Using Private Job Agencies: Optimal Screening or Cream Skimming?

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Abstract

In a model with private information of the worker about her ability and unobservable effort choice, the role of public and private employment services is analyzed. The coexistence of an inefficient employment exchange and an efficient private agency may lead to optimal screening with first best contracts. This is due to the assumption that good types of workers lose more human capital than bad types in periods of unemployment or mismatch. A bad type of worker earns an information rent if the employment exchange is inefficient and the employer chooses not to use the private agency.

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JEL classification: D82, D83, J41, J64

1 Introduction

Public employment services in many countries share the property of dealing mainly with applicants and jobs of low or middle salaries. Smaller firms for example who search for workers only on a regional level use public services that are offered for free. However, highly qualified workers are rarely matched with jobs at the employment exchange. These matches often come about because firms or workers engage in search activities themselves, for example firms announce jobs in newspapers, workers pay for "employment wanted" advertisements or send their application documents to big, well–known firms without being asked to do so. A third possibility to match workers with vacancies is intermediation by private employment agencies. In a number of countries, they have gained importance over recent years.[1]

Highly qualified and able workers often prefer engaging in search activities for an adequate job themselves instead of waiting for a job at the employment exchange. High opportunity costs and the loss of human capital from delays due to slow or inefficient actions of the public service can make it worthwhile for good workers to incur some costs themselves. Similarly, employers who are looking for qualified workers use costly newspaper advertisements or contact private employment agencies.

It is often argued and it will be assumed in the model that private agencies, whose employees tend to have stronger incentives than public employees, are more efficient. They provide good workers with a job rather quickly and costlessly, but employers must pay a commission fee for these services.[2] Thus, employers trade off the higher cost with the efficiency of private agencies.

The model presented below shows that there are efficiency and distribution

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[1] In Germany private employment agencies may operate only since August 1, 1994. Before the market for job intermediation was deregulated, the public employment exchange had a monopoly position (with a few exceptions as headhunting for managers, private agencies for artists etc.). Other countries with coexistence of public and private services are Denmark, Great Britain, Ireland, the Netherlands, Portugal, Switzerland, and the United States. See Walwei [12] and [13]. In most countries, the market share of the employment exchange only amounts to around 15% of all successful matches leading to a regular employment contract. In some countries, for example in Great Britain and Germany, the public exchange is responsible for 25% of all new matches while in other countries, for example in Switzerland and the U.S., the market share of the public exchange is not above 5%. See Walwei [14]. Thus, informal search and private employment agencies play an important role.

[2] In most countries it is forbidden to make workers pay the commission (for example in Germany, Great Britain, Ireland, and the Netherlands, but not in Portugal and the U.S.). There are exceptions in Germany for artists, models, and some other professions. In Switzerland the employee may not be charged more than 5% of her first monthly salary. See Walwei [12] and [14].

effects from the coexistence of public and private services. These effects are driven by asymmetric information between the employer and the worker. In particular, it is assumed that the worker has private information about her true ability while the employer only knows the probability distribution over different worker types. The model aims at explaining why employers offer different contracts – maybe even at different agencies – for one single job, what properties these contracts have, and at which employment agency they are offered.

First and not very surprising, overall efficiency can be increased when efficient private agencies exist in addition to the public employment exchange. When the public exchange is inefficient, employers can hire workers via private agencies and thus prevent high losses.[3] It is shown that there is a second, more subtle efficiency effect. When both public and private services are used to hire workers, optimal separation of types can be feasible via first best contracts. Screening is achieved by offering contracts at the two different agencies, which destroys the worker's incentive to mimic another type.

Second, bad workers may earn information rents when the employment exchange is inefficient. If employers choose not to bypass[4] the public exchange, bad workers may have an incentive to mimic good workers who must be compensated for their loss of human capital. The paper investigates the commonly held view that cream skimming of private agencies leads to a stigmatization of bad workers who remain with the employment bureau. It emerges that a bad worker can in fact be harmed by the employer's use of a private agency, but this is due to a loss of information rent and not to stigmatization.

