asymmetric information problem that emerges when a candidate meets our modern world Brunhilde cannot simply be bridged by a look at each other's bank accounts. The male candidate's ability and dedication to earn an income hinge on characteristics that are much better known to him than to her, and the credible transmission of this information is an important problem.<sup>1</sup> Evolutionary psychology literature suggests that men (but not women) use costly signals such as flaunting luxury possessions to display their earning capacity and ability to support their offspring as this has proven an evolutionarily beneficial courtship strategy.<sup>2</sup> In line with this argument, whereas men put greater weight on physical attractiveness in mates, women place more value on intelligence, favor men who grew up in wealthier neighborhoods (Fisman et al. 2006), and prefer men who have a good earning potential (Buss and Barnes 1986). This finding is substantiated by a recent field experiment on a Chinese online dating website where women of all income levels visited profiles of high-income males more often and where women's visits to these profiles were an increasing function of their own income (Ong and Wang 2013). There is also experimental evidence that men in a mating mindset are more likely to pay attention to status goods (Janssens et al. 2011) and actually intend to buy more luxury products (and less functional products) whereas in women the mating motive triggers not conspicuous consumption but conspicuous benevolence

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<sup>1</sup>The problem is even more serious if we take further aspects into account. Treating her to dates and giving her presents may also be about revealing spending habits and financial values. People afraid of being perceived as a tightwad or spendthrift soon find themselves in a quandary as they are uncertain about what exactly their potential partner infers from the conspicuous gifts they gave to him or her. The exact message conveyed by conspicuous products is unclear. In addition, people talk about their profession, their college, their family, and what kind of friends they have. Depending on what these pieces of information say about someone (for example, whether the person has an old or new money background), this person should actually choose a different consumption pattern to signal his or her otherwise unobservable earning potential, income or wealth. To make things even worse, people realize that during courtship they do not want to burn money which they would prefer to spend once they found the right partner to marry. The purpose of this paper is to shed some light on these issues. In a first approach to the topic, we disregard these intricate matters.

<sup>2</sup>For a comprehensive survey on consumer behavior from an evolutionary perspective, see Griskevicius and Kenrick (2013) who discuss so-called fundamental motives such as attaining status, acquiring and keeping a mate. Pan and Houser (2011) also provide an overview of evidence from experimental economics and evolutionary psychology explaining gender differences in pro-social behavior.

(Griskevicius et al. 2007)<sup>3</sup>. Moreover, Sundie et al. (2011) report that women interpret men’s signaling behavior correctly and that women find men who buy status goods more sexually attractive. Also, women in the fertile phase of the menstrual cycle pay more attention to status products (Lens et al. 2012).

The economic theory on status consumption highlighted the instrumental role of conspicuous consumption for attracting a better marriage partner. This instrumental aspect of status is behind many of the status-seeking models. De Fraja (2009), for instance, explicitly links utility maximization to the biological problem of fitness maximization. Men face a trade-off between investing in their survival and conspicuous consumption that signals their quality and thus increases their matching probability. Much of the theory emphasizes the role of status goods as a means to signal income (Bagwell and Bernheim 1996; Corneo and Jeanne 1997; Frank 1985; Ireland 1994, 1998, 2001; Glazer and Konrad 1996; Moav and Neeman 2012) often with consideration of the role of the income of potential grooms in the context of marriage matching and much of this literature simply awards a benefit to an individual if he is successful in signaling certain properties such as income in a signaling game.

Several papers are closely related to our analysis. Bergstrom and Bagnoli (1993) suggest that men’s earnings ability is their private information when they are young, but over time, and as they get older, this ability is better and better observable. They conclude that men with a high earnings ability may find it worthwhile to postpone their courtship decision until their high ability is revealed, whereas low-ability men ought to marry early, and they find supporting empirical evidence for this. Pesendorfer (1995) also considers asymmetric information and considers a direct link between status consumption and marriage markets. In his framework, wearing the latest fashion trends increases the probability of being matched with a high-quality partner.<sup>4</sup> Similarly, addressing the role of conspicuous consumption for the initiation of a relationship, Thomas (2013) derives the market demand for a single status good and identifies a critical price above which a separating equilibrium emerges. Corneo and Jeanne (1998) study the effect of the timing of a status contest over a two-period life cycle on aggregate savings. Matching takes place in social interaction groups that belong

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<sup>3</sup>The role of women’s conspicuous spending in relationships is studied in a recent experiment by Wang and Griskevicius (2014) who suggest that women use luxury products to signal their partners’ commitment to them to deter romantic rivals.

<sup>4</sup>Pesendorfer (1995) models a dating game with signaling via fashion trends to explain fashion cycles.

either to a high or low income class. Therefore, conspicuous consumption improves the matching outcome as it allows men to be believed to belong to the high income class. Hoppe et al. (2009) consider a matching contest in a two-sided market characterized by incomplete information on the desirability of the potential partner. Both men and women send costly signals which are then used to rank individuals according to their signals and to match them assortatively. Moav and Neeman (2012) also analyze income signaling. Their framework shares the property with ours that individuals have different components that determine their income. The observable component in their framework is human capital. Using an overlapping generations model, they endogenize the amount of extra information (i.e., human capital), which is available in addition to the signal via conspicuous consumption.<sup>5</sup>

This literature assumes a signaling game. Candidates choose observable expenditure for status goods and leave it to the other side of the market to interpret these observable actions and to form beliefs about the desirable characteristics of the candidate. In contrast, we pursue a screening approach to overcome this problem of asymmetric information. Rather than waiting for some signals and interpreting them, the bride who is looking for Mr. Right uses a screening device. She may tell possible grooms how she would interpret what kind of action. From a theory perspective, there is a clear efficiency argument in favor of screening. Sorting candidates under signaling is less efficient compared to screening due to over-investment in signaling games off the equilibrium play, which is corroborated by experimental evidence (Güth and Winter 2013).<sup>6</sup> A second distinguishing feature of our approach is partial observability. Financial assets or family background may be observable. Other characteristics that also affect a male's income prospects are not. We ask how this component-wise difference in observability affects the optimal screening mechanism, and whether this can explain

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<sup>5</sup>Furthermore, our paper relates to signaling models that account for information on the sender's type, which is available in addition to his signal. In Feltovich et al. (2002), apart from the endogenously chosen signal, the receiver observes some noisy exogenously given extra information about the sender. This extra information is not known to the sender when he chooses his signal. Equilibria are found in which medium types signal to distinguish themselves from low types. In contrast, high types choose to countersignal, i.e., they do not signal as they are confident that they will not be perceived as low types. Fremling and Posner (1999) distinguish between two components of status: one which is a fixed endowment, and a second component which is affected by signaling. They discuss how, within the same income class, individuals endowed with high status choose to signal less compared to those individuals endowed with little status.

