Temporary Help Agencies and Job Market Sorting

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Preliminary - Please do not cite

July 9, 2012

Abstract

This paper develops a model of Job market sorting wtih Temporary Help Agencies (THAs). Workers are heterogeneous across skill, impatience and gender. Differing search costs by gender lead to different worker decisions about job search methods. Sufficiently patient workers are better off from THA sorting in terms of their labor income. Empirical analysis from NLSY79 data shows that female agency temp workers sorted by the THA experience increased earnings compared to other temp workers, while men do not. To the degree that the female workers selecting THA jobs have more job market patience compared to similar men in this data, model predictions are consistent with empirical wage impacts. The wage heterogeneity within each worker skill group arises as temp workers are sorted differently based on impatience.

Keywords: Labor Income, Skill Heterogeneity, Temporary Help Agencies, Gender, Job Search

JEL codes: J24, J31, J41

1 Introduction

This paper presents a model of job sorting in the American labor market. The model considers Temporary Help Agencies (THAs) as an alternative to traditional job search and offers an explanation for the gender disparities in outcomes for THA matched workers present in the empirical literature, Jahn (2008); Jahn and Pozzoli (2011). The gender difference in the income gap between THA and direct-hire temp workers is shown to follow from unobserved characteristics, captured in the model by a parameter reflecting job market impatience.

Job search costs vary by method of search leading more patient workers to select job search methods where they are sorted into a job matching their skills. The more patient workers may be interpreted as either career focused individuals willing to wait for a suitable job, or secondary earners for their households who do not need immediate employment. The THA may find it worthwhile to sort these workers. The less patient workers, however, may be interpreted as primary earners who are in need of an immediate placement so they may provide for their household. The THA may find it too costly to sort these workers because they are so impatient and therefore will not offer them any sorting benefit above traditional search methods. SOrting is possible when the information asymmetry is between workers and firms is alleviated through a costly screening process which is not explicitly modeled in this paper.[1]

Differences in job search costs in the permanent market lead endogenously to differences in sorting behavior by gender and patience. In addition, the selection decisions of these workers limit the pool of temporary searchers which the THA may hire affecting the sorting decision of the THA. Sorted workers, who have generally lower levels of impatience, receive higher earnings in equilibrium as a result of a better pairing between their skills and job requirements. In equilibrium the THA sorts more women than men, resulting in heterogeneity in the suitability of jobs and the accompanying wages by gender.

[1]The revelation principle, however, would indicate that a direct mechanism is a suitable mechanism to have in mind.

Supporting empirical evidence on the sorting technologies comes from the NLSY79 data and identifies different long term earnings outcomes for men and women with THA job histories in the United States. THA women observed in the data appear to be more patient than the direct-hire temp women and estimates of worker outcomes match model predictions. The sorting process performed by THA firms benefits the more patient THA women in terms of income with post-THA wages up to 55% higher than direct-hire temporary wages. This job sorting premium paid to patient THA workers suggests little skill loss between jobs. Men, on the other hand experience a slight dip in earnings initially, but no long term effects over the same time period. This short-term loss for the men is indicative of the "human capital destruction" or loss of specific skill described in Kambourov and Manovskii (2009).

1.1 Temporary Help Agencies

When the THA is able to sort a worker, the sorting process can be described in the following way. Maximizing their profits, this labor market intermediary places job seekers into contract positions with a firm.[2] Potential employees, from a proprietary database of applicants, are paired with appropriate vacancies based on their apparent skills. The THA may have the prospective worker attend training sessions, or complete tasks to asses their suitability for various jobs. In sorting the workers, much of the randomness and worker directed aspects of the traditional search technology are alleviated. THA staff have more knowledge of the employer than the worker does because of ongoing relationships with the firm, and more knowledge of the worker than the firm due to the sorting process. While some firms do attempt to sort temp workers, it should be apparent that the THA enjoys a comparative advantage in this process and that the firm may focus their sorting efforts on permanent employees

[2] THA agencies may also place the currently employed individuals who practice on-the-job search, however, I feel it is unlikely for a permanent employee to leave their relatively secure job for a temporary position.

1.2 Literature on THA Sorting Technology

Recent work on occupational specificity, (Yamaguchi, 2010, 2009; Poletaev and Robinson, 2008; Kambourov and Manovskii, 2009), shows that skill and task mismatch in a new job is major determinant of wages via occupational specific human capital. Such results suggest a need for more careful job placement criteria and motivates a comparison between THA jobs and those generated by traditional job search.

Similar work on placement job assistance is found in an analysis of the public labor exchange by Plesca (2010), and Fougère et al. (2005). These models, however, do not allow for the same degree of heterogeneity in the workforce and focus on public provision of job search assistance. By allowing workers to vary along dimensions of impatience and skill, this paper is able to illustrate heterogeneity in both job matches and the THA's decision of which workers to sort. Autor (2001) also models THA job matching, focusing on an explanation for the up-front skills training that THA's offer to workers. This paper's framework is able to relax Autor's assumption that all workers are sorted, allowing for a comparison of the sorting technologies of THA's and firms.

Empirical investigation of THA worker outcomes in the American literature is limited to disadvantaged workers. Lane et al. (2003); Autor and Houseman (2005a,b); Hamersma and Heinrich (2008) find weakly positive effects from THAs on these workers. Ichino et al. (2008); King et al. (2005); Amuedo-Dorantes et al. (2008) provide European evidence on THA outcomes with results differing by country. The income based gender differences found in this paper are similar to those in Booth et al. (2002); Addison et al. (2009). These papers, however, do not differentiate THA from direct-hire workers and therefore do not provide insight into the role of the THA or its sorting process. Jahn and Pozzoli (2011); Jahn (2008) distinguish German THA workers by gender, and discover that women fare better than their male counterparts.

In order to glean information on the impact of the THA sorting technology relative to the traditional job search technology, the control-group in this paper is comprised of direct-hire temporary workers. The decision to use direct-hire temporary workers as a control group for the THA treatment group follows from the notion that temporary employment in general is often considered inferior to a permanent work arrangement (Lane et al., 2003; McGrath and Keister, 2008), and it is desirable to avoid the issues pertaining to selection into temporary work.[3]

The goal of this paper is to understand the sorting technology used by the THA, and compare it to the traditional job search methods used by direct-hire temp workers. Comparing THA to direct-hire temporary workers by gender, the impact of the THA sorting technology is identified for men and women separately. In the presence of heterogeneity among both worker skills and job tasks, this paper finds that the THA firm performs as a superior sorting technology.[4]

2 The Model

This section considers a structural approach to the job market, based on the sorting decisions of heterogeneous workers into various methods of job search. The job market is represented as a one-shot Bayesian game with three types of players: A continuum of workers, one THA, and one production firm. The workers have three characteristics, gender denoted $i \in \{m, f\}$, skill, and impatience, denoted β. The workers are assumed to be distributed uniformly across an *impatience* dimension, $\beta_i \sim U[\underline{\beta_i}, 1]$, while the characteristic skill is evenly divided among two types, {A,B}.[5] The model places no restrictions on the relative number of each gender. Both gender and impatience, β_i, are observed by all players in the model. Skill type, however, is the private information of the worker.

[3]Hamersma and Heinrich (2008) and Amuedo-Dorantes et al. (2008) caution against the use of regular workers for comparison. In fact, impacts for this paper were also calculated for comparisons of THA to permanent employees and were dominated by the difference between temporary work in general and permanent work. These estimates are excluded because of the lack of insight into the direct impact of a THA agency.

[4]Given the relative expertise and experience from job market sorting on a daily basis, THA placements should be superior jobs (Jahn, 2008). Increased earnings should imply a superior job placement through resulting increase in productivity.

[5]One could consider the case where $\underline{\beta} = 0$, however, this assumes there are workers who are perfectly patient and leads to a less general solution.

There are at least as many vacancies posted by the firm as there are workers, and the requirements of vacancies align with worker skills, {A,B}. The vacancy requirements, which are not observable to the worker, are horizontally differentiated in terms of the production process.[6]

A job is defined as a pair of vacancy requirements and worker skills $(\cdot, \cdot)$. Each created job yields output denoted N, which depends on whether a job is good or bad. A good job is formed if worker skills are the same as job requirements, {(A,A), (B,B)}, and output from this job is denoted $N > 0$. A bad job is formed if skills and requirements differ, {(A,B),(B,A)}, leading to a null output, $N = 0$. The probability of getting a good job, P_j, depends on whether workers are sorted according to their skills when they apply for jobs. The parameter $j \in \{y, n\}$ denotes sorted and unsorted jobs respectively. When a worker is sorted they are placed into the correct job with certainty and so, $P_y = 1$. Unsorted workers, however, are placed randomly and so $1 > P_n > 0$.[7]

The model has three periods. In the first period the firm posts vacancies by choosing wages. In the second period, the THA re-sells some of these jobs for a fixed fee of $c_i > 0$.[8] It also makes a binary choice $\phi_i(\beta_i)$, which defines the subset of workers it is willing to sort $(j = y)$', and how much to charge in addition to c_i for its sorting services, s_i. Workers who are sorted will be guaranteed a good job. In the third and final period, workers decide if they will search for a job, and how to do so.

Workers with $\beta_i > \overline{\beta_i}$ find all search options too costly and are unemployed.[9] For the workers who can afford to search, Direct-Hire job search in the permanent and temporary markets costs

[6]The goal of this model is to discuss the presence of heterogeneity among a subset of the labor market, rather than observing the effect of the labor market on ranked skill groupings. The entire distribution of workers may represent, for example, the low skill workers in a general equilibrium framework.

[7]With skills and job requirements distributed uniformly within each gender, this probability can be set at half, $P_n = 0.5$.

[8]A fee of $c_i \leq 0$ would lead all workers to apply for jobs through the THA and result in no permanent jobs. In equilibrium, however, the THA will never choose $c_i \leq 0$ because it can earn positive profits from increasing c_i.

[9]This model does not distinguish unemployed workers from those out of the labor force, because no unemployment benefits are paid to workers $\beta_i > \overline{\beta_i}$ For these workers, $U_i(\beta_i) = 0$.

a worker $R_i(\beta_i)$ and $g\beta_i$ respectively. Both of these costs are increasing in impatience, and we assume $R_i(\beta_i) > g\beta_i \quad \forall\beta_i$. Regardless of job search method, all workers who search will find a job.[10] Because there is uncertainty about the worker's type, the solution concept is a Bayesian perfect equilibrium. Full solutions for both male and female workers are avaliable in the Appendix sections A1.3 and A1.1 respectively

2.1 Firms

The firm can create an infinite number of vacancies. Assuming that worker skills A and B are complements in the production process, the vacancies created are divided evenly amongst the two types. The firm would like to maximize the profits from a given job, $N - w_i$, so it does not matter to the firm which method a worker will use to find the job. This means that each created job is paid only according to its output. Where the created job is bad, productivity $N = 0$ and therefore these jobs are paid $w_i = 0$. A worker in a good job, however, produces $N > 0$ and is paid a wage $w_i > 0$ by the firm. Therefore firms accept no risk in the job market. The firm's objective function is given by:

$$\max_{w_i} \pi_i^F = \int_{\underline{\beta_i}}^{\overline{\beta_i}} [P_j(N - w_i)] d\beta_i. \tag{1}$$

2.2 THA

The THA can observe the skill requirements of the firm's vacancies and chooses to re-post some of the available vacancies from the firm, offering a different pricing package to workers. The THA also chooses which workers to sort into vacancies at a cost of $t\beta_i$, ensuring a perfect match between the skills of the worker and the vacancy requirements. The sorting decision is defined by:

$$\phi_i(\beta_i) = \begin{cases} 1 & \text{if } \beta_i < \beta_i^* \qquad \Rightarrow \qquad j = y \\ 0 & \text{if } \beta_i > \beta_i^* \qquad \Rightarrow \qquad j = n \end{cases}$$

[10] Bad jobs, however, will be destroyed immediately, before production or wage payments are realized.

where the THA is indifferent between sorting or not sorting the worker with an impatience level of β^*. If the THA does not sort the workers based on their skills the job creation procedure is costless for the THA, and so it charges workers a fixed price c_i for job placement. Since this job is unsorted, just like a direct-hire temp job, the worker faces the expected wage $P_n w_i < w_i$. Therefore workers choose this option only when alternatives are too costly.