Third, the model shows that a good type's information rent can be partially or fully destroyed either by her loss of human capital from a delayed match at the employment exchange or by the unattractiveness of a bad type's contract offered at the public exchange.

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[3]It can be argued that newspaper ads (in combination with a personnel department) are another fairly efficient way to hire good workers. Thus, in Germany the public employment exchange did not have a true monopoly position before private agencies appeared on the market. The model encompasses this interpretation as it explains the effects of segmentation between a public bureau and any other more efficient, but costly institution.

[4]In the context of natural monopoly, bypass means that customers avoid dealing with the monopolist or major enterprise by making contracts with other (often upstream) providers or by supplying the product or service themselves. In the labor context, the public employment exchange often has a dominant position for matching workers and employers (for example because unemployment benefits are paid only to those jobless who report to the employment exchange or because private employment agencies are forbidden). The employment exchange can be bypassed by using private agencies, job advertisements in newspapers, or internal labor markets.

The empirical literature on search/recruitment channels investigates the efficiency of matching technologies for workers with different visible characteristics such as prior employment or unemployment.[5] It is sometimes suggested that public and private job agencies serve different markets, i.e. that they have complementary aims rather than competing with each other. However, German evidence suggests that private agencies serve small as well as big firms, that only about two thirds of the workers at private agencies are qualified, and that 25% of those matched at a private agency were without a job.[6] Thus, clients of public and private agencies cannot simply be distinguished by visible characteristics such as the level of qualification, their profession or the length of unemployment. In this paper, an attempt is made to explain segmentation according to invisible characteristics such as a worker's ability. For example, a person with a degree in economics could be hired via the public exchange or via the private agency, depending on her unobservable skills.

A number of issues concerning intermediation in general or on specific markets (such as financial, housing, or labor markets) have been discussed in the literature. Whether allocative efficiency is enhanced or reduced by deregulating the market for employment services depends on at least two effects: On the one hand, successful matching may take place more quickly because private agencies have stronger incentives[7] and because competition spurs the effort of the employment exchange (due to more regulatory control by comparing its performance with that of private agencies for example). On the other hand, economies of scale from one monopoly institution with a large number of vacancies and job searchers are lost.[8] However, Pissarides [10] shows that the public provision of intermediation has its drawbacks. He argues that the employment exchange which can be used for free crowds out private search activities. This negative externality leads to more frictional unemployment.

Another source of scale effects is specialized knowledge about job profiles, required attributes of applicants etc. representing a large fixed cost. Chan [2] points out that there are returns to intermediation because clients can exploit economies of scale by contracting with an intermediary.

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[5]See Lindeboom et al. [11].

[6]See *Frankfurter Allgemeine Zeitung*, "30000 Vermittlungen von privaten Agenturen", March 9, 1997.

[7]See Zweifel and Zaborowski [16] whose model focuses on the different incentive structures of public and private employment services.

[8]Economies of scale can be preserved to some extent if private agencies and the employment exchange cooperate by letting each other use their files, exchanging information etc.

Apart from scale effects in information acquisition, the existence of intermediaries, employment agencies, middlemen etc. can be explained by two inefficiencies on a search market. First, search efforts of agents are not always successful and second, there are positive externalities of search because the search activity of one agent increases the probability of a match for another agent.[9] Thus, agents may search less than in the social optimum.

Asymmetric information plays a role on search markets in a number of ways. For example, the quality of a private employment agency may not be observable for employers and workers or agents have private information about their types. Marketmakers who sell and buy a commodity have been shown to reduce this second information problem in a number of ways. Garella [4] shows that middlemen can increase average quality in a 'lemons' market by offering random pricing schemes to sellers. Biglaiser [1] assumes that a middleman has a stronger incentive to invest in knowledge about the commodity than a buyer because he trades it more often. In addition, middlemen take an interest in developing a reputation for selling high quality goods. These two effects can lead to welfare gains from having a middleman in the market. Yavaş [15], who also assumes private information of agents about their valuations, shows that matchmaking can be more profitable than marketmaking, which is never the case with common knowledge of valuations.[10]