<sup>6</sup>However, Kübler et al. (2008) find similar investment rates in signaling and screening treatments.

observed status consumption patterns. The optimal screening mechanism also extracts less than the full amount of information. Brunhilde only needs to know whether the respective candidate's total income is above some threshold. Third, in our framework status consumption is costly not only for the player who buys these goods, but also for Brunhilde who is hurt by the status expenditure. The bride does not want a potential groom to spend too much money on luxury products, thereby wasting resources they would consume jointly once they are married.<sup>7</sup> This is a key difference between standard screening models and our approach.

Our framework is flexible as regards the share in the screening cost borne by the screening player. In fact, to court his potential bride a man may buy status products which also give him some intrinsic utility. Or he may buy status gifts, which also give some intrinsic utility to Brunhilde. At the one extreme, some conspicuous goods only serve as proof of his wealth, but provide no intrinsic utility either to him or to his potential bride. At the other extreme, there are conspicuous presents to the potential bride such as jewelry or branded handbags from which she derives some intrinsic utility. But even if all status consumption is in terms of conspicuous gift giving, the value Brunhilde attributes to the gifts is presumably lower than the opportunity cost, which is using this money optimally in a future relationship.<sup>8</sup>

Finding a husband is a search problem that may take several periods. As we focus on the question of how a potential bride may design a menu of contracts that induces but also limits conspicuous consumption to screen candidates, we start with a one-shot choice problem.<sup>9</sup> We focus on one opportunity to date a given, randomly drawn candidate and on the screening problem from the perspective of a single woman.

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<sup>7</sup>There are several other reasons why women may judge men who buy luxury goods carefully. First, men may go into debt to provide a dishonest signal of their desirability as a mate (Gallup and Frederick 2010). Kruger (2008) finds that men who spend more than they save and are more likely to live beyond their means to have a significantly higher number of sex partners compared to men with a more frugal lifestyle. Lastly, purchasing conspicuous products may not signal the desirable qualities of a partner but rather the opposite: interest in status goods is found to be triggered by feeling powerless (Rucker and Galinsky 2008, 2009) or a need to restore one's self-worth (Sivanathan and Pettit 2010).

<sup>8</sup>In China, a significant fraction of consumption of luxury products is reported to be driven by conspicuous gift giving to second wives (Doctoroff 2011). Also, in 2010 government action curbed boasts of wealth in a popular Chinese dating TV show (Yang 2010).

<sup>9</sup>For a survey on search theory see McMillan and Rothschild (1994). Important contributions to the theory on marriage matching include Burdett and Coles (1997, 1999). Browning et al. (forthcoming) provide a broad treatment of family economics including matching theory.

She decides about this candidate and has a default utility in case she rejects this candidate. In a more encompassing model, this default utility may be endogenized and may depend, among other things, on her future prospects of meeting alternative candidates. In a later section we discuss some aspects of this larger, dynamic context.

Our model substantiates the observation that, in contrast to people from an old money background, the nouveaux riches also flaunt luxury goods when it comes to marriage matching. In fact, a candidate from an old money background will be requested to spend less money conspicuously compared to a self-made man who made it into the class of new money but has little observable wealth.<sup>10</sup> Additionally, we find that screening candidates becomes more difficult for a potential bride who is particularly sought after (for example, because of her beauty or personality or due to a highly male-biased sex ratio). In this case, men of all income classes may be willing to spend so much money conspicuously to generate a conflict with the potential bride’s aim to limit wasteful conspicuous expenditures.

The paper is organized as follows. In the next section, we present the framework of the model and derive the bride’s sorting strategy in a static setting. Section 3 addresses some dynamic implications. Section 4 discusses and concludes.

## 2 Assumptions and analytical framework

We consider the decision making of an unmarried female who is seeking a resource rich marriage partner. We name her Brunhilde. Suppose she meets one potential partner. This candidate  $i$  would like to marry Brunhilde. It is up to her to say yes or no. The candidate is drawn randomly from a given set of possible candidates. The candidate has two sources of (lifetime) income. Income may be interpreted in a wide sense here and may include components that have a monetary equivalent, including aristocratic title, connectedness, a good family background, etc. Candidate  $i$ ’s total present value of lifetime income is

$$x_i = m_i + n_i. \tag{1}$$

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<sup>10</sup>Whereas, in our model, conspicuous consumption is decreasing in observable income, in Moav and Neeman (2012) conspicuous consumption is decreasing in observable human capital. There it is argued that the poor and the nouveaux riches do not hold diplomas or professional titles and therefore rely on conspicuous consumption to signal their success.



Both income components  $m_i$  and  $n_i$  are drawn independently from a uniform distribution on the unit interval  $[0, 1]$  and are observed by the candidate. Brunhilde can only observe one component,  $m_i$ , and knows the distribution from which the second component  $n_i$  is drawn. The interval  $[0, 1]$  is a normalization, and the choice of a uniform distribution is made to allow for closed form solutions. Conceptionally, it is clear how the analysis generalizes for a more general distribution of observable and unobservable income components and for different distributions for  $m_i$  and  $n_i$ .

The candidate can spend any amount  $c_i$  of his income  $x_i$  on a conspicuous activity, which we refer to as conspicuous or status consumption.<sup>11</sup> What remains after conspicuous consumption is available for genuine consumption. If  $i$ 's total income is  $x_i$ , then  $c_i \in [0, x_i]$  and genuine consumption is

$$g_i = x_i - c_i. \tag{2}$$

Prior to observing any characteristic or choice by the candidate, Brunhilde can offer a screening contract. This contract is denoted as a function

$$p(c_i; m_i) : [0, 2] \times [0, 1] \rightarrow \{0, 1\}. \tag{3}$$

It states that Brunhilde is willing to marry the candidate with probability  $p(c_i; m_i)$  if this candidate  $i$  has an observable income  $m_i$  and displays a status consumption equal to  $c_i$ . Brunhilde specifies such a probability as a function of  $c_i$  and  $m_i$ . Note that the acceptance probability can depend on the observable characteristics  $c_i$  and  $m_i$  only, and that  $m_i$  is exogenous and the actual  $c_i$  is chosen by the candidate. As seen from (3), we limit attention to deterministic screening functions:  $p(c_i; m_i) \in \{0, 1\}$ .<sup>12</sup>

Summarizing the timing, first a candidate shows up. Nature chooses the candidate's characteristics  $m_i$  and  $n_i$  and the candidate observes these values. Then Brunhilde announces the function  $p(c_i, m_i)$  to him. She then observes the candidate's income component  $m_i$ . The candidate is confronted with the contract  $p(c_i; m_i)$  that applies to the observable income component of this candidate. The candidate decides on  $c_i$ . Then Brunhilde observes this  $c_i$  and behaves according to the screening contract she has offered. If Brunhilde accepts the candidate, they marry and live together forever

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<sup>11</sup>Practically speaking, candidates may face a liquidity constraint. This is an important aspect and leads to some qualifications of our results, but in a first approach we disregard this aspect.