For the sorted jobs, the cost of $t\beta_i$ which the THA incurrs is the price to discover the worker's type. The THA will offset this cost by collecting revenue from the placement fee c_i as well as from the sorting charge s_i.[11,12] Not all workers, however, will be worth sorting because the sorting cost is increasing in β_i; a sufficiently impatient worker would be too costly to sort.[13]

Main Result 1 $\underline{\beta_i} < \beta_i < \beta_i^*$

- *workers will all choose sorted options, earning w_i and producing N, while $\overline{\beta_i} > \beta_i > \beta_i^*$ workers choose among unsorted options earning an expected wage $P_n w_i$ and producing an expected output of $P_n N$. The expected penalty for an unsorted job, $(1-P_n)w_i$ is sufficiently high compared to the fees charged by the THA for sorting, that those workers who the THA will sort would all choose to be sorted.*

The THA's objective function is given by:

$$\max_{\beta_i^*, s_i, c_i} \pi_i^T = \int_{\beta_{1i}}^{\overline{\beta_i}} c_i d\beta_i + \int_{\beta_{2i}}^{\beta_i^*} [s_i + c_i - t\beta_i] d\beta_i. \qquad (2)$$

The endogenous value β_{1i} represents the worker who the THA would not sort, that is indifferent between searching for a temp job on their own and paying the fixed fee to be placed by the THA. At this level of impatience, the variable direct-hire temp search costs $g\beta_i$ are equal to the fixed fee for THA (unsorted) search, c_i.

Main Result 2 $\overline{\beta_i} > \beta_{1i} > \beta_i^*$*:*

[11] In this case the THA acts as a monopolist, balancing the marginal revenue and marginal costs of sorting. Therefore s_i represents the surplus of the worker who would be sorted, but is least likely to search through THA.

[12] There is no reason to presume that s_i must be positive. In equilibrium, since the THA earns positive profits on all workers, it would like to employ more rather than fewer. If the THA sets $s_i < 0$, it is simply charging a lower fee c_i to the worker in order to induce them to stay with the THA, since their alternative is to search on their own where the THA earns nothing from them.

[13] Very impatient workers may not cooperate with screening tasks, or may insist that the THA find them a job too quickly for the THA to carry out sorting effectively.

- $\beta_{1i} > \beta_i^*$: *Some workers will search on their own, since they are not elligable for THA sorting, but have low enough search costs such that THA assistance withour sorting is relatively expensive. Recall from Main Result 1 that all workers with* $\beta_i > \beta_i^*$ *are sorted and so they do not make a decision among the unsorted options.*

- $\overline{\beta_i} > \beta_{1i}$: *Some workers will always choose the unsorted THA job. Because both the firm and the THA make non-negative profits on all workers they employ, they will want this group of workers to be employed.*

Similarly, β_{2i} gives indifference for the workers who the THA would sort. Because these workers are patient enough to be sorted, the β_{2i} worker compares sorted wage jobs and therefore is indifferent between search costs from the THA's offer of a sorted placement in the temp market, $c_i + s_i$ and search costs for direct-hire search in the permanent market, $R_i(\beta_i)$.[14]

Main Result 3 $\underline{\beta_i} < \beta_{2i} \leq \beta_i^*$:

- $\beta_{2i} \leq \beta_i^*$: *There are not always THA sorted workers. Since the workers can move after the THA chooses who to sort, the fees charged by the THA for sorting may be too high and so all those workers who would be elligable to be sorted find it relatively less expensive to search in the permenant market.*

- $\underline{\beta_i} < \beta_{1i}$: *There are always permenant workers. There are always some workers sufficiently patient to benefit from job search in the permenant market. Because the THA is a monopolist, it prefers to increase it's fees in favor of capturing a smaller number of workers.*

2.3 The Workers

Each of the infinitely many workers with $\beta_i \in \{\underline{\beta_i}, \overline{\beta_i}\}$ in the model is searching for employment. Workers who are not sorted have the probability $(1 - P_n)$ of choosing a vacancy that results in a bad job and a wage of zero.[15] Unlike skill, the impatience parameter β_i is observed by all players in the labor market. The parameter β_i is central to both the selection process of the worker and the sorting process of the THA because, in both cases, costs are assumed to be

[14]It turns out that in equilibrium, the β_{2i} worker is also indifferent to the option of direct-hire temp market search with costs of $g\beta_i$. Since $g\beta_i < R_i(\beta_i)$ it is much less costly for the worker to search on their own in the temp market, but the expected wage for an unsorted job is lower.

[15]This is equivalent to stating that a worker is unaware how their skills may match with the specific requirements of a given job. Another possibility could be that the worker does not know their own type in the skill dimension.

increasing in β_i. Allowing $C_i(\beta_i)$ to represent a general cost function for all cases, a worker's expected utility is given by:

$$U_i(\beta_i) = P_j w_i - C_i(\beta_i).$$

We assume workers have an outside option of unemployment without benefits, and so the participation constraint is given by

$$P_j w_i - C_i(\beta_i) \geq 0. \tag{3}$$

.

Main Result 4 $P_n w_i - C_i(\beta_i) > 0$*:*

- *The participation constraint will bind only for those an unsorted worker, $j = n$. The most impatient workers have the highest search costs, and these are precisely the workers which the THA will not offer to sort. In addition, these workers will find it too costly to search on their own. By offering a fixed fee schedule, the THA is able to employ some of these unsorted workers who would not otherwise work. Since sorted workers have lower costs, their participation constraint will be slack.*

The workers take job vacancies as given and choose among three types of job search: The given THA job which depends on the THA's sorting decision $\phi_i(\beta_i)$, a direct-hire temporary job they must search for on their own, or a direct-hire permanent job they will search for on their own. Utility can therefore be expressed in terms of the possible methods of job search.

$$U_i(\phi_i, \beta_i) = \max \left\{ \underbrace{\phi_i(\beta_i)(w_i - s_i - c_i) + (1 - \phi_i(\beta_i))(P_n w_i - c_i)}_{THA}, \underbrace{P_n w_i - g\beta_i}_{DH_{temp}}, \underbrace{w_i - R_i(\beta_i)}_{DH_{perm}} \right\} \tag{4}$$

3 Equilibrium

The job market is divisible into two main components: the permanent job market for those workers seeking long term employment, and the temporary job market for those who are unable or unwilling to find permanent jobs.

Within the permanent market, workers must search for jobs on their own and apply directly to the firm. Job search is more costly than in the temp market because the firm will sort workers for permanent positions, resulting in an expected wage of w_i.[16]. Because job search costs are so high, only the most patient workers $\beta_i < \beta_{2i}$ will find it worthwhile to search in the permanent market.

Within the temp market, workers must choose whether to search directly for a temporary job, or whether to pay for THA job sorting. If a worker searches on their own, they will pay a cost of $g\beta_i < R_i(\beta_i)$. If the worker chooses THA assisted job sorting, their payoffs depend on whether or not the THA will sort them. The permanent job search costs, however, differ by gender:

$$R_i(\beta_i) = \begin{cases} r\beta_i & \text{if } i = f \\ r\beta_i^2 & \text{if } i = m \end{cases}$$

and so the model has a separate solution for both men and women. Heterogeneity in the permanent job search costs by gender arises because men in our model are assumed to invest more in job-specific human capital. Job search is therefore more costly for men, by assumption, as they will invest more to ensure they find a suitable match for their skills.[17] Empirically this is documented in the American job market by Madden (1987) among others.

The Bayesian perfect equilibrium is found by backward induction, solving the workers problem first. For a meaningful solution, parameter restrictions are $0 < g < t < r$.[18] Full solutions with these restrictions, for both men and women, are available in the Appendix.

[16]Because permanent jobs involve higher firing costs, benefits and a greater degree of relationship between employee and employer the firm can not fire a badly sorted worker as easily and will therefore invest more into ensuring a good match between worker skills and vacancy requirements

[17]Similarly, we can consider the case where temporary jobs have quadratic costs for men. The model is far less comprehend-able, but appears to gives similar predictions for the behavior of all players.

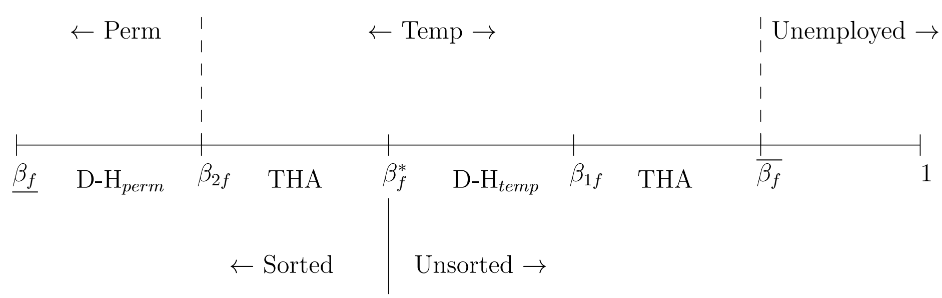
[18]This set of restrictions ensures marginal costs are positive, and that permanent job search is more costly than temporary job search. It also implies that the THA has more difficulty sorting a worker than the worker has searching them-self in the temp market.

3.1 Women

Because the THA chooses β_f^* first, there are two groups of female workers who will choose THA assistance. The most impatient workers ($\beta_f > \beta_{1f}$), will find the fixed fee c_f more attractive than the cost $g\beta_f$ they would pay for direct-hire search. Therefore they will choose the THA vacancy, even though they will not be sorted and will still earn $P_n w_f \leq w_f$. Since these workers are too impatient for the THA to sort, their permanent job search costs are also too high for this option to be feasible. More patient workers, $\beta_f < \beta_f^*$, would be happy to search directly, but the THA offers to sort them. Those workers too impatient to choose a permanent job but sufficiently patient for the THA to sort will find the expected wage when sorted, w_f, is worth the costs $c_f + s_f$. The most patient workers, of course, search for permanent jobs.

The jobs created for women in equilibrium are depicted along the continuum of impatience in Figure 1 below.