This paper addresses the role of matchmaking on the labor market where the problem of asymmetric information arises quite naturally. It offers another explanation for the role of intermediation in reducing informational asymmetries without assuming that employment services have superior information about worker types than employers. In contrast to most of the literature, search is not modeled explicitly. Instead, matching is simply assumed to be either costly or insecure depending on the matching technology. The main focus of the paper is on screening via different institutions or matching technologies. Formally, the model is related closest to Laffont and Tirole [8] or [9], Chapter 6, who consider cream skimming and bypass in the context of monopoly regulation.

Section 2 introduces the model. In Section 3, optimal contracts under asymmetric information as well as the employer's optimal choice between a public and a private agency are analyzed. Section 4 concludes the paper.

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[9]See Diamond [3] and, for a specific labor market application, Howitt and McAfee [6].

[10]His main question is under which conditions intermediaries are marketmakers who buy and sell a commodity themselves or matchmakers (brokers) who simply match two agents (for a different approach to this problem see Hackett [5]). However, this does not seem a meaningful question for the labor market as there are moral and legal reasons for the pervasiveness of matchmaking.

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2 The model

There is one employer with a vacancy and one worker looking for a job. The employer can offer a menu of contracts on a take–it–or–leave–it basis. Each contract specifies a wage w that is related to a level of output y and the employer's payoff from a contract is the difference between output and wage payment, $y - w$.

The worker has to put in some positive level of effort to produce an output y. The disutility of effort is described by the function $\phi(\cdot)$ which is increasing and strictly convex in output, $\phi_y > 0$ and $\phi_{yy} > 0$, and satisfies $\phi_{yyy} \geq 0$, ensuring that stochastic incentive schemes are nonoptimal. The worker's reservation utility is normalized to zero. The disutility of producing a certain output depends on the worker's ability (her type). There are two possible types of agents, denoted by $\overline{\theta}$ and $\underline{\theta}$ with $\overline{\theta} - \underline{\theta} > 0$ and it is assumed that the disutility of effort is decreasing with the productivity of the worker, $\phi_\theta < 0$. The worker's productivity lowers the marginal disutility of producing a certain output, $\phi_{y\theta} < 0$. Thus, the single–crossing condition of indifference curves holds. The worker is risk–neutral and her payoff from the contract is $w - \phi(y, \theta)$.

There is one private employment agency.[11] It secures an immediate match, but the employer has to pay a finite fixed commission of $F > 0$. It is assumed for simplicity that all matches are successful in that the employment relation lasts for a sufficiently long period of time. The public agency can be used for free, but it is a bureaucracy which fails to do its job with probability $1 - \beta$ where $\beta \in (0, 1]$. If the worker is not matched with the employer, the employer gets no profit and the worker no rent, but a good type of worker also loses a finite amount of human capital $d > 0$ during the period of unemployment which is of uniform length.[12] Put differently, d denotes the difference between a good and a bad type's depreciation of human capital during unemployment or mismatch.[13] If the public agency is inefficient and β is small, a good worker expects a significant loss in human capital as $(1 - \beta)d$

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[11] A large number of private agencies may increase (more competition) or decrease (loss of scale effects) overall efficiency. However, this has no impact on the features of the optimal contract analyzed below as long as a private agency matches workers and employers more quickly than the public exchange.

[12] Alternatively, d can be interpreted as the expected future wage loss due to "blank spaces" on the CV during periods of job search.

[13] Notice that a good type mimicking a bad type is worse off than a bad type if no match occurs as a bad type gets zero while a good type gets $-d$ (he can preserve his reservation utility of zero only by self–employment). This is justified as long as the model is interpreted as pointing to long–term effects (namely the loss of human capital leading to losses not just in the current period, but also in the future, which is represented by d.)

is approaching the maximum loss of d. A good type's expected rent from a contract offered at the employment exchange is $\beta(w - \phi(y, \overline{\theta})) - (1 - \beta)d$. A worker has the opportunity to become self–employed[14] in order to prevent the depreciation of human capital and get the reservation utility of zero.