<sup>12</sup>Potentially, this is a limitation. Brunhilde may improve on efficiency if she makes the acceptance probability smoothly increasing in  $c_i$ . But a random mechanism need not be ex-post incentive compatible and may need commitment, which is difficult to obtain in marriage markets.

after. If Brunhilde rejects the candidate, he leaves and he and Brunhilde receive a default utility. We describe the marriage utilities and default utilities in the following.

The objective function of the candidate is as follows. A candidate with income  $x_i = m_i + n_i$  who chooses  $c_i$  has a consumption utility of the income net of the cost  $C(c_i; x_i)$  of conspicuous consumption  $c_i$ . To be more specific, we assume

$$C(c_i; x_i) = \frac{c_i}{x_i}. \quad (4)$$

This cost function satisfies the required single crossing property, i.e., the cost for a given level of conspicuous consumption is higher for people with a lower income.<sup>13</sup> Overall, the candidate's expected utility is

$$ap(c_i; m_i) + x_i - \frac{c_i}{x_i}.$$

Here  $a$  is the utility equivalent of the non-monetary benefit of being married to Brunhilde.<sup>14</sup> This benefit occurs with probability  $p(c_i; m_i)$ . In turn, this probability is given by the screening contract, observable income, and conspicuous consumption. The selection process is governed by Brunhilde. The candidate who is rejected can consume his income, but does not get  $a$ . This determines his default utility. It may, but need not be thought of as the utility of remaining single and consuming his income on his own. We assume that the candidate under consideration has  $a > 0$ . This makes sure that, ceteris paribus, he would benefit from marrying Brunhilde. In addition, we assume that this  $a$  does not dominate all other considerations, or that

$$a \in \left(0, \frac{1}{2\gamma}\right) \quad (5)$$

where  $\gamma \in (0, 1]$ ; the significance of this condition will be explained further below.

Turn now to the objective function of Brunhilde. Brunhilde would like a resource rich husband. She would like to have a husband who has a high income available for genuine consumption. In the back of our minds we may consider several motives for

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<sup>13</sup>Broom and Ruxton (2011) also assume this cost function, but model a signaling game.

<sup>14</sup>The non-material benefit from marriage is given, common knowledge and the same for all candidates. It is also unaffected by their income. However, there is experimental evidence that men primed with a large sum of money adjust their mating strategy, i.e., they increase their dating requirements - particularly for physical attractiveness (Yong and Li, 2012). Therefore candidates who differ in income should also differ in their preference for Brunhilde. But as long as Brunhilde can freely observe  $a$ , this does not invalidate the analysis here. Departure from these assumptions leads to a two-sided search and screening problem that we leave for future research.

this desire. Brunhilde may simply enjoy a greater consumption. Another important motive that is prominent in much of the literature on marriage (e.g., see Edlund 2006 for a review) is the desire to provide a strong resource endowment for raising children. Whatever the motive, Brunhilde’s genuine consumption is defined as  $x_i - c_i$ . The candidate’s conspicuous consumption may also give Brunhilde some benefit. The utility she attributes to  $c_i$  is typically smaller than its monetary amount  $c_i$ , and we assume it is  $(1 - \gamma)c_i$ , where  $\gamma \in (0, 1]$  is a constant and is exogenously given.<sup>15</sup> We may, for instance, think of expensive status goods handed over to Brunhilde, who values each unit of the good only by  $1 - \gamma$ . Or Brunhilde may enjoy being given a ride in the candidate’s fancy sports car. Overall, Brunhilde’s payoff from marrying a candidate with income  $x_i$  and conspicuous expenditure  $c_i$  is  $x_i - \gamma c_i$ .

Recall that the screening costs affect both the candidate and Brunhilde. This is an important departure from the standard screening framework. The candidate always bears the screening costs imposed by conspicuous consumption described by (4). But also, Brunhilde dislikes high conspicuous consumption because this reduces what is left for joint genuine consumption or child raising.<sup>16</sup>

If Brunhilde rejects the candidate, she receives her default utility  $v$ . This utility may be determined, for instance, by the quality and frequency of future candidates and her rate of time preference. For the moment, let us assume that  $v$  is exogenously given and determine the optimal screening contract for this exogenous  $v$ . We will discuss in section 3 how changes in  $v$  affect Brunhilde’s behavior, how one could determine  $v$  endogenously in a dynamic framework with a sequence of candidates, and how  $v$  may change in a continuing search process.

First, we describe the choice problem of candidate  $i$  with observable income  $m_i$  for

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<sup>15</sup>Our model can also capture the two extreme cases where Brunhilde also bears the full screening costs ( $\gamma = 1$ ) and where Brunhilde bears no screening costs ( $\gamma = 0$ ). The latter case is discussed at the end of section 2.

<sup>16</sup>Note that the way we describe the problem, the income of the candidate becomes the joint consumption of the married couple, one interpretation being that these resources are used to raise children and children are a public good for both of them. In a more general consideration, the candidate’s present value of income may yield a higher or lower utility to him if he marries than if he does not marry. To assume that it has the same effect on his utility is mainly for notational convenience. This income net of conspicuous consumption also affects Brunhilde’s utility, and it may do so either more strongly or less strongly. This is fully accounted for in the analysis even though the monetary amount affects Brunhilde’s payoff directly, as the results do not change if we scale Brunhilde’s payoff by an arbitrary positive factor.