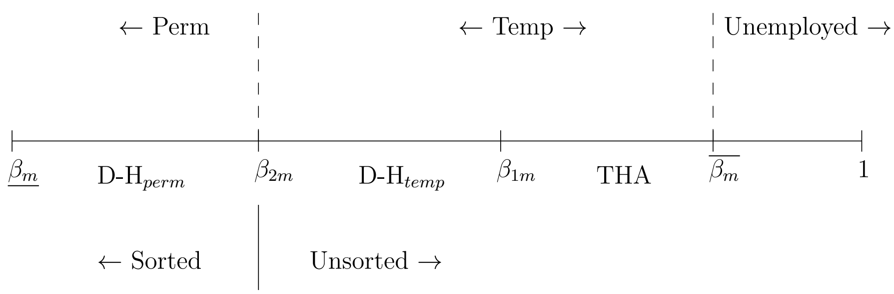
Figure 1: β_f and Job Types for Women



3.2 Men

Unlike the women who sort into four sections according to impatience, the men sort only into three. The collapse of the section $\beta_m \in [\beta_{2m}, \beta_m^*]$ occurs because of the increased cost of search in the permanent market. Because of the higher permanent search costs, the THA can employ a relatively more patient worker with the men in its sorted group. The more patient worker has more surplus which the THA can capture, and exploiting its monopolist power the THA will reduce the number of workers it screens in favor of a larger surplus per worker.[19] This shifts β_m^* such that $\beta_m^* \leq \beta_{2m}$; workers who would be sorted will find direct-hire search for a permanent job to be preferable. Figure 2 depicts jobs created for men in equilibrium.

Figure 2: β_m and Job Types for Men



3.3 Impatience in Equilibrium

For each of the endogenous variables β_{1i}, c_i, and $\overline{\beta_i}$, behavior is the same in equilibrium for men and women. Rearranging β_{1i}, shows how the marginal unsorted worker equates the costs of their two options. In equilibrium β_{1i} is expressible only as a function of the most impatient worker, $\overline{\beta_i}$. If $\overline{\beta_i}$ increases in equilibrium, it is because the firm allows increasingly impatient workers to enter the labor market via higher wages to satisfy the reservation utility. The fixed fee, c_i is closely related to $\overline{\beta_i}$, and is expressible as $P_n w_i$ or the expected wage of an unsorted worker. In equilibrium, the THA is capturing all of the surplus from THA unsorted workers. In other words their participation constraint given by (3) holds with equality.

The THA decision of which male workers to sort, β_m^*, is uninteresting. It is simply given as a ratio of the relative searching (sorting) costs of the worker (THA). This is because β_m^* is redundant following the male workers choice of β_{2m}.

[19] As the THA equates MR and MC, it finds the optimal decision is to sort fewer workers and increase the surplus per worker s_m.

Rearranging the womens equilibrium expression for β_i^* illustrates the monopolistic behavior of the THA: $t\beta_i^* = s_i + c_i$, equating marginal revenues to marginal costs for the most costly of the workers it will sort. It is also true for the women that $\beta_f^* = \frac{r}{t}\beta_{2f}$. As the THA anticipates more impatient workers selecting into the permanent market, the most patient worker it will employ is now less patient than before. Because this worker is less patient, they have a more costly outside option in the direct-hire temp search and so the THA can capture more surplus per worker, s_f. With more surplus per worker, the THA is able to relax its quantity restriction and sort more workers by increasing β_f^*.

Worker choices between temporary and permanent markets are given in equilibrium by β_{2i}. For the men, β_{2m} is simply a function of costs t and r. The THA's sorting cost t is not particularly meaningful here, because in equilibrium no men are sorted by the THA. Therefore β_{2m} illustrates the fact that fewer workers select into permanent work when the costs of searching there increase. For women, β_{2f} can be expressed as the ratio of cost-benefit differences, $\beta_{2f} = \frac{w_f(1-P_n)}{(r-g)}$. The numerator gives the difference between permanent and temporary direct-hire wages, while the denominator gives the difference between permanent and direct-hire costs. As the difference in benefits increases (or costs decreases), β_{2f} moves leftward as permanent search becomes relatively more attractive to the worker. For both the men and the women, β_{2i} can be expressed by equating the costs faced by those workers who would be sorted by the THA.[20]

3.3.1 Comparative Statics

The wage decisions of the firm, ultimately affect the decisions of all players of the game because they determine the payoffs for each player. This section discusses movements in the wage from exogenous variation.

The firm's decision on the wage level is positively impacted by both productivity and the

[20]This additional indifference condition does not preclude indifference with the direct hire temporary job, since the β_{2i} worker is indifferent between all three.

most patient worker, $\frac{\partial w_i}{\partial N} > 0, \frac{\partial w_i}{\partial \underline{\beta_i}} > 0$. Both of these wage movements are determined by the participation constraint on the most impatient worker. The first comparative static illustrates how the firm awards productivity. As (expected) productivity per worker increases, the firm is able to employ more un-sorted workers in equilibrium by increasing the wage; the participation constraint is satisfied for a less patient worker. Meanwhile, the patience level of the most patient worker plays a similar role. As the most patient workers exit the market, the firm must pay more to satisfy the less patient workers who will take their places.[21]

For women, changes in wages are also positive when driven by increases in the job searching and sorting costs for sorted workers, $\frac{\partial w_f}{\partial t} > 0, \frac{\partial w_f}{\partial r} > 0$. As the THA's sorting cost, t, increases the firm will pay more to ensure the THA can still afford to sort a sufficient number of temp workers. Because the firm makes strictly more money in expectation on a sorted worker, $N > P_n N$, the firm would prefer that more workers were sorted. The preference for sorted workers continues into the permanent market. As permanent search costs, r, increase the firm will also increase wages to ensure workers still select into the permanent market where they are sorted into good jobs.

The comparative statics with respect to the unsorted market are less transparent. Increases in worker's own search costs, g, and their probability of finding a good match, P_n, depend on their relative magnitudes. When g is much smaller than r there are many workers in the temp market. In this case $\frac{\partial w_f}{\partial g} > 0$ and $\frac{\partial w_f}{\partial P_n} < 0$ since the firm needs to satisfy the participation constraints as costs rise, but may pay less as the expected wages increase. If the direct-hire temporary search costs are not as large with respect to search costs in the permanent market, then there are fewer unsorted workers employed in equilibrium. Now wage movements with respect to g are driven by the THA; $\frac{\partial w_f}{\partial g} < 0, \frac{\partial w_f}{\partial P_n} > 0$ because the THA can charge more

[21]Since the most impatient employed worker is endogenously determined and since $\frac{\partial \overline{\beta_i}}{\partial \underline{\beta_i}} > 0$, an increase in the impatience level at the left hand limit of the distribution of β_i leads to an increase in the right hand limit also. Therefore to some extent, an increase in the least impatient worker's level of impatience leads to a more impatient group overall in the market as well an increase in the patience level of the most impatient worker.

surplus per worker when their outside option of direct search is more costly and, so the firm need pay the worker less to ensure the THA can capture enough surplus.

Although the expression for male wages differs, the behavior of the firm is remarkably similar. Comparative statics for $N, \underline{\beta_i}, r$ are the same for men as for women. Interestingly, $\frac{\partial w_m}{\partial t} < 0$ for the men. Interpretation of this result is not clear because in equilibrium, no workers are screened and the THA does not pay the costs associated with t. The comparative statics for g and P_n also depend on the relative size of parameter values in the same way as they did for the women.

3.4 Implications of the THA

The presence of a THA in the model has impacts on wages and therefore also affects all endogenous aspects of the model. We can consider direct effects of the THA's existence on the other players through this wage change, and indirect effects through changes to the sorting decisions of workers as wage fluctuations alter the marginal patience levels. The direct effect of a THA on wages is negative. Because the THA is placing more workers for certain, the firm is able to lower the wage it offers while satisfying the participation constraints of an optimal number of workers. This is true and follows from the condition that $r > t$.[22] With higher wages, the entire curve $U_i(\beta_i)$ in Figures A2 and A5 would shift upwards. The indirect effects mean changes in $\beta_{1i}\beta_{2i}$and$\underline{\beta_i}$, as well as changes to which workers are sorted (effectively β_i^*). Since $\frac{\partial \beta_{2f}}{\partial w_f} > 0$, more female workers will select into the permanent market without the THA. β_{1i}, which represents the last employed worker when the THA is not in the market, will also increase meaning more workers will be searching in the direct-hire temp market.

In terms of the direct effect, the firm benefits from the THA's presence. When the THA ensures the reservation utility of the most impatient worker, $\underline{\beta_i}$ is satisfied, all workers $\beta_i \in$

[22]For women, equilibrium wages with and without the THA are given by $w_f = \frac{\underline{\beta_f} tg(r-g)}{2tP_n^2(r-g)+rg(1-P_n)^2}$, and $w_f = \frac{\underline{\beta_f} g(r-g)}{2P_n^2(r-g)+g(1-P_n)^2}$ respectively.

$[\beta_{1i}, \underline{\beta_i})$ are employed because of the THA.[23] Although these workers are no better off than they would be if they abstained from the job market, the fixed fee option of the THA allows them to accept employment. This is true for both men and women. The firm is better off if more workers are employed in equilibrium, provided there are not fewer sorted workers, because the firm has a positive expected profit for each worker employed.

The indirect effect on the firm is negative. Whether the firm is better off without the THA can depend in part on whether $\beta_{1i,NoTHA} < \overline{\beta}_{i,WithTHA}$ and also whether $\beta_{2i,NoTHA} < \beta*_{i,WithTHA}$. As long as these inequalities hold, the indirect effect of the THA on the firm is positive because the firm employs more workers and more of these workers will be sorted in equilibrium.

The direct effect on workers of the THA's existence is negative. Without the THA workers earn more in equilibrium. This follows directly from the solution for the firms problem with and without a THA, given that we assume $t < r$.

The indirect effect on the how a worker's impatience level compares to β_{1i} and β_{2i} with and without the THA. Workers just barely satisfying $\beta_i > \beta_{1i}$ may be better off without the THA because they would have searched on their own at a lower cost if the THA's presence did not lower wages causing them to cross into the unsorted THA group. Similarly, β_{2i} will move if the THA exits the market so the support of the distribution who choose permanent employment also change. So while some of the workers $\beta_i < \beta_{2i}(THA)$ but $\beta_i > \beta_i(NoTHA)$ may prefer the THA when the THA exists, they could enter into the permanent market in it's absence and be better off if wages were higher. Workers with $\beta_{2i}(NoTHA) < \beta_i < \beta_i^*$ are better off with the THA sorting. This is because the surplus they give up to be sorted in equilibrium is small compared to the benefit of a guaranteed wage w_i.

[23]In equilibrium with the THA, β_{1i} and $\overline{\beta_i}$ workers receive the same utility.

4 Data

4.1 The NLSY79

Empirical results on THA worker outcomes come from analyses on the National Longitudinal Survey of Youth (NLSY) 1979 cohort available publicly from the Bureau of Labor Statistics. This cohort study, created from a survey of 1979 United States population aged 14-22, is one of the few independently compiled datasets with information about the type of temporary work placement.[24] Because the primary work arrangement is the target of interest in the case of multiple jobs, this paper focuses on the CPS job (job#1) from the NLSY surveys. From the 12,686 individuals originally sampled in 1979, there are observations for 672 workers with a temporary primary job, of which 313 are observed working through a THA.[25] The questionnaire rounds from 1994, 1996 and 1998 distinguish THA from direct-hire temporary workers, and provide data on workers aged 29-41. Future rounds of the survey do not distinguish the THA workers as clearly, and provide no comparison group for analysis.[26] Over the three years this sample has 2.99% of the employed workers in temporary jobs, which is consistent with THA representation in the United States population of just under 3% (Peck and Theodore, 2002). Estimations to illustrate the effect of THA sorting technology restrict the data to those who "considered [themselves] a temp worker, sent by a temporary agency," or a "temp worker, hired directly by the company." This restriction ensures the adoption of correct treatment and comparison groups, THA workers and direct-hire temporary jobs respectively. Other sampling restrictions exclude temporary workers in active military service, and agricultural workers.