Information is distributed asymmetrically between the employer and the worker. The worker knows her type before signing the contract while the employer only has a prior distribution over types. The probability for a good type $\overline{\theta}$ is denoted by ν, thus $\Pr(\theta = \underline{\theta}) = 1 - \nu$. The employer can use screening contracts in order to separate types. With full information, assume that the employer never offers a contract to the bad type at a private agency as[15]

$$\underline{y}^* - \underline{w}^* - F < 0. \tag{1}$$

Under a first best contract denoted by $(\underline{y}^*, \underline{w}^*)$, the cost of employing a bad type when she comes from a private agency is higher than its revenue. Assume further that the probability for a good type is not too high so that the employer does not want to exclude a bad type of worker. The employer is able to offer different contracts at different agencies. His expected profit when using only the public employment exchange is

$$\beta[\nu(\overline{y} - \overline{w}) + (1 - \nu)(\underline{y} - \underline{w})]. \tag{2}$$

When the employer uses a private employment agency (denoted by the superscript r) for a good type in addition to the public exchange, his expected profit is

$$\nu(\overline{y}^r - \overline{w}^r - F) + \beta(1 - \nu)(\underline{y}^r - \underline{w}^r). \tag{3}$$

A bad type still gets the job via the public service, but her contract is denoted by $(\underline{y}^r, \underline{w}^r)$ because it may differ from her contract when a good type is also hired via the employment exchange. Hence, the employer contacts a private agency in addition to the public exchange whenever

$$\beta[\nu(\overline{y} - \overline{w}) + (1 - \nu)(\underline{y} - \underline{w})] < \nu(\overline{y}^r - \overline{w}^r - F) + \beta(1 - \nu)(\underline{y}^r - \underline{w}^r) \tag{4}$$

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[14]Instead of going into self–employment, the worker can search for a job by herself. To allow for this interpretation it has to be assumed that search activities of good workers only lead to matches with employers who advertise their jobs or have a good reputation (for example due to learning on and off the job measures, flexible promotion rules etc.). Private search activities and reputation building are not modeled explicitly, but they are captured by F with a slight change in interpretation.

[15]For notational simplicity let $y(\underline{\theta}) = \underline{y}$, $w(\underline{\theta}) = \underline{w}$ and so forth.

for optimally chosen contracts.[16] The worker observes the contracts possibly offered at different agencies and decides which one is more profitable to her. The timing of the game is as follows:

stage 1: The employer offers two contracts, $\{\overline{w}, \overline{y}\}$ and $\{\underline{w}, \underline{y}\}$, each of them either at the public exchange or at the private agency.

stage 2: The worker either rejects both contracts or chooses one of them and if she is matched with the employer, production takes place.

stage 3: The employer's payoff is realized and the worker receives the wage payment.

The function $\phi(\cdot)$ and the parameters β, F, and d are common knowledge. Output y is verifiable. It is never optimal for the employer to offer the same contract at both agencies because one of the agencies is always more attractive to him and there is no coordination problem. Thus, the worker's choice of one of the contracts is equivalent to the choice of one of the agencies. Note that a worker has to decide whether to contact the employment exchange without knowing whether she will be matched or not. She only knows the contract offer and the probability β with which a match takes place.

In the benchmark case of full information, the employer observes a worker's type and can thus induce efficient output. The employer either maximizes his profit (2) subject to the participation constraints

$$
\begin{aligned}
\underline{w} - \phi(\underline{y}, \underline{\theta}) &\geq 0 \\
\beta[\overline{w} - \phi(\overline{y}, \overline{\theta})] - (1 - \beta)d &\geq 0
\end{aligned}
$$

or (3) subject to

$$
\begin{aligned}
\underline{w}^r - \phi(\underline{y}^r, \underline{\theta}) &\geq 0 \\
\overline{w}^r - \phi(\overline{y}^r, \overline{\theta}) &\geq 0.
\end{aligned}
$$