a given screening function. We consider deterministic screening functions  $p : (C \times M) \rightarrow \{0, 1\}$  that map different choices of conspicuous consumption for a given  $m_i$  into acceptance probabilities  $p(c; m_i) \in \{0, 1\}$ . The consumption choice  $c_i$  by candidate  $i$  with income  $x_i (= m_i + n_i)$  determines whether the candidate is accepted by Brunhilde and receives payoff

$$x_i - \frac{c_i}{x_i} + a$$

or stays unmarried and receives

$$x_i - \frac{c_i}{x_i}.$$

Among all  $c_i$  that yield  $p(c_i; m_i) = 0$ , the payoff maximizing choice is  $c_i = 0$ . Among all  $c_i$  that yield  $p(c_i; m_i) = 1$ , the payoff maximizing choice for the candidate is the smallest possible  $c_i$  that yields  $p(c_i; m_i) = 1$ . The candidate either chooses  $c_i = 0$  or the smallest  $c_i$  that induces  $p(c_i; m_i) = 1$ . Denote this smallest consumption level by  $c$ . Note that, for any given  $c > 0$ , there is some critical total income  $x$  such that the candidate prefers  $c_i = c$  compared to  $c_i = 0$  if the total income  $x_i$  is at least equal to  $x$ , and prefers  $c_i = 0$  otherwise. This critical  $x(c)$  is

$$x = \frac{c}{a}. \tag{6}$$

Brunhilde may screen candidates using this condition. If she requires a given  $c$ , then all candidates with  $x_i \geq x$  choose  $c(x)$ ; all others choose  $c_i = 0$ . This separates candidates according to their  $x_i$ . Note that due to the parametric specification  $c(x)$  is a function of  $x$ , with

$$c(x) = ax, \quad c'(x) = a > 0 \text{ and } c''(x) = 0 \tag{7}$$

This completes the description of the choice behavior of candidate  $i$ .

Brunhilde can unconditionally reject the candidate (formally, she can require an impossible  $c > 2$ ). This gives her a default payoff of  $v$ . Brunhilde can also leave the option to screen unused and just marry the candidate. She then obtains the expected benefit  $m_i + E[n_i] = m_i + \frac{1}{2}$ . Lastly, if Brunhilde actively screens, the relationship  $x(c)$  as in (6) that governs the candidate's choice as a function of total income becomes relevant. Proposition 1 addresses this option.

**Proposition 1** *Let condition (5) hold. If Brunhilde chooses an active deterministic screening mechanism  $p(x_i, m_i)$ , then she marries candidate  $i$  if he chooses*

$$c(m_i) = a \frac{v - \gamma a(m_i + 1)}{1 - 2\gamma a} \tag{8}$$

and rejects him otherwise. This implies that she marries the candidate in the equilibrium if and only if the candidate's true full income is at least  $x_i(m_i) = \frac{1}{a}c(m_i)$ . Within the range in which active screening occurs, the amount of conspicuous consumption and the threshold level of total income that is sufficient for acceptance monotonically decrease in the observed income component  $m_i$  and, for a given observed income  $m_i$ , conspicuous consumption increases in the default payoff  $v$ .

**Proof.** If Brunhilde actively screens, then she maximizes

$$w_s(x, m_i) = (x - m_i)v + \int_x^{m_i+1} (z - \gamma c(x)) dz \quad (9)$$

by a choice of  $c$ . The first-order condition for a local maximum of  $w$  is

$$\frac{\partial w_s}{\partial x} = v - x + 2\gamma ax - \gamma am_i - \gamma a = 0. \quad (10)$$

In (10) the optimal choice of  $c$  just balances the marginal disadvantage and the marginal benefit for Brunhilde. Note that (10) implies that  $(v - (x - \gamma ax) = \gamma a(m_i + 1 - x) > 0$ , or  $v > x - \gamma c(x)$ : Brunhilde commits to accepting candidates who provide her with a lower marriage utility  $x - \gamma c(x)$  than her fallback utility  $v$  from continuing the search. Intuitively, by accepting even such inferior candidates she increases her genuine consumption for all the superior candidates she selects, as these waste less income on conspicuous consumption. Note that this strategy is time consistent: Up to the point in time when Brunhilde and the successful candidate marry, Brunhilde behaves optimally using all information available to her.<sup>17</sup> Note further that

$$\frac{\partial^2 w_s}{(\partial x)^2} = -(1 - 2\gamma a). \quad (11)$$

Hence, the function  $w$  is concave for  $a \leq 1/(2\gamma)$ . This is where we make use of (5). If  $a < 1/(2\gamma)$ , the optimal choice by Brunhilde is either the  $x$  that solves (10) and is a screening optimum, or a corner solution, in which case no screening occurs. We can calculate the threshold value that distinguishes candidates who are accepted from those who are rejected by (10) and this yields (8) and  $x(m_i) = \frac{1}{a}c(m_i)$  holds by (7).

The comparative static results follow directly from (8):

$$\frac{\partial x(m_i)}{\partial m_i} = -\frac{\gamma a}{1 - 2\gamma a} < 0$$

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<sup>17</sup>We do not allow for Brunhilde to get divorced after learning her husband's previously unobservable income, which would also change the game before she gets married.

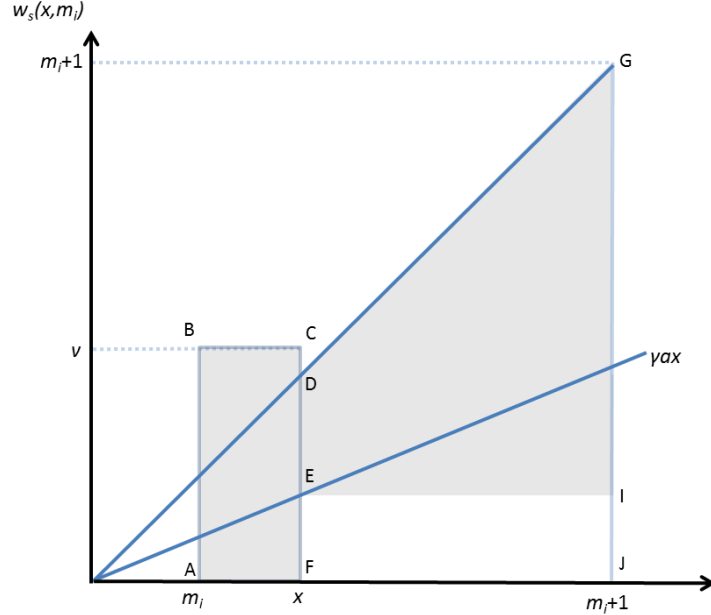


Figure 1: Brunhilde's payoff for a given  $v$  and  $m_i$

$$\frac{\partial x(m_i)}{\partial v} = \frac{1}{1 - 2\gamma a} > 0$$

and the fact that  $c(x) = ax$ . ■

Figure 1 illustrates the problem for a given  $v$  and a given  $m_i$ . For a given cut-off level  $x$ , Brunhilde's payoff consists of the sum of the two shaded areas, ABCF of size  $v(x - m_i)$ , and EDGI, which is equal to the integral in (9). It is equal to the expected income of the candidate for  $x_i > x$ , net of the area EIJF, or  $[(m_i + 1) - x]\gamma a$ . This area is the measure of the cost which Brunhilde bears of the candidate's cost of conspicuous consumption. It is this area that makes Brunhilde's problem differ from a standard screening problem in which she would simply choose a cut-off of  $x = v$ . The solution here converges to this solution for  $\gamma a \rightarrow 0$ . Figure 1 can also be used to illustrate the effect of a marginal change in  $x$ . An increase in  $x$  by one marginal unit increases the cost which Brunhilde has from the candidate's conspicuous consumption, by  $\gamma a[(m_i + 1) - x]dx$ . Brunhilde's gain from this increase in  $x$  is measured by  $[(v - x) + \gamma ax]dx$ . Equating the marginal cost and the marginal benefit yields the first-order condition (10).