The treatment effect of THA-sorting on the workforce is measured with the natural log of

[24] The NLSY79 data were collected annually from 1979-1993, at which point the survey was administered every other year starting with 1994.

[25] In order to maximize the sample size I include the main sample as well as the race over samples.

[26] 2002-2008 survey rounds ask respondents if they were paid by a THA agency. Because THA agencies have been known to provide outsourcing payroll solutions for existing employees, this sample would likely be contaminated by such observations and allow no insight into the effects of being placed in a job via a THA agency. These years also do not provide any observations specifically for the direct-hire temporary arrangement.

earnings, including wage income and tips, in U.S. Dollars.[27] This outcome shows the percentage difference in the earnings of a worker who has held a THA job, compared with the earnings of a worker who has held a direct-hire temporary job. Earnings are further broken down into weekly hours worked and the hourly wages to separate the contributions to income of labor supply and productivity.

This outcome should reflect the quality of a job placement when one considers that better job placements lead to increased productivity, and therefore higher wages. A superior job placement is also more likely to generate future employment opportunities, or act as a stepping stone, and therefore could lead to higher future probability of employment. Since the average THA assignment is 10-12 weeks in duration, (American Staffing Association, 2009), the first of the bi-annual observations should capture most workers after their original THA assignment. There is very little repeat incidence of temporary jobs in this sample, with only 12% of THA workers observed in THA jobs more than once, 13% for temporary workers in general.

4.2 Observable Characteristics

Due to the comprehensive nature of the NLSY79 dataset, a rich set of personal characteristics are available as control variables. Personal demographics used in this paper include age, race, immigration status, geography, marital status, health concerns, and the number of children in the household. To measure the intellectual capacity and the skill set of the workers covariates for educational attainment, a measure of the number of jobs held by the worker, and the workers Armed Forces Qualification Test (AFQT) score are included. Finally, workforce variables include current occupation category as well as past labor force status, measures of weekly hours worked in past years, and the local unemployment rate. Because selection into THA jobs may introduce bias, estimates are conditioned on past labor market status following Heckman and Smith (1999), who find that unemployment and not earnings dynamics, drive participation in

[27]Outcomes are measured on data from 1996-2008 which includes the most recently available information from the NLSY79.

labor market programs.[28]

Examination of these observable characteristics (See Table 1) by type of temporary job, for both genders, identifies some key differences in both the workers and their labor markets. These differences suggest the differing distributions of job market patience between the men and women in the sample.

When they are employed, past and present THA women are found in more favorable labor markets. They also appear to have a higher level of ability than their direct-hire counterparts, but may lack the educational credentials to match their higher ability. The THA and direct-hire women also differ in the following ways which the men do not: THA women have more labor market experience, as seen through the total number of jobs ever held, are less likely to be married and have fewer children than the direct-hire women. These summary statistics suggest the THA women are more career oriented than the direct-hire women, and are willing and able to abstain from poor labor markets. These characteristics suggest a higher degree of job market patience for THA women compared to direct-hire women.

Three digit occupational codes, using 1970 encoding, are available for the workers in this sample. The distribution of occupations by type of temp job is more heterogeneous in the women than the men, as illustrated by Figure A1 in the appendix. Because certain transferable skill jobs, such as clerical work, may lend themselves to THA positions it is important to control for occupation of the worker. It is possible that occupations more common to THA jobs also pay differently than those occupations usually offered by firms which hire their own workers.

5 Empirical Framework

Two estimators are used in this paper to illustrate the selection process and outcomes for THA workers as described in the model.

In order to compare the causal impact that a THA job has on its workers based on observable

[28] Heckman and Smith (1999) show that changes in wages from labor market programs are a consequence of underlying changes in labor market status.

Table 1: Temporary Worker Characteristics

	Women			Men		
	THA	D-H	Difference	THA	D-H	Difference
Local Unemp Rate During	2.391 (0.064)	2.850 (0.077)	-0.460**	2.649 (0.090)	2.848 (0.094)	-0.199
Local Unemp Rate After	2.136 (0.058)	2.665 (0.093)	-0.529**	2.391 (0.095)	2.591 (0.106)	-0.200
Weekly Hrs During	36.889 (0.968)	28.872 (1.037)	8.017***	39.066 (1.001)	35.568 (1.308)	3.499**
Weekly Hrs After	33.194 (1.218)	26.995 (1.186)	6.199***	38.216 (1.273)	38.448 (1.612)	-0.232
Total No. Jobs Ever	11.235 (0.497)	9.986 (0.332)	1.249**	12.841 (0.449)	13.649 (0.566)	-0.807
Completed Yrs of Schooling	12.543 (0.160)	12.611 (0.204)	-0.068	12.152 (0.146)	12.324 (0.191)	-0.172
Pr(College Graduate)	0.086 (0.022)	0.180 (0.027)	-0.139***	0.066 (0.020)	0.101 (0.025)	-0.035
Pr(H.S. Graduate)	0.728 (0.035)	0.672 (0.032)	0.055	0.755 (0.035)	0.669 (0.039)	0.086
Pr(Married)	0.401 (0.039)	0.540 (0.035)	-0.139***	0.258 (0.036)	0.277 (0.037)	-0.019
AFQT Score	27.635 (1.893)	29.950 (1.966)	-2.314	24.603 (1.923)	27.133 (2.100)	-2.530
Hourly Wage	8.164 (0.416)	8.690 (0.595)	-0.526	7.853 (0.345)	12.326 (3.377)	-4.473
Number of Kids in HH	1.599 (0.102)	1.919 (0.086)	-0.321**	0.576 (0.089)	0.682 (0.101)	-0.106

T-test for equality of means by type of temp job. Sample of temp workers from the NLSY79 years 1994-98. Standard errors in parentheses. Difference reported as $\mu_{THA} - \mu_{Direct-Hire}$. AFQT score reported as a percentage, hourly wage in U.S. dollars. During refers to the year a worker is observed in a temp job, after refers to the period 2 years after they are observed in a temp job.

characteristics in the data, this paper presents cross sectional measurement of the treatment effects of having held a THA job.[29] The direct impact of THA work on a worker is given by the difference

$$\Delta = E[Y_1 - Y_0|X] \tag{5}$$

where Y_1 is the outcome when an agent has held a THA job and Y_0 is the outcome if the agent has not held a THA job. Two classes of workers are considered from the data and identified by an indicator variable D so that $D = 1$ identifies a THA employee, and $D = 0$ marks control observations comprised of direct-hire temporary employees. However, only $E[Y_1|D = 1, X]$ and $E[Y_0|D = 0, X]$ are observable. To observe the Δ for the THA employees we need

$$\Delta^{ATT} = E[Y_1|X, D = 1] - [Y_0|X, D = 1] = E[Y_1 - Y_0|D = 1, X]. \tag{6}$$

If a worker has had a THA job, however, Y_0 is never observed for this worker and so the counter factual, $E[Y_0|D = 1, X]$, must be imputed. In order to create the counter factual, the matching estimator compares each individual in the treatment group to a group of similar individuals in the control group. Where the comparison is sufficiently strong, because we match on a rich set of observables, the counter factual is well approximated by a direct-hire worker with very similar X and we observe the Average effect of Treatment on the Treated, Δ^{ATT}.

While the above estimation looked at workers in the cross sections of the data, the difference in difference estimates exploit the panel structure to eliminate the effect of patience on the THA job sorting technology. Because patience is not observed directly, cross sectional matching estimation techniques may not identify the causal effect of the THA. Conditioning on pre-treatment covariates, this paper uses the matching framework to estimate the following

$$\Delta^{ATT}_{DID} = E[(Y_{1,t+h} - Y_{1,t}) - (Y_{0,t+h} - Y_{0,t})|X_t, D_t = 1] \tag{7}$$

where h represents the number of periods post-treatment where the worker's outcomes are measured.

[29]Not to be confused with theoretical job matching concepts, referred to as job sorting mechanisms in this paper, which are of no direct relation.

5.1 Bias-Corrected Estimator

Estimates in this paper for both cross-sectional and DID methodologies use the simple bias-corrected estimator from Abadie and Imbens (2002) and Abadie et al. (2004). The counter factual is imputed by matching the treated observation to the nearest m control observations across all covariates X. The most similar m control observations should provide an adequate comparison individual who differs only in treatment status, D. This estimator matches on the metric distance of all $x \in X$. Given the vector norm $||x||_V = (x'Vx)^{1/2}$, the distance metric for covariate matching is written

$$w = ||z - x||_V \tag{8}$$

where x are the covariates of the treated and z are the equivalent control group values of the nearest m matches.

For a finite sample the match on X is unlikely to be exact, meaning that the covariates of treatment and controls may differ slightly.[30] When computing the ATT matching on observables D and X, a bias arises of the form

$$Bias^{ATT} = E[\hat{Y_1} - \hat{Y_0}|X, D = 1] - (E[Y_0|X, D = 1] - E[Y_0|X, D = 0]) \tag{9}$$

from the non-zero value of w. Eliminating this bias corrects for the difference in $E[X|D = 0]$ and $E[X|D = 1]$, and represents a best effort at identification of a causal effect based on observables. The bias-corrected results will therefore exhibit conditional mean independence:

$$E[Y_0|X, D = 1] = E[Y_0|X, D = 0]. \tag{10}$$

The bias correction in this estimator is carried out by differencing linear regressions

$$\hat{\mu_1} = E[Y_1|X] \quad and \quad \hat{\mu_0} = E[Y_0|X] \tag{11}$$

for treatment and controls respectively. Linear regression minimizes sum of squared deviations between actual and predicted outcomes within each group, and reports the mean difference in

[30] Although asymptotically this bias approaches zero.

the outcomes conditional on covariates X. This mechanism captures the impacts of X on the outcomes for treatment and controls. By differencing these conditional means we can isolate the change in impact which is due to discrepancy in X values across the two groups, and adjust our counter factual observation accordingly. The counter factual observation $(Y_0|D = 1)$ is imputed as

$$\tilde{Y_0} = \frac{1}{m} \sum \left[(Y_0|D = 0) + \hat{\mu_1} - \hat{\mu_0} \right]. \tag{12}$$

Finally, the impact of treatment on the treatment group (THA employees) is found:

$$\Delta^{ATT} = \frac{1}{N_{D=1}} \sum [Y_1 - \tilde{Y_0}]. \tag{13}$$

6 Estimation Results

6.1 Worker Income

Estimation of the impacts on worker incomes reveal a gender disparity across the outcomes as a result of the THA assisted job sorting process. Table 2 shows results for women, while Table 3 shows results for men. In both tables, specifications 1-3 give the impact of THA sorting on outcome levels in the cross sections based on observables. Estimates are computed using the bias-corrected matching estimator due to Abadie and Imbens (2002), where each treatment observation is matched to the nearest 8 controls. Specifications 4-6 present difference-in-difference results from the longitudinal perspective, which controls for unobservables including impatience. It appears that the ability of the THA sorting technology to outperform a typical job market sorting mechanism, as seen in specifications 1-3, is limited by the impatience of the workers who have selected into the temporary job market. Differing job market conditions and family structures make this possible for the women in the sample. Comparison of Cross-sectional to longitudinal analysis shows that unobservable characteristics, such as patience, are complements to the sorting technology of the THA and necessary for a worker to benefit from THA job search assistance.