The first best contracts are characterized by

$$
\begin{aligned}
\phi_y(\underline{y}, \underline{\theta}) = 1, &\qquad \phi_y(\underline{y}^r, \underline{\theta}) = 1, \\
\underline{w} = \phi(\underline{y}, \underline{\theta}), &\qquad \underline{w}^r = \phi(\underline{y}^r, \underline{\theta}), \\
\phi_y(\overline{y}, \overline{\theta}) = 1, &\qquad \phi_y(\overline{y}^r, \overline{\theta}) = 1 \\
\overline{w} = \phi(\overline{y}, \overline{\theta}) + \frac{(1 - \beta)}{\beta}d, &\qquad \overline{w}^r = \phi(\overline{y}^r, \overline{\theta}).
\end{aligned}
$$

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[16] It is straightforward to show that also with asymmetric information it is never optimal to hire both types via the private agency or a good type via the public exchange and a bad type via the private agency if inequality (1) holds.

Optimal output levels $\overline{y}^* = \overline{y}^{r*}$ and $\underline{y}^* = \underline{y}^{r*}$ at which marginal cost of effort is equal to marginal benefit are independent of the agency at which the contract is offered. Also, $\underline{w}^* = \underline{w}^{r*}$, but the optimal wage of a good type differs between the two agencies as $\overline{w}^* > \overline{w}^{r*}$. At the public employment exchange a good type must be compensated for her expected loss of human capital because she can always get the reservation utility of zero by going into self–employment. The employer uses a private agency iff

$$F < (1 - \beta)[\overline{y}^* - \phi(\overline{y}^*, \overline{\theta}) + d]. \tag{5}$$

Holding F and d fixed, the employer's choice is determined by the efficiency parameter β of the employment exchange. The less efficient the public exchange, the more attractive is the private agency. In particular, the contract for a good type is offered at the private agency if the cost F is smaller than the expected loss from no match with a good type at the public exchange. For $\beta = 1$ it is optimal for the employer to use the public employment exchange. As there is no loss of human capital, optimal contracts are the same at both agencies and the employer wants to save the cost F.

3   The optimal contract

In the presence of asymmetric information, a good type may be able to earn an information rent by mimicking a bad type. This information rent is equal to the difference between a bad and a good type's disutility of effort for producing a certain output, $U(y) = \phi(y, \underline{\theta}) - \phi(y, \overline{\theta})$. If β is close to 1, a good type does not lose much human capital at the public exchange and gets almost the full rent. But if β is small, the expected loss of human capital can reduce the rent below the reservation utility such that it is more profitable for a good type to stay at home than to look for a job at the employment exchange.[17] In order to satisfy a good worker's participation constraint, the employer can either compensate a good type for this loss by paying a higher wage or he can switch to a private agency.

The optimal contracts under asymmetric information for the two scenarios with and without bypass are derived. Due to the revelation principle search for the optimal contract can be restricted to direct incentive compatible mechanisms. Following the analysis of Laffont and Tirole [8] or [9], Chapter 6, a variation of the exogenous parameter β yields different regimes characterized by the worker's output level, her information rent, and use (or

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[17]It is assumed that a worker cannot do both, wait for a job and work as a self–employed, at the same time. This can be due to time restrictions which make it costly for her to show up at the employment exchange regularly while working on her own.

non–use) of the private employment agency. The employer's maximization program [P1] takes the following form

$$\max_{\overline{y},\underline{y},\overline{w},\underline{w}} \beta[\nu(\overline{y} - \overline{w}) + (1 - \nu)(\underline{y} - \underline{w})]$$

subject to

$$\beta[\underline{w} - \phi(\underline{y}, \underline{\theta})] \geq \beta[\overline{w} - \phi(\overline{y}, \underline{\theta})] \tag{6}$$
$$\beta[\overline{w} - \phi(\overline{y}, \overline{\theta})] - (1 - \beta)d \geq \beta[\underline{w} - \phi(\underline{y}, \overline{\theta})] - (1 - \beta)d \tag{7}$$
$$\beta[\underline{w} - \phi(\underline{y}, \underline{\theta})] \geq 0 \tag{8}$$
$$\beta[\overline{w} - \phi(\overline{y}, \overline{\theta})] - (1 - \beta)d \geq 0 \tag{9}$$