Proposition 1 characterizes conspicuous consumption if Brunhilde actively screens. The amount of conspicuous consumption she requires declines with the amount of ob-

servable income. This is well in line with the notion described in the introduction about “old money”. If a candidate has a rich family background, an aristocratic title or other observable characteristics that have a positive monetary equivalent, the candidate needs a lower conspicuous consumption to make Brunhilde willing to accept him. Further, “old money” candidates need to be less wealthy on average in the equilibrium for being acceptable for Brunhilde. The threshold amount of total income that is acceptable for her in the equilibrium is lower for “old money” than for the nouveau riche. So, in comparison, the nouveaux riches face two disadvantages in the marriage market. They have to squander more income to provide the right signal and they need to be richer on average to be successful, compared to “old money” candidates.

Note that the deviation of  $x$  from  $v$  is not a result of risk attitudes on the part of Brunhilde, as her payoff has consciously been chosen to be linear in income, but it is an outcome of the costliness of conspicuous consumption. “Old money” candidates need to have a smaller amount of unobserved income to be sufficiently attractive, and this allows for a lower conspicuous consumption requirement.

So far, we have characterized the optimal active screening mechanism provided that it is optimal for Brunhilde to set a positive, but not prohibitive threshold. Next, we explore alternatives to her active screening mechanism. If Brunhilde has a very high default utility  $v$  and observes the  $m_i$  of a candidate, any screening may be a hopeless exercise. A sufficient, but not a necessary condition for this to happen is  $v > m_i + \max\{n_i\} = m_i + 1$ , as this implies that the default payoff is higher than the payoff from marrying the best possible type of candidate. Also, if  $v$  is very low and  $m_i$  is sufficiently high, for instance,  $m_i > v$ , then it becomes a dominant strategy to accept the candidate and ask for  $c = 0$ , to minimize the conspicuous consumption cost. Again, this is only a sufficient condition. In general, which of the three strategies (active screening, outright rejection, and outright acceptance) is best, depends on the parameters of the model.

Here we provide some characterization. Recall that Brunhilde has three potentially optimal options: outright reject, outright accept with  $c = 0$ , and active screening. Let

$$\begin{aligned} w_r(v, m_i) &= v \\ w_a(v, m_i) &= m_i + (1/2) \\ w_s(v, m_i) &= \max_x \left[ (x - m_i)v + \int_x^{m_i+1} (z - \gamma c(x)) dz \right] \end{aligned}$$

denote the maximal payoffs for these three choices. We are now ready to study her

optimal choice as a function of  $m_i$  and  $v$ . We identify the optimal choices for different areas in Figure 2.

*H1: outright rejection versus active screening:* Rejecting a candidate with observed income component  $m_i$  independent of his conspicuous consumption is (weakly) superior to active screening if

$$v \geq (x - m_i)v + \int_x^{m_i+1} (z - \gamma c(x)) dz \quad (12)$$

for all possible cutoffs  $x < m_i + 1$ . This condition can be rewritten using  $ax = c$ , rearranging, integrating, and dividing by  $(m + 1 - x)$  as

$$v \geq \frac{m_i + 1 + x}{2} - \gamma ax \quad (13)$$

Making use of  $\gamma a < 1/2$  by (5), the right-hand side in (13) strictly increases in  $x$  and reaches a maximum for  $x = m_i + 1$ . Hence, for (12) to be fulfilled for all possible  $x$ , it is required that  $v > (m_i + 1)(1 - \gamma a)$ . This defines a hyperplane  $H_1$  in the  $v - m_i$  space for which the payoff maximizing active screening mechanism yields the same payoff as an outright rejection of the candidate

$$H_1 : v = (m_i + 1)(1 - \gamma a).$$

It shows that the critical level of  $m_i$  increases with Brunhilde's default utility  $v$ , and also increases with the cost of conspicuous consumption, which is higher if  $\gamma$  and/or  $a$  are larger. Also, the line divides the  $v - m_i$ -space into a range with  $w_r > w_s$  (upper-left) and with  $w_r < w_s$  (lower-right).

*H2: outright rejection versus outright acceptance:* A second hyperplane is drawn in Figure 2. It shows the combinations  $(v, m_i)$  for which  $w_a = w_r$ , or

$$H_2 : v = m_i + (1/2).$$

This hyperplane separates all combinations  $(v, m_i)$  for which  $w_r > w_a$  (upper-left) from those with  $w_r < w_a$  (lower-right). The two hyperplanes intersect for

$$m_i = \frac{1 - 2\gamma a}{2\gamma a} > 0,$$

and this value  $m_i \equiv \hat{m}$  may, but need not, be smaller than 1. At the intersection Brunhilde is indifferent to all three alternatives:  $w_s(v(\hat{m}), \hat{m}) = w_r(v(\hat{m}), \hat{m}) = w_a(v(\hat{m}), \hat{m})$  holds.