Table 2: Bias-Corrected Matching Results for Women

	(1)	(2)	(3)	(4)	(5)	(6)
Years	ln(Income)	ln(Wage)	ln(Hours)	Δln(Income)	Δln(Wage)	Δln(Hours)
2	0.444***	0.106**	0.152**	0.200	-0.069	-1.904
	(0.159)	(0.053)	(0.066)	(0.249)	(0.074)	(2.103)
4	0.521***	0.181**	0.154**	0.134	-0.014	-2.248
	(0.172)	(0.081)	(0.069)	(0.258)	(0.083)	(2.520)
6	0.285*	0.063	0.064	-0.283	-0.336***	-4.148
	(0.159)	(0.087)	(0.070)	(0.266)	(0.104)	(2.598)
8	0.352**	0.087	0.02	-0.035	-0.092	-5.047*
	(0.171)	(0.136)	(0.088)	(0.246)	(0.141)	(2.967)
10	0.123	0.119	-0.050	-0.645***	-0.071	-8.827***
	(0.173)	(0.158)	(0.066)	(0.244)	(0.175)	(2.378)

Impacts measure the affect of THA job sorting on THA workers. Bias-corrected matching estimates for THA vs. direct-hire temps. Sample from years 1994, 1996, 1998 of the NLSY79. Matching covariates include age, race, immigration, marital status, health, number of children, educational attainment, number of jobs held, AFQT score, occupation, past labor force status, weekly hours worked and local unemployment rate. Standard errors in parentheses. Treated observations matched on 8 controls. Estimates report average treatment effects on the treated. Years are post THA job. Income includes wages and tips, wage in $U.S. per hour, hours measured weekly.

Women appear to benefit from holding a THA job compared to other temporary workers, as seen from specification (1). Matching estimates for labor income after a THA job indicate that the average female worker earns 55% more two years later than they would have if they had not been placed by a THA firm. This effect persists in the long term declining to 42% after eight years, and losing significance at the ten year mark. It is likely that training or experience provided through the THA placement has been a complement to their skill set and ability and has resulted in high productivity in the workplace. In other words, more of these women have been placed into “good”' jobs for their skill category.

Although data on the time spent finding a placement for these THA women is not available, it is expected that fewer women are the primary income source for their families meaning that an agency has more time to sort them into jobs. This hypothesis is consistent with the data on local unemployment rates in Table 1. If THA women are working in more attractive labor markets, they will be more likely to obtain a suitable job where their productivity and wages can increase. In addition, the higher wages observed for THA women support the assumption that THA women seem are more career focused relative to the direct-hire sample. With fewer children it can be expected that women who have selected the THA job search method are able to give their career a higher priority than the direct-hire women. A more patient group of women selecting into temporary work leads the THA to sort more of the female temp workers leading to higher average earnings in equilibrium.

By contrast, difference in difference (DID) estimates eliminate the effect of the THA on income. This result supports the implications of the model, suggesting that the THA impacts are contingent upon sufficient patience in the workers, which is unobservable in the cross-sectional matching estimates.

Compared to the direct-hire men, estimation results suggest that, THA men suffer slightly in the short term earnings. The average male THA worker earns 40% less because of THA job sorting assistance two years after their THA job, although this effect is not significant beyond

Table 3: Bias-Corrected Matching Results for Men

Years	(1) ln(Income)	(2) ln(Wage)	(3) ln(Hours)	(4) Δln(Income)	(5) Δln(Wage)	(6) Δln(Hours)
2	-0.331*	-0.125	-0.03	0.094	0.170**	-3.616
	(0.186)	(0.084)	(0.061)	(0.409)	(0.085)	(3.843)
4	0.179	0.121	-0.079	-0.095	-0.087	-2.891
	(0.254)	(0.120)	(0.055)	(0.399)	(0.131)	(4.163)
6	0.034	-0.324	-0.058	-0.571	0.120	0.871
	(0.253)	(0.213)	(0.075)	(0.429)	(0.220)	(4.233)
8	-0.201	-0.367	0.026	-0.021	0.001	-0.138
	(0.212)	(0.189)	(0.054)	(0.345)	(0.138)	(3.208)
10	-0.141	-0.199	-0.037	-0.043	0.012	-3.425
	(0.176)	(0.139)	(0.045)	(0.349)	(0.204)	(2.991)

Impacts measure the affect of THA job sorting on THA workers. Bias-corrected matching estimates for THA vs. direct-hire temps. Sample from years 1994, 1996, 1998 of the NLSY79. Matching covariates include age, race, immigration, marital status, health, number of children, educational attainment, number of jobs held, AFQT score, occupation, past labor force status, weekly hours worked and local unemployment rate. Standard errors in parentheses. Treated observations matched on 8 controls. Estimates report average treatment effects on the treated. Years are post THA job. Income includes wages and tips, wage in $U.S. per hour, hours measured weekly.

the two year time period. Therefore it appears that a THA placement has no long term impact on their earnings. The job sorting assistance of THA may not lead to higher future earnings because the THA may be unable to find these male workers a job which is well matched with their skill-set, or is unable to place them into occupations which lead to opportunity for career growth. As predicted by the model, the lack of statistical difference between the two types of male temp workers suggests that the majority of THA men equally likely to find a "good" job as a direct-hire temp worker because they are not sorted by the THA.

If the pressure of traditional gender roles is strong enough to alter the incentives facing male temporary workers it is possible that they are asking the THA to place them quickly, since they are a primary income source for their family, rather than waiting for a more suitable placement.[31] The short term dip in earnings at the two year mark is therefore likely related to human capital destruction occurring after exiting a THA position, which matches the results of Kambourov et al. (2010). THA women are avoiding this dip because of their patience; they are placed more accurately according to their skills because they can be sorted by the THA.[32]

The short term earnings dip for men appears to be driven primarily by productivity loss rather than labor supply. This can be interpreted as evidence in favor of the human capital destruction theory whereby men accumulate more job-specific human capital. Job switching is therefore more costly for the men in the short run.[33] Evidence of this human capital destruction is found in the Appendix Table A2, illustrating the net change in squared occupational code after THA placement. Men experience a significantly larger magnitude change in occupational code after they are observed in the THA job. To the extent that occupational codes are grouped based on similarity, this t-test suggests that men work in less similar occupations after THA placement. Not only are the therefore less likely to be able to benefit from the skills accumulated

[31]Theory suggests that male temp workers are less patient than the women because there is a lesser degree of heterogeneity among male temp workers.

[32]Patience may be higher because women invest less into job specific human capital.

[33]This also demonstrates the expected stability of the male labor supply, consistent with the supply of primary earners.

during the THA job match, but also an occupational change after THA placement suggests they were unlikely to have been productive or satisfied with the THA sorted outcome. These results may help to explain the findings of Booth et al. (2002); Addison and Surfield (2006) where women are found to fare better that men in all temporary jobs.

When income is split into wage and hours, the estimations show that both the productivity and labor supply channels are behind the increases in the wages of women. THA women are able to work more hours in the future and earn a higher wage. The labor supply results support the career focused hypothesis; these women are not just in temporary work for short-term cash, but are interested in a career and are therefore patient by necessity. The increase in wages, however, speaks to productivity increases in earnings to the better placements these THA women experience. Although each of these effects is independently significant for only four years following their THA job, together they contribute to significant income increases lasting over eight years. DID estimates, eliminating the effect of patience on hours, reveal that cross sectional estimates held an upward bias.[34] These THA women in our sample who are more patient may actually begin to reduce their hours worked as they age, especially those who are secondary earners for the household. At 8 and 10 years post THA, the workers in our sample are aged 37-49 and many may select into part time work as their career peaks.[35]

It is important to note that for both men and women, the patience effects on selection and the resulting sorting behavior are eliminated by the DID estimation. This suggests that the model has the appropriate degree of heterogeneity to explain the selection decisions of the workers.

[34]The author expects a positive bias due to the following: $corr(patience, hours) > 0$, $corr(patience, AFQT) > 0$.

[35]DID Estimates of probability of employment confirm this result. Women in this sample are less likely to be employed 10 years after the THA placement.

6.1.1 Other reasons for the Gender Disparity

It is possible that the quality or "prestige" of the THA placed occupation may also play a role in the gender difference. Using measures of occupational prestige due to Stevens and Featherman (1981) Appendix Table A3 maps the the 3 digit census occupation codes of temp workers to the various levels of prestige. The prestige, or "socioeconomic index of occupational status", assigns higher values to occupations which are attributed to socioeconomic status in the sociology literature. Estimates show that women experience an increase in the prestige of their occupation after THA assisted job placement, while men do not. Gaining experience within a more prestigious occupation may contribute positively to future labor market opportunities.

The revealed difference in income across gender can not be explained by attrition patterns of women in this sample. The fractions of women and men who are not employed at some point following their THA placed job, called "survivors," are very similar at 63% and 67% respectively. This similarity remains when comparing attrition rates for direct-hire workers. The similarity in attrition rates across genders and temporary jobs holds for several measures of attrition across all intervals of time following the temporary job.[36] Impacts of THA sorting on income levels for these temporary workers who "survive" and are observed employed in all years following their temporary job are similar, although significance suffers due to small sample sizes. These estimates are presented in the Appendix Table A6.

The above matching estimation results are robust to the number of control comparisons and alternative estimates are available from the author upon request.

7 Conclusion

This paper compares two alternative job sorting technologies, the traditional job search and placements arranged by THA agencies, by comparing THA workers to direct-hire temporary

[36] Workers who are not employed 2,4,6,8, and 10 years after holding a temporary job are evenly distributed across gender and type of temporary job.

workers on the basis of earnings.

The model presented above illustrates the effect of unobservable characteristics, such as impatience, on workers sorting decisions: with higher costs in the permanent market, less patient men select into temporary work compared to the women. As a result of the gender differences in sorting behavior, temporary male workers are a much more homogeneous group than their female counterparts and all earn wages given by Pw. Job search through the THA does not lead to better sorting nor higher wages as the THA is unable to sort the men. This follows endogenously from the patience level of the men who select into the temp market. By contrast, women are more heterogeneous. Some THA women earn w while other temp workers earn Pw. Therefore the THA women earn more on average than their direct-hire counterparts. Because many of the THA women are sufficiently patient, the THA sorting technology is able to place them into better jobs leading to higher earnings.

Using the NLSY79 dataset and a bias-corrected matching estimator this paper measures the impact of THA sorting technology on workers, finding a gender differential in terms of earnings which persists for eight years. This difference in income is found to be driven both by the labor supply decisions and the productivity increases of the THA women. THA placed women, who appear more often as secondary earners for their households, experience higher income in comparison to direct-hire female workers. Two years after THA work they earn 55% more than if they had held a direct-hire job, with the gap disappearing after eight years.

The men in our sample do not experience the same effect. Initially the men in our sample suffer a diminished earnings rate, which can be partially attributed to the human capital destruction from switching between jobs. Beyond the two year mark however, there is no significant effect on men since the sorting process for THA men is limited by their relatively higher levels of impatience in job search. This is supported in the data by the similarity in labor markets and personal characteristics facing both THA and direct-hire men.

This gender difference in labor market outcome may be attributed to the sorting technology of the THA. The model presented in this paper illustrates how unobserved differences in characteristics like impatience, which have lead to a divided empirical literature, limit the ability of the THA to screen workers. The men in our sample are passed through the THA without the sorting due to their high screening costs, while the several of the women are screened and sorted based on their skills. The model predicts that unobservables, such as impatience, drive both worker selection and the resulting heterogeneity of income levels in equilibrium across genders.

Empirical results support the theory that unobservable characteristics, and their impacts on selection behavior, underly the difference in worker outcomes. Panel data estimates wash out the sorting effect of the THA so that there is no difference between THA and direct-hire women (or men).