when all contracts are made via the public agent and [P2]

$$\max_{\overline{y},\underline{y},\overline{w},\underline{w}} \beta(1 - \nu)(\underline{y}^r - \underline{w}^r) + \nu(\overline{y}^r - \overline{w}^r - F)$$

subject to the constraints

$$\beta[\underline{w}^r - \phi(\underline{y}^r, \underline{\theta})] \geq \overline{w}^r - \phi(\overline{y}^r, \underline{\theta}) \tag{10}$$
$$\overline{w}^r - \phi(\overline{y}^r, \overline{\theta}) \geq \beta[\underline{w}^r - \phi(\underline{y}^r, \overline{\theta})] - (1 - \beta)d \tag{11}$$
$$\beta[\underline{w}^r - \phi(\underline{y}^r, \underline{\theta})] \geq 0 \tag{12}$$
$$\overline{w}^r - \phi(\overline{y}^r, \overline{\theta}) \geq 0 \tag{13}$$

when the private agency is used. For further reference, denote the constraints of program [P1] by $\underline{IC}$, $\overline{IC}$, $\underline{IR}$, and $\overline{IR}$ and the corresponding constraints of program [P2] by $\underline{IC}'$, $\overline{IC}'$, $\underline{IR}'$, and $\overline{IR}'$.

In general, for every program there are as many possible regimes as there are possible combinations of binding constraints. However, some combinations can be excluded ex ante using the standard results that pooling is non–optimal, that for every type either the incentive or the participation constraint must be binding, and that with two types and two different contracts, only one incentive constraint can be binding.[18] Five possible combinations of binding participation and incentive constraints remain for program [P1]. The number of possible combinations of binding constraints in program [P2] is further restricted to three by

Lemma 1 *When the employer uses the private agency, a bad type's incentive constraint is never binding.*

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[18]See Laffont and Tirole citeLaffont/Tirole:93, Chapter 6, for example.

Proof Notice that $\underline{IC}'$ is not binding for any β if a good type is offered the first best contract at the private agency because $\overline{w}^{r*} - \phi(\overline{y}^{r*}, \underline{\theta}) < 0$. $\qquad\square$

The value of the parameter β determines which constraints are binding for given d and F. Thus, the remaining regimes (possibly on degenerate intervals) can be ordered with respect to β with critical parameters $\beta_i, i = 1, .., 4$ at which regimes change. From Table 1 can be taken that the critical parameters β_1 and β_2 for regimes 1 to 3 are the same with and without use of the private agency while the parameters β_3 and β_4 are only of relevance when the private agency is not used. With bypass, optimal contracts are the same for all $\beta \in (0, \beta_2)$ because of Lemma 1.

Table 1: Binding Constraints

	regime	public exchange only				public exchange and private agency		
$\beta \in [\beta_1, 1]$	1	$\overline{IC}$,	$\underline{IR}$			$\overline{IC}'$,	$\underline{IR}'$	
$\beta \in [\beta_2, \beta_1)$	2	$\overline{IC}$,	$\underline{IR}$,	$\overline{IR}$		$\overline{IC}'$,	$\underline{IR}'$,	$\overline{IR}'$
$\beta \in [\beta_3, \beta_2)$	3		$\underline{IR}$,	$\overline{IR}$			$\underline{IR}'$,	$\overline{IR}'$
$\beta \in [\beta_4, \beta_3)$	4		$\underline{IR}$,	$\overline{IR}$,	$\underline{IC}$		$\underline{IR}'$,	$\overline{IR}'$
$\beta \in (0, \beta_4)$	5			$\overline{IR}$,	$\underline{IC}$		$\underline{IR}'$,	$\overline{IR}'$

3.1 Using only the public exchange

First consider the case where only the employment exchange is used, for example because private agencies