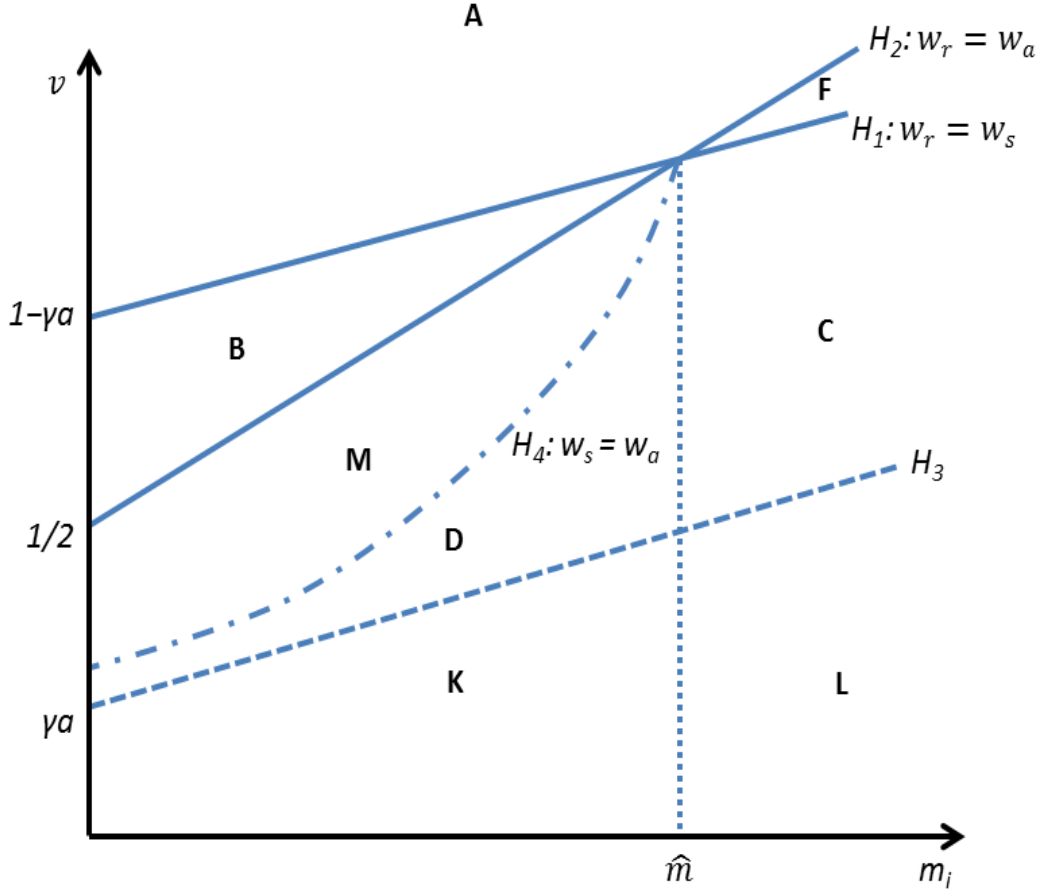


Figure 2: Brunhilde's strategy for a given  $m_1$

$H_3$ : *outright acceptance better than any active screening contract*: To further limit the area of possible active screening, we note that active screening is strictly dominated by outright acceptance for all  $(v, m_i)$  for which  $x(m_i) \leq m_i$ . This condition yields a further hyperplane  $H_3$ , which determines the combinations  $v$  and  $m_i$  for which  $x(m_i) = m$ :

$$H_3 : v = m_i(1 - \gamma a) + \gamma a.$$

For all combinations below this line active screening is inferior to outright acceptance. Unlike  $H_1$  and  $H_2$ , however, this line only provides a sufficient condition. Active screening does not dominate outright acceptance for all points above this line.

Hyperplanes  $H_1$ ,  $H_2$ ,  $H_3$  and the vertical line through  $(v(\hat{m}), \hat{m})$  span seven areas  $A, B, C, D, F, K$ , and  $L$ , for which the following partial order is established. For  $A$

Brunhilde chooses outright rejection, as this dominates active screening and outright acceptance. For  $F$  Brunhilde chooses outright acceptance, as  $w_s < w_r$  and  $w_r < w_a$  in this area. For  $B, C, D, K$  and  $L$  Brunhilde will not choose outright rejection. Whether active screening or outright acceptance yields a higher payoff needs to be considered more closely. A necessary condition for an active screening outcome not to be dominated by outright acceptance with  $c = 0$  is that  $(v, m_i)$  is to the upper-left of  $H_3$ . Accordingly, outright acceptance with  $c = 0$  occurs in  $K$  and  $L$ .

So we turn to  $B, C, D$ . Consider some  $\widetilde{m}_i > \hat{m}$  and start at the point  $(H_1(\widetilde{m}_i), \widetilde{m}_i)$  vertically above  $\widetilde{m}_i$  on  $H_1$ . A reduction in  $v$  leaves  $w_a$  unchanged. However, it reduces  $w_s$ , as

$$\frac{dw_s}{dv} = x - m_i > 0, \quad (14)$$

where  $\frac{\partial w_s}{\partial x} \frac{\partial x}{\partial v} = 0$  holds due to the envelope theorem. The inequality  $x - m_i > 0$  always holds in an active screening equilibrium above  $H_3$ . The condition (14) shows that  $w_s$  is strictly monotonically decreasing if  $v$  is decreasing between  $H_1$  and  $H_3$ . For  $m_i \in (\hat{m}, 1)$ , consider the point  $(H_1(\widetilde{m}_i), \widetilde{m}_i)$  vertically above  $\widetilde{m}_i$  on  $H_1$ . Consider a decrease in  $v$  starting from this point. At this point,  $w_s = H_1(\widetilde{m}_i) = w_r < w_a$ . A decrease in  $v$  decreases  $w_s$  further, but keeps  $w_a$  constant. Accordingly,  $w_s < w_a$  for all combinations  $(v, m_i) \in C$ , establishing that Brunhilde chooses outright acceptance with  $c = 0$  for combinations of  $(v, m_i)$  in  $C$ . For  $m_i \in (0, \hat{m})$ , consider again the point  $(H_1(\widetilde{m}_i), \widetilde{m}_i)$  vertically above  $\widetilde{m}_i$  on  $H_1$ . Consider a decrease in  $v$  starting from this point. At this point,  $w_s = w_r = H_1(\widetilde{m}_i) > w_a$ . A decrease in  $v$  decreases  $w_s$ , but keeps  $w_a$  constant. A decrease in  $v$  reduces  $w_s - w_a$ . Once we reach  $H_2(\widetilde{m}_i)$ , we know that  $w_s > w_r$  at this point (we are below  $H_1$ ). Moreover, we know that  $w_r = w_a$  at this point (we are right on  $H_2$ ). Accordingly,  $w_s > w_a$ . This allows us to conclude that Brunhilde will use active screening for all combinations  $(v, m_i) \in B$ . If, for given  $m_i$ ,  $v$  is further decreased below  $H_2(m_1)$ , then  $w_s$  decreases further and eventually falls below  $w_a$ . For instance, for  $v = H_3(\widetilde{m}_i)$  Brunhilde has a dominant strategy of accepting with  $c = 0$ . By monotonicity and the intermediate-value theorem, there is exactly one  $v$  such that  $w_s = w_a$ . By this principle, we can construct a critical level of  $v$  for every  $m_i \in [0, \hat{m})$ . These critical levels yield a fourth hyperplane  $H_4$ . All points between  $H_1$  and  $H_4$  describe combinations of  $(v, m_i)$  for which Brunhilde uses active screening, for all combinations below  $H_4$  she chooses outright acceptance with  $c = 0$ .