Two important considerations arise from the results. Firstly, more suitable placements are possible when information asymmetry is alleviated, at least in part, with regard to worker skills or ability. These jobs are better for the firm and the worker, and empirical evidence has shown that they can have dramatic benefits for wages. This suggests that when considering a dynamic labor market, it is not beneficial for a worker to be misleading with their resume. Secondly, social pressures seem to result in differing incentives surrounding job search. These incentives lead to job placements which are not ex-post efficient; there are better jobs available for those who wait. This is particularly illustrated by our male sample who are likely unable to smooth their consumption in the short run without immediate employment.

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Appendix

Table A1: Affect of THA Matching on Income for "Survivors"

Years	Women ln(Income)	Men ln(Income)
2	0.2595	-0.3792
	(0.2345)	(0.2626)
4	0.3852*	-0.0073
	(0.214)	(0.1903)
6	0.1491	-0.1649
	(0.2253)	(0.2246)
8	0.184	-0.4255*
	(0.2183)	(0.2457)
10	-0.0505	-0.3104
	(0.2437)	(0.2643)

Bias controlled matching estimates on 8 controls. Impacts report affect of THA matching on those matched by THA who have always been employed (survived) since THA job. Standard Errors in parentheses.

Table A2: Squared Occupation Code Changes by Type of Temp Worker

	Women			Men		
Years post Treatment	Δ^2 THA Occ Code	Δ^2 D-H Occ Code	Difference	Δ^2 THA Occ Code	Δ^2 D-H Occ Code	Difference
2	60767.38	105226.3	44458.92**	82548.46	88539.33	5990.874
	(8881.039)	(16566.13)	18839.08	(13311.8)	(14343.96)	(19551.48)
4	41573.81	163636.9	122063.1***	73312.48	99794.34	26481.86
	(7668.213)	(26599.82)	(29181.83)	(15325.36)	(24565.98)	(28498.89)

Results are t-Test for equality of means of squared changes in occupation code from temp job.
Difference shown represents $[\Delta_{DH}(OCC)]^2 - \Delta_{THA}(OCC)]^2$

Table A3: Occupational Prestige estimates

	Women	Men
Years post Treatment	prestiege	prestiege
2	7.548**	4.145***
	(3.231)	(3.518)
4	9.429*	7.808
	(5.018)	(8.300)

Results are ATT matching estimates
For occupational prestiege codes due to
Stevens and Featherman (1981)
Sample size too small for further analysis

Figure A1: Occupation Distribution by Gender

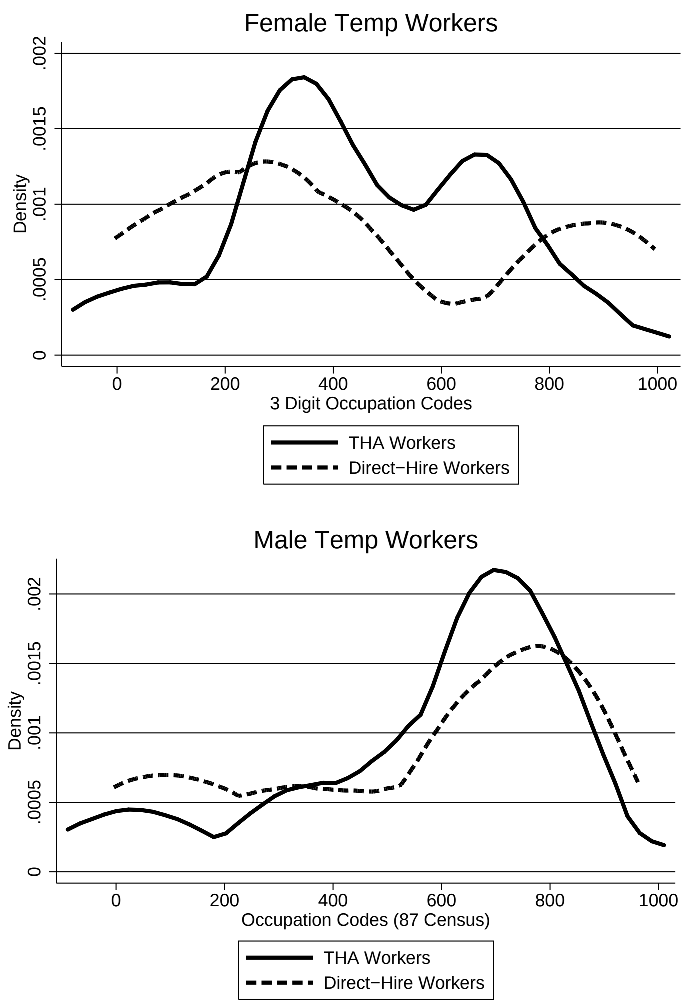


Table A4: Bias-Corrected Matching Sensitivity Results

	# Matches		1	2	3	4	5	6	7	8
Women	Ln Income	2yrs	0.170	0.361**	0.378**	0.394**	0.408***	0.422***	0.441***	0.444***
			(0.184)	(0.163)	(0.160)	(0.160)	(0.157)	(0.159)	(0.159)	(0.159)
		4yrs	0.183	0.471***	0.448***	0.469***	0.502***	0.495***	0.513***	0.521***
			(0.203)	(0.177)	(0.171)	(0.174)	(0.170)	(0.170)	(0.172)	(0.172)
		6yrs	-0.174	0.115	0.206	0.241	0.283*	0.291*	0.275*	0.285*
			(0.173)	(0.165)	(0.163)	(0.162)	(0.159)	(0.154)	(0.158)	(0.159)
		8yrs	-0.025	0.199	0.229	0.329*	0.330*	0.338**	0.347**	0.352**
			(0.202)	(0.166)	(0.161)	(0.169)	(0.171)	(0.171)	(0.170)	(0.171)
		10yrs	-0.255	-0.044	-0.033	0.073	0.114	0.104	0.126	0.123
			(0.193)	(0.181)	(0.176)	(0.173)	(0.168)	(0.171)	(0.173)	(0.173)
	Pr Emp	2yrs	-0.036	-0.024	-0.013	-0.019	-0.022	-0.028	-0.023	-0.022
			(0.025)	(0.025)	(0.027)	(0.026)	(0.025)	(0.026)	(0.027)	(0.027)
		4yrs	-0.038	-0.009	-0.016	-0.014	-0.014	-0.010	-0.005	-0.009
			(0.049)	(0.046)	(0.044)	(0.044)	(0.044)	(0.044)	(0.045)	(0.044)
		6yrs	-0.001	0.019	0.002	-0.007	-0.001	0.019	0.021	0.023
			(0.062)	(0.055)	(0.054)	(0.053)	(0.053)	(0.052)	(0.052)	(0.053)
		8yrs	-0.094	-0.076	-0.059	-0.044	-0.027	-0.039	-0.034	-0.030
			(0.069)	(0.062)	(0.059)	(0.060)	(0.059)	(0.058)	(0.058)	(0.059)
		10yrs	-0.089	-0.097	-0.092	-0.080	-0.066	-0.061	-0.049	-0.047
			(0.078)	(0.067)	(0.065)	(0.064)	(0.063)	(0.061)	(0.062)	(0.063)
Men	Ln Income	2yrs	-0.524**	-0.388**	-0.355**	-0.370**	-0.347*	-0.371**	-0.337*	-0.331*
			(0.243)	(0.198)	(0.180)	(0.176)	(0.181)	(0.180)	(0.184)	(0.186)
		4yrs	-0.202	0.302	0.262	0.255	0.179	0.162	0.160	0.179
			(0.259)	(0.266)	(0.246)	(0.251)	(0.241)	(0.245)	(0.250)	(0.254)
		6yrs	0.192	0.091	0.095	0.084	0.027	0.063	0.055	0.034
			(0.335)	(0.265)	(0.245)	(0.246)	(0.246)	(0.259)	(0.257)	(0.253)
		8yrs	-0.135	-0.264	-0.217	-0.165	-0.177	-0.174	-0.203	-0.201
			(0.260)	(0.236)	(0.221)	(0.211)	(0.216)	(0.217)	(0.216)	(0.212)
		10yrs	0.505	-0.188	-0.263	-0.221	-2.05	-0.188	-0.187	-0.141
			(0.221)	(0.187)	(0.177)	(0.171)	(0.182)	(0.184)	(0.179)	(0.176)
	Pr Emp	2yrs	-0.012	-0.011	-0.016	-0.020	-0.018	-0.019	-0.018	-0.019
			(0.042)	(0.035)	(0.032)	(0.032)	(0.033)	(0.034)	(0.035)	(0.035)
		4yrs	0.026	0.050	0.034	0.009	0.007	-0.004	-0.002	0.000
			(0.071)	(0.067)	(0.065)	(0.065)	(0.064)	(0.062)	(0.063)	(0.064)
		6yrs	-0.019	-0.049	-0.037	-0.048	-0.063	-0.061	-0.063	-0.071
			(0.085)	(0.076)	(0.073)	(0.076)	(0.074)	(0.075)	(0.075)	(0.074)
		8yrs	-0.125	-0.141**	-0.135**	-0.122*	-0.121*	-0.120*	-0.109	-0.110*
			(0.076)	(0.065)	(0.065)	(0.066)	(0.067)	(0.067)	(0.066)	(0.067)
		10yrs	-0.061	-0.072	-0.086	-0.081	-0.090	-0.079	-0.073	-0.078
			(0.072)	(0.063)	(0.061)	(0.063)	(0.065)	(0.064)	(0.065)	(0.065)

Table A5: Bias-Corrected Matching Sensitivity Results

	# Matches		9	10	11	12	13	14	15
Women	Ln Income	2yrs	0.434***	0.450***	0.451***	0.448***	0.434***	0.429***	0.423***
			(0.158)	(0.158)	(0.158)	(0.158)	(0.158)	(0.157)	(0.157)
		4yrs	0.520***	0.524***	0.539***	0.542***	0.540***	0.543***	0.550***
			(0.172)	(0.173)	(0.173)	(0.173)	(0.171)	(0.170)	(0.169)
		6yrs	0.261*	0.258	0.263*	0.264*	0.269*	0.274*	0.278*
			(0.159)	(0.160)	(0.160)	(0.157)	(0.156)	(0.157)	(0.158)
		8yrs	0.376**	0.393**	0.394**	0.404**	0.404**	0.408**	0.426**
			(0.175)	(0.176)	(0.176)	(0.177)	(0.176)	(0.178)	(0.178)
		10yrs	0.114	0.140	0.144	0.141	0.140	0.134	0.131
			(0.173)	(0.173)	(0.172)	(0.171)	(0.168)	(0.167)	(0.168)
	Pr Emp	2yrs	-0.023	-0.019	-0.020	-0.021	-0.022	-0.022	-0.023
			(0.026)	(0.027)	(0.027)	(0.027)	(0.027)	(0.027)	(0.026)
		4yrs	-0.006	-0.004	-0.004	-0.005	-0.009	-0.009	-0.011
			(0.044)	(0.044)	(0.044)	(0.043)	(0.043)	(0.043)	(0.042)
		6yrs	0.019	0.016	0.015	0.016	0.027	0.031	0.035
			(0.053)	(0.052)	(0.051)	(0.051)	(0.051)	(0.051)	(0.051)
		8Yrs	-0.032	-0.037	-0.029	-0.020	-0.015	-0.016	-0.014
			(0.059)	(0.059)	(0.059)	(0.059)	(0.059)	(0.059)	(0.059)
		10yrs	-0.045	-0.050	-0.052	-0.046	-0.045	-0.051	-0.053
			(0.063)	(0.063)	(0.063)	(0.063)	(0.063)	(0.063)	(0.063)
Men	Ln Income	2yrs	-0.316*	-0.335*	-0.323*	-0.321*	-0.315*	-0.292	-0.280
			(0.189)	(0.188)	(0.189)	(0.192)	(0.192)	(0.193)	(0.197)
		4yrs	0.190	0.201	0.195	0.183	0.186	0.215	0.228
			(0.251)	(0.255)	(0.252)	(0.251)	(0.250)	(0.250)	(0.247)
		6yrs	0.015	0.005	0.008	-0.007	-0.006	0.002	0.025
			(0.251)	(0.253)	(0.248)	(0.250)	(0.247)	(0.247)	(0.249)
		8yrs	-0.181	-0.187	-0.179	-0.170	-0.172	-0.174	-0.161
			(0.211)	(0.212)	(0.208)	(0.209)	(0.209)	(0.209)	(0.209)
		10yrs	-0.143	-0.125	-0.110	-0.131	-0.134	-0.107	-0.114
			(0.175)	(0.172)	(0.172)	(0.170)	(0.171)	(0.172)	(0.174)
	Pr Emp	2yrs	-0.017	-0.015	-0.016	-0.013	-0.011	-0.010	-0.008
			(0.036)	(0.036)	(0.036)	(0.037)	(0.037)	(0.037)	(0.038)
		4yrs	-0.002	0.006	0.007	0.007	0.010	0.011	0.012
			(0.064)	(0.064)	(0.064)	(0.064)	(0.064)	(0.064)	(0.064)
		6yrs	-0.073	-0.079	-0.086	-0.082	-0.090	-0.094	-0.095
			(0.074)	(0.074)	(0.074)	(0.074)	(0.074)	(0.074)	(0.074)
		8yrs	-0.104	-0.111	-0.107	-0.107	-0.107	-0.103	-0.102
			(0.067)	(0.068)	(0.068)	(0.069)	(0.068)	(0.068)	(0.068)
		10yrs	-0.077	-0.073	-0.078	-0.079	-0.077	-0.079	-0.076
			(0.065)	(0.065)	(0.064)	(0.065)	(0.065)	(0.065)	(0.065)

Table A6: Affect of THA Matching on Income for "Survivors"

Years	Women ln(Income)	Men ln(Income)
2	0.2595	-0.3792
	(0.2345)	(0.2626)
4	0.3852*	-0.0073
	(0.214)	(0.1903)
6	0.1491	-0.1649
	(0.2253)	(0.2246)
8	0.184	-0.4255*
	(0.2183)	(0.2457)
10	-0.0505	-0.3104
	(0.2437)	(0.2643)

Bias controlled matching estimates on 8 controls. Impacts report affect of THA matching on those matched by THA who have always been employed (survived) since THA job. Standard Errors in parentheses.

Table A7: Difference in Difference Estimates of Income

	Women	Men
Years post Treatment	ln(income)	ln(income)
0	196.9	-2473
	(2027)	(2345)
2	3883*	-6704***
	(2302)	(2484)
4	3725	948
	(2752)	(3972)

Results are matching DID estimates
Effect of THA on change in income

A1.1 The Model - Solution for Women

A1.1.1 The Workers Problem

Workers maximize their utility choosing between three states:

1. Temp job with through THA
2. Temp job Direct-Hire
3. Permanent job Direct-Hire

$$U_f(\phi_f, \beta_f) = \max \{\phi_f(\beta_f)(P_{f,y}w_f - s_f - c_f) + (1 - \phi_f(\beta_f))(P_n w_f - c_f), P_n w_f - g\beta_f, P_{f,y}w_f - r\beta_f\} \tag{14}$$

Since the THA moves before the worker, the worker takes $\phi_f(\beta_f)$ as given:

- If $\phi_f(\beta_f) = 0$: Then $\beta_f > \beta_f^*$ and the worker is too impatient for THA sorting. Since $t < r$, the permanent market is also too expensive for these workers and so the utility function simplifies to

$$U_f(\beta_f) = \max \{P_n w_f - c_f, P_n w_f - g\beta_f\} \tag{15}$$

The worker who is indifferent between these two options, β_{1f}, is implicitly defined by:

$$\begin{aligned} P_n w_f - c_f =& P_n w_f - g\beta_{1f} \\ \beta_{1f} =& \frac{c_f}{g} \end{aligned} \tag{16}$$

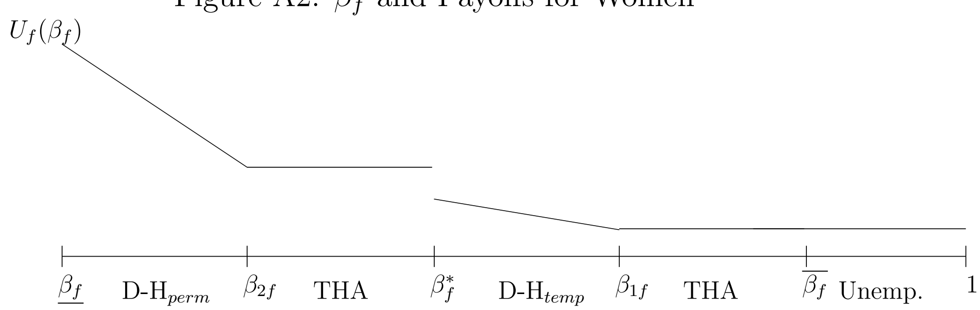
- If $\phi_f(\beta_f) = 1$: Then $\beta_f < \beta_f^*$ and the worker will be sorted if they choose the THA. Therefore $P_{f,j} = 1$. These more patient workers, however, may choose to search on their own in the permanent market which offers the sorted wage, but relatively lower search costs for patient workers.

$$U_f(\beta_f) = \max\{w_f - s_f - c_f, w_f - r\beta_f\} \tag{17}$$

The worker who is indifferent between these two options, β_{2f}, is implicitly defined by:

$$\begin{aligned} w_f - s_f - c_f =& w_f - r\beta_{2f} \\ \beta_{2f} =& \frac{s_f + c_f}{r} \end{aligned} \tag{18}$$

Figure A2: β_f and Payoffs for Women



A1.2 The THA's Problem

Knowing how the workers will react to their decisions, the THA chooses who to sort and how much to charge by solving it's objective function subject to (16) and (18) above.:

$$\max_{\beta_f^*, s_f, c_f} \pi_f^T = \int_{\beta_{1f}}^{\overline{\beta_f}} c d\beta_f + \int_{\beta_{2f}}^{\beta_f^*} [s_f + c_f + t\beta_f] d\beta_f \tag{19}$$

$$\max_{\beta_f^*, s_f, c_f} \pi_f^T = \left(\overline{\beta_f} - \frac{c_f}{g}\right) c_f + (\beta_f^* - \beta_{2f})(s_f + c_f) - \frac{t}{2}(\beta_f^{*2} - \beta_{2f}^2)$$

FOC's:

$$\beta_f^*: \quad s_f + c_f - t\beta_f^* = 0 \tag{20}$$

$$s: \quad \beta_f^* - \frac{2(s_f + c_f)}{r} + \frac{t(s_f + c + f)}{r^2} = 0 \tag{21}$$

$$c: \quad \overline{\beta_f} - \frac{2c_f}{g} + \beta_f^* - \frac{2(s_f + c_f)}{r} + \frac{t(s_f + c_f)}{r^2} = 0 \tag{22}$$

From 22 and 27

$$\begin{aligned} \frac{s_f + c_f}{t} - \frac{2(s_f + c_f)}{r} + \frac{t(s_f + c_f)}{r^2} &= 0 \\ 1 - \frac{2t}{r} + \frac{t^2}{r^2} &= 0 \\ \left(1 - \frac{t}{r}\right)^2 &= 0 \end{aligned} \tag{23}$$

A maximum in s_f occurs where $t = r$, but the parameter restrictions result in a corner solution, and the left hand side of (21)> 0.[37] The optimal choice is therefore to set s_f as large as possible $s_f = \tilde{s_f} > 0$.

Assuming $s_f > 0$, The choice of s_f which the THA makes can be found implicitly; since the FOC tells us the THA will capture as much surplus as possible, then this surplus will be defined by the hardest worker to satisfy who selects into THA sorting, β_{2f}:

$$\begin{aligned} P_n w_f - g\beta_{2f} =& P_n w_f - \frac{g(s_f + c_f)}{t} \\ w_f - s_f - c_f =& P_n w_f - \frac{g(s_f + c_f)}{r} \\ s_f =& \frac{rw - f(1 - P_n)}{r - g} - c_f \end{aligned} \tag{24}$$

With the corner solution, the maximization problem becomes:

$$\max_{\beta_f^*, c_f} \pi_f^T = \left(\overline{\beta_f} - \frac{c_f}{g}\right) c_f + (\beta_f^* - \beta_{2f}) \left(\frac{rw_f(1 - P_n)}{r - g}\right) - \frac{t}{2}(\beta_f^{*2} - \beta_{2f}^2)$$

[37] Recall $0 < g < t < r$

$$\beta_f^* : \quad s_f + c_f - t\beta_f^* = 0 \tag{25}$$

$$c : \quad \overline{\beta_f} - \frac{2c_f}{g} = 0 \tag{26}$$

From 25

$$\beta_f^* = \frac{s_f + c_f}{t} \tag{27}$$

From 26 22

$$c_f = \frac{g\overline{\beta_f}}{2} \tag{28}$$

To check for a maximum in c_f and β_f^* we check second order conditions evaluated at the corner solution for s_f.

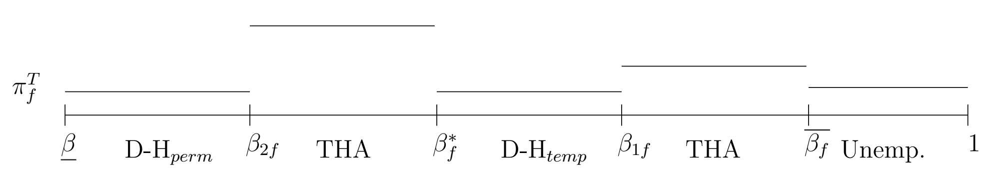
$$H = \begin{bmatrix} -t & 0 \\ 0 & -\frac{2}{g} \end{bmatrix} \tag{29}$$

$|H_1| < 0, \qquad |H_2| > 0$, Therefore a maximum has interior solutions above.

Solutions for β_f^* and β_{2f} follow from (18), (27) and (24).

$\beta_f^* = \frac{rw_f(1-P_n)}{t(r-g)}, \qquad \beta_2 = \frac{w_f(1-P_n)}{(r-g)}$. Since $t < r$, we know that $\beta_{2f} < \beta_f^*$.

Figure A3: β_f and THA Payoffs



A1.2.1 The Firm's Problem

The firm posts jobs through it's decision of the wage, w_f knowing which workers will chose permanent jobs and which workers will choose THA jobs. In other words, the firm is perfectly informed about which workers will be sorted.

Assuming workers have an outside option of unemployment, the firm must ensure it satisfies the reservation utility. Without loss of generality we assume it is zero. Therefore when the firm decides how much to pay for productivity N, it is also choosing the most impatient worker it will hire. Since the most impatient worker chooses THA unsorted job search, $\overline{\beta_f}$ is found by substitution of (28) into $P_n w_f - c_f \geq 0$, giving $\overline{\beta_f} = \frac{2P_n w_f}{g}$.

So the firm solves it's objective function as follows:

$$\max_{w_f} \pi_f^F = \int_{\beta_f^*}^{\overline{\beta_f}} P_n(N - w_f) d\beta_f + \int_{\overline{\beta_f}}^{\beta_f^*} P_y(N - w_f) d\beta \tag{30}$$

$$\max_{w_f} \pi_f^F = \left(\frac{2P_n w_f}{g} - \frac{r w_f(1 - P_n)}{t(r - g)} \right) P_n(N - w_f) + \left(\frac{r w_f(1 - P_n)}{t(r - g)} - \underline{\beta_f} \right)(N - w_f)$$

FOC:

$$(N - 2w_f) \left(\frac{2P_n^2}{g} - \frac{r P_n(1 - P_n)}{t(r - g)} + \frac{r(1 - P_n)}{t(r - g)} \right) + \underline{\beta_f} = 0 \tag{31}$$

Solving (31) for wages gives solutions for all endogenous variables:

$$w_f = \frac{\underline{\beta_f} g t(r - g)}{2t(r - g)P_n^2 + (1 - P_n)^2 r g} + \frac{N}{2} \tag{32}$$

$$\overline{\beta} = \frac{2P_n w_f}{g} \tag{33}$$

$$c_f = P_n w_f \tag{34}$$

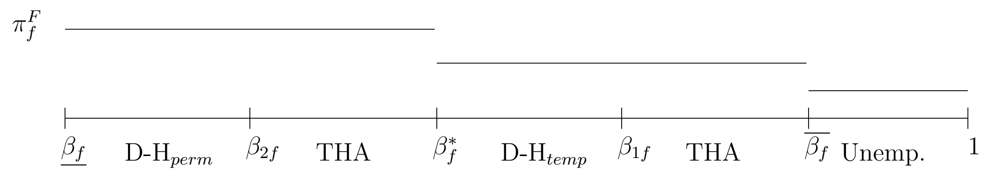
$$s_f = t\beta_f^* - c_f \tag{35}$$

$$\beta_f^* = \frac{w_f r(1 - P_n)}{t(r - g)} \tag{36}$$

$$\beta_{1f} = \frac{\overline{\beta_f}}{2} \tag{37}$$

$$\beta_{2f} = \frac{w_f(1 - P_n)}{(r - g)} \tag{38}$$

Figure A4: β_f and Firm Payoffs



A1.3 The Model - Solution for Men

A1.3.1 The Workers Problem

Workers maximize their utility choosing between three states:

1. Temp job with through THA
2. Temp job Direct-Hire
3. Permanent job Direct-Hire

$$U_m(\phi_m, \beta_m) = \max\left\{\phi_m(\beta_m)(w_m - s_m - c_m) + (1 - \phi_m(\beta_m))(P_n w_m - c_m), P_n w_m - g\beta_m, P_y w_m - r\beta_m^2\right\} \tag{39}$$

Since the THA moves before the worker, the worker takes $\phi_m(\beta_m)$ as given:

- If $\phi_m(\beta_m) = 0$: Then $\beta_m > \beta_m^*$ and the worker is too impatient for THA sorting. Since $t < r$, the permanent market is also too expensive for these workers and so the utility function simplifies to

$$U_m(\beta_m) = \max\{P_n w_m - c_m, P_n w_m - g\beta_m\} \tag{40}$$

The worker who is indifferent between these two options, β_1, is implicitly defined by:

$$\begin{aligned} P_n w_m - c_m =& P_n w_m - g\beta_{1m} \\ \beta_{1m} =& \frac{c_m}{g} \end{aligned} \tag{41}$$

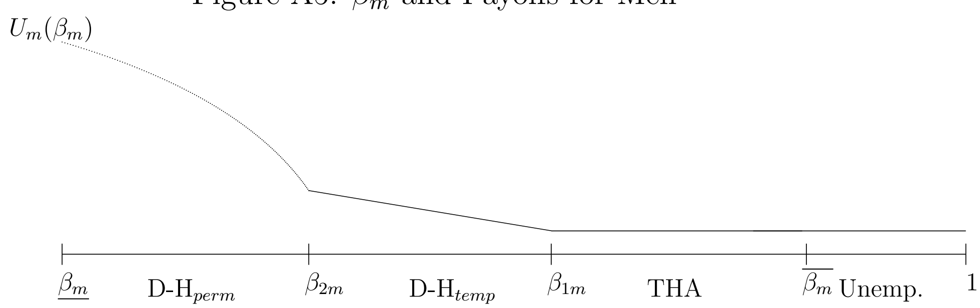
- If $\phi_m(\beta_m) = 1$: Then $\beta_m < \beta_m^*$ and the worker will be sorted if they choose the THA. These more patient workers, however, may choose to search on their own in the permanent market which offers the sorted wage, but relatively lower search costs for patient workers. Recall that $P_y = 1$ for $\phi_m = 1$.

$$U_m(\beta_m) = \max\left\{w_m - s_m - c_m, w_m - r\beta_m^2\right\} \tag{42}$$

The worker who is indifferent between these two options, β_{2m}, is implicitly defined by:

$$\begin{aligned} w_m - s_m - c_m =& w_m - r\beta_{2m}^2 \\ \beta_{2m} =& \sqrt{\frac{s_m + c_m}{r}} \end{aligned} \tag{43}$$

Figure A5: β_m and Payoffs for Men



A1.4 The THA's Problem

Knowing how the workers will react to their decisions, the THA chooses who to sort and how much to charge by solving it's objective function subject to (41) and (43) above.:

$$\max_{\beta_m^*, s_m, c_m} \pi_m^T = \int_{\beta_{1m}}^{\overline{\beta_m}} c_m d\beta_m + \int_{\beta_{2m}}^{\beta_m^*} [s_m + c_m - t\beta_m] d\beta_m \tag{44}$$

$$\max_{\beta_m^*, s_m, c_m} \pi_m^T = \left(\overline{\beta_m} - \frac{c_m}{g}\right) c_m + \left(\beta_m^* - \sqrt{\frac{s_m + c_m}{r}}\right)(s_m + c_m) - \frac{t}{2}\left({\beta_m^*}^2 - \frac{s_m + c_m}{r}\right)$$

FOC's:

$$\beta_m^*: \quad s_m + c_m - t\beta_m^* = 0 \tag{45}$$

$$s_m: \quad \beta_m^* - \frac{3}{2}\sqrt{\frac{s_m + c_m}{r}} + \frac{t}{2r} \geq 0, \qquad w_m \geq 0 \tag{46}$$

$$c: \quad \overline{\beta_m} - \frac{2c_m}{g} + \beta_m^* - \frac{3}{2}\sqrt{\frac{s_m + c_m}{r}} + \frac{t}{2r} = 0 \tag{47}$$

From 45

$$\beta_m^* = \frac{s_m + c_m}{t} \tag{48}$$

From 46 and 47

$$c_m = \frac{g\overline{\beta_m}}{2} \tag{49}$$

From 47 and 48

$$t^2 = 2t\sqrt{r(s_m + c_m)} - 2r(s_m + c_m)$$

$$(t - \sqrt{r(s_m + c_m)} \quad)(t - 2\sqrt{r(s_m + c_m)} \quad) = 0 \tag{50}$$

$$s_m = \left\{\frac{t^2}{4r} - c_m, \frac{t^2}{r} - c_m\right\}$$

The Hessian for the THA problem is given by:

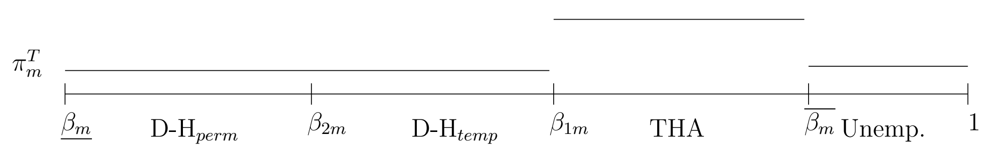
$$H = \begin{bmatrix} -t & 1 & 1 \\ 1 & -\frac{3}{4\sqrt{r(s_m+c_m)}} & -\frac{3}{4\sqrt{r(s_m+c_m)}} \\ 1 & -\frac{3}{4\sqrt{r(s_m+c_m)}} & -\frac{3}{4\sqrt{r(s_m+c_m)}} - \frac{2}{g} \end{bmatrix} \tag{51}$$

Evaluating the Hessian at the two solutions for s_m gives:

$$H = \left\{ \begin{bmatrix} -t & 1 & 1 \\ 1 & -\frac{3}{2t} & -\frac{3}{2t} \\ 1 & -\frac{3}{2t} & -\frac{3}{2t} - \frac{2}{g} \end{bmatrix}, \begin{bmatrix} -t & 1 & 1 \\ 1 & -\frac{3}{t} & -\frac{3}{t} \\ 1 & -\frac{3}{t} & -\frac{3}{t} - \frac{2}{g} \end{bmatrix} \right\} \tag{52}$$

$H_1 < 0, \qquad H_2 > 0, \qquad H_3 < 0$ are satisfied for $s_m = \frac{t^2}{4r} - c_m$. The solution for s_m gives $\beta_m^* = \frac{t}{4r} > \beta_{2m} = \frac{t}{2r}$. This means the THA would sort the worker only if the worker is even more patient than the level of patience at which point they select into the permanent market.

Figure A6: β_m and THA Payoffs



A1.4.1 The Firm's Problem

The firm posts jobs through it's decision of the wage, w_m knowing which workers will chose permanent jobs and which workers will choose THA jobs. In other words, the firm is perfectly informed about which workers will be sorted.

Assuming workers have an outside option of unemployment, the firm must ensure it satisfies the reservation utility. Without loss of generality we assume it is zero. Therefore when the firm decides how much to pay for productivity N, it is also choosing the most impatient worker it will hire. Since the most impatient worker chooses THA unsorted job search, $\overline{\beta_m}$ is found by substitution of (49) into $P_n w_m - c_m \geq 0$, giving $\overline{\beta_m} = \frac{2P_n w_m}{g}$. In both cases, the result is that no workers are sorted by the THA. For this reason, the choice of s is irrelevant because the THA never captures this amount from any male worker in the model.

So the firm solves it's objective function as follows:

$$\max_{w_m} \pi_m^F = \int_{\max\{\beta_m^*, \beta_{2m}\}}^{\overline{\beta_m}} P_n(N - w_m) d\beta_m + \int_{\overline{\beta_m}}^{\max\{\beta_m^*, \beta_{2m}\}} P_y(N - w_m) d\beta_m \tag{53}$$

$$\max_{w_m} \pi_m^F = \left(\frac{2P_n w_m}{g} - \frac{t}{2r}\right) P_n(N-w) + \left(\frac{t}{2r} - \underline{\beta_m}\right)(N - w_m)$$

FOC:

$$\frac{(N-2w_m)2P_n^2}{g} - \frac{(1-P_n)t}{2r} + \underline{\beta_m} = 0 \tag{54}$$

Solving (54) for wages gives solutions for all endogenous variables:

$$w_m = \frac{g}{4P_n^2}\left(\underline{\beta_m} - \frac{(1-P_n)t}{2r}\right) + \frac{N}{2} \tag{55}$$

$$c_m = P_n w_m \tag{56}$$

$$\beta_{1m} = \frac{\overline{\beta_m}}{2} \tag{57}$$

$$\beta_m^* = \frac{t}{2r} \tag{58}$$

$$\beta_{2m} = \frac{t}{4r} \tag{59}$$

$$\overline{\beta_m} = \frac{2P_n w_m}{g} \tag{60}$$

Figure A7: β_m and Firm Payoffs