Lastly, we can show that  $H_4$ , which separates the range  $w_s > w_a$  from  $w_s < w_a$ , has a positive slope. Note that  $w_a$  is invariant for changes in  $v$ , but increases with

$m_i$ . As  $H_4$  is an indifference surface with  $w_a = w_s$ , for a proof that its slope is indeed positive we consider the slope of this locus. Using the envelope theorem again and solving  $(x - m_i)dv + (-v + m_i + 1 - \gamma ax - 1) dm_i = 0$  for this slope yields

$$\frac{dv}{dm_i} = -\frac{m_i - \gamma ax - v}{x - m_i}. \quad (15)$$

As  $x(m_i) > m_i$  must hold for active screening not to be strictly dominated by outright acceptance, the denominator is positive. Further,  $m_i - \gamma ax - v < x - \gamma ax - v < 0$  as it was shown earlier that  $v > x - \gamma c(x)$ . Hence, the slope (15) is positive for all  $m_i$  in the relevant range.

We summarize these considerations by

**Proposition 2** *Brunhilde outrightly rejects candidates in region A. She accepts candidates and requests  $c = 0$  in regions F, C, D, K, L. She applies the optimal active screening contract in regions B and M.*

Figure 2 illustrates Brunhilde's trade-offs based on the parametric version of her problem. We used this parametric form to allow for some analytic solutions, but the comparative static results are indicative of what would happen in a more abstract framework. More generally, Brunhilde's behavior depends on how much the candidate desires to marry her (captured by  $a$ ), the nature of conspicuous consumption (captured by the candidate's cost of conspicuous consumption and by  $\gamma$ ), and on factors determining the candidate's and Brunhilde's default utilities. Brunhilde's optimal choice also depends on the distribution of  $n_i$  in comparison to the size of  $m_i$ . The characterization of the equilibrium solutions for the parametric case in Propositions 1 and 2 is indicative, however, of more general cases. Whether or not  $m_i$  is high enough for outright marriage, or whether Brunhilde outrightly rejects the candidate, will depend on a comparison between her default utility and the upward potential, i.e., the range of  $n_i$ , and on the size of the screening costs in an equilibrium with active screening. The latter very much depend on the size of  $\gamma a$ . Also, for a sufficiently large  $m_i$  and a sufficiently narrow range for the distribution of  $n_i$ , it is likely that Brunhilde prefers a contract that accepts the candidate if the candidate chooses  $c_i = 0$ .

We can also consider Brunhilde's strategy for a sufficiently small and for a sufficiently large marriage premium  $a$ . Consider  $a \rightarrow 0$ . In this case, Brunhilde offers a screening contract to all candidates regardless of their level of observable income, as screening becomes costless. Several factors may affect the size of  $a$ . On the macro-level,

there may be an imbalance between the shares of male and female population.<sup>18</sup> On the micro-level the value attributed to marrying Brunhilde may have to do with her beauty or character. Note that this has a counterintuitive implication.

**Corollary 1:** *Women who are particularly sought after are disadvantaged: applying an active screening device is more costly for them than for others.*

Departing from (5), let  $a \geq 1/(2\gamma)$ . In this case, Brunhilde does not use a screening contract. Instead, she requests that candidates choose  $c_i = 0$  and rates a candidate who complies with this request on the basis of his observable income component only. For a very low  $m_i$  she rejects, for a very high observable income she accepts. The threshold is

$$\tilde{m} + \frac{1}{2} = v \tag{16}$$

**Proposition 3** *Active screening is inferior for Brunhilde for  $a \geq 1/(2\gamma)$  for any levels of  $m_i$  and  $v$ .*

**Proof.** By convexity in the proof of Proposition 1, there exists no interior solution for the critical income level  $x$ . The corner solution  $x = m_i$  induces a minimal amount of conspicuous consumption such that Brunhilde is unable to refuse even very low income candidates. Her expected payoff is then  $m_i(1 - \gamma a) + \frac{1}{2}$ , which implies that she is worse off compared to the outright decision to marry any candidate who chooses  $c_i = 0$  and to obtain  $m_i + \frac{1}{2}$ . Conversely, the alternative corner solution  $x = m_i + 1$  is equivalent to rejecting all candidates and yields an expected payoff of  $v$  for all  $m_i$ . Thus, for  $a \geq 1/(2\gamma)$  demanding zero conspicuous consumption makes Brunhilde better off. ■

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<sup>18</sup>China's one-child policy is considered to be responsible for a smaller share of women in the population (Hesketh 2009). Moreover, out-migration from regions that lack economic opportunities is often different for men and women, causing gender imbalances: Kröhnert and Vollmer (2012) report that in 2005 the sex ratio for 18 to 29-year-olds was 89 women per 100 men due to disproportionate migration of women from East to West Germany. As studied by Griskevicius, et al. (2012), a male-biased sex ratio affects decision making on saving, borrowing, and spending consistent with evolutionary biological theory predicting the effects on the intensity of competition for mates. When the sex ratio was male-biased, men (but not women) were found to choose more immediate rewards and to discount the future more strongly, to plan to save less and to be more willing to increase their credit card debt. In addition, when women were scarce, participants - regardless of their sex - expected men to spend more money during courtship, e.g., to buy a more expensive engagement ring.

Lastly, our model relates to the literature in which screening costs are borne by the informed agent only. If Brunhilde does not bear any screening costs, i.e.,  $\gamma = 0$ , she sets the critical income threshold equal to her reservation utility (formally,  $x = v$ ). Screening is not costless, but all screening costs are borne by the candidate in this case. As long as screening does not affect the quality, number, or frequency of candidates showing up, Brunhilde offers a screening contract to all candidates in this case, irrespective of their observable income. Simply waiving the conspicuous consumption requirement for candidates with a high observable income is not superior any more. A candidate with a high observable income may have a very low additional unobservable income. Utilizing her screening device, Brunhilde prefers to identify such a candidate to be able to reject him if screening is costless for her. With  $\gamma = 0$ , this is the case because all expenditures for status goods are in fact expenditures for conspicuous gifts to Brunhilde.

### 3 Dynamic implications

We have so far solved for Brunhilde's optimal local strategy if she interacts with one single candidate who wants to marry her, with each having an exogenously given default utility. This single decision may be imbedded in a dynamic context, for instance, a sequence of marriage decisions, which continue until marriage occurs. Such a framework typically has a Markov property: Brunhilde's payoff from marrying a given candidate depends only on this candidate's conspicuous consumption  $c_i$  and actual income  $x_i$ , but typically it does not depend on the sequence of rejections that occurred previously, which allows us to consider single marriage decisions in isolation, as we have done in section 2, and where the decision behavior characterizes local strategies as a function of the current candidate's observed income component  $m_i$  and the candidate's conspicuous consumption.

If there is a long time horizon and Brunhilde foresees a long line of possible candidates following each rejection decision, all drawn from the same distribution of candidates, then the dynamic problem may be reasonably well described as a stationary problem. The decision problem in Section 2 can then be seen as the period decision in a dynamic framework with an infinite number of periods, with one candidate showing up in each period until Brunhilde finally marries. A possible extension of our framework is to solve for the perfect Bayesian equilibrium in stationary Markov strategies in this

case. To do this formally requires quite some notation, but conceptually it is clear how the continuation value  $v$  becomes endogenous in such a framework and is determined by the expected payoff – which Brunhilde has if she does not marry in a given period but rather waits for future options – and by the time discount rate.

Whether stationarity is an appropriate assumption in this context is unclear. Brunhilde naturally grows older, future candidates may reassess their benefits of marrying her, and the flow of further candidates may be finite and may change its characteristics over time. This changes her default utility of staying single from one marriage decision to the next. She may feel her biological clock ticking; being older, she may feel a greater urge to find a supporting husband soon. For the decision problem analyzed in Section 2, these aspects find their counterparts mostly in a change in  $v$ . The implications of such a change for  $a < 1/(2\gamma)$  in the range of equilibrium with active screening is

$$\frac{\partial x(m_i)}{\partial v} = \frac{1}{a} \frac{\partial c(m_i)}{\partial v} = \frac{1}{1 - 2\gamma a} > 0$$

If her default utility decreases, Brunhilde will be willing to marry a candidate with a lower total income and she will require a smaller amount of status consumption as proof of a candidate’s unobservable income, if she applies an active screening mechanism. Also, a change in  $v$  may result in a change of the equilibrium regime. As seen in Figure 2, a reduction in  $v$  may cause either of several transitions: from active screening to outright acceptance, from outright rejection to active screening or to outright acceptance.

In a dynamic context, a number of factors affect Brunhilde’s default utility  $v$ , which then becomes the continuation value she obtains from not marrying a given candidate. The number of future options may narrow in the course of life. This should reduce  $v$ . The pool of candidates may change over time. Candidates will also be older. As argued by Bergstrom and Bagnoli (1993), this typically causes a shift in which part of income or ability is observable and in which part is unobserved. A larger proportion of potential income made observable to Brunhilde reduces the information problem. The first round effect of this is an increase in default utility  $v$  over the lifetime. There are some other effects, however. Taking up the storyline in Bergstrom and Bagnoli (1993), young male candidates who have a high earnings potential in comparison to what is observable tend choose to wait, such that older candidates are a good match. This should also increase  $v$ . However, candidates with a high earnings potential wait because they expect this to improve their attractiveness, which in turn changes their

aspirations. This may reduce  $a$ , the parameter measuring the candidates' desire to marry a specific Brunhilde. It would be interesting to study the interaction between Brunhilde's information extraction problem on the one side and the candidate's means to change the distribution of observable and unobservable income components over time.

Overall, there are many effects of aging in this framework, but many of these point at a reduction of  $v$  and a better informed Brunhilde at the time of decision making. Both work in a similar direction. As candidates with a lower total income, who were previously not acceptable, become acceptable, Brunhilde also becomes willing to immediately accept some candidates who were previously required to consume conspicuously. For these candidates, as their observable income makes them sufficiently attractive, Brunhilde no longer finds it necessary to screen for their unobservable income, thereby wasting resources on luxury products.

The empirical counterpart (and testable hypothesis) for this result is a relationship between age and courtship expenditure. *Ceteris paribus*, the intensity of status consumption in the context of courtship should decrease with age. Anecdotal evidence may be in line with this result. And while a standard explanation for this behavior may be "lost ambitions," or "illusions lost" and a "more realistic attitude toward life," our theory would explain this as an equilibrium phenomenon among people who are fully rational when they are young and when they are old.

## 4 Discussion and conclusions

We study a screening approach to marriage matching with conspicuous consumption providing information about a man's financial capacity or prospects. We show that a potential bride can utilize a menu of contracts to sort candidates and thereby induce but also curb conspicuous spending during courtship. The screening device unveils in the equilibrium whether a candidate's total income exceeds an optimally chosen threshold. However, the amount of conspicuous consumption required from all candidates above the threshold is the same (if their observable income is the same). Candidates below the threshold give up and do not consume conspicuously at all. In addition, the required amount of conspicuous consumption is decreasing in observable income.

There is also a range of observable income in which active screening via conspicuous consumption is not used. In this range, a candidate's observable income can make

him sufficiently desirable – but only if he does not flaunt any luxury products. This result highlights a unique and original aspect of conspicuous consumption as a signal or screening device in the marriage market: conspicuous consumption is costly not only for the informed party, but also for the uninformed party. What is used on conspicuous consumption is lost and cannot be used for mutually beneficial expenditure, for instance, for providing a sound environment for a couple’s future offspring. The mutual benefit of outright marriage is that both Brunhilde and the candidate save all the costs of possible conspicuous consumption. The observable part of income replaces the need for conspicuous consumption; it serves a very similar purpose, but at a lower social cost.

Our model also captures that conspicuous consumption to court Mrs. Right may take different forms, some that are equivalent to “burning money” and others that are conspicuous gifts to the potential bride. Depending on the fraction of conspicuous gift giving, the potential bride also bears the costs of screening candidates. This is another critical feature of our model. The bride searches for a husband with a sufficiently high income for genuine consumption once they are married. Hence, by inducing conspicuous consumption during courtship the bride also reduces the amount of resources which she later wants to spend on genuine consumption.

The model makes a number of predictions that fit with casual or anecdotal evidence. In particular, it can explain that conspicuous consumption is discouraged or is very low for candidates with a rich family background or other visible indications of high financial status (“old money”), whereas it is more prominent among the “new rich.” It also offers a rational choice explanation for lower conspicuous consumption and less extensive gift giving of status goods in the context of courting among older cohorts.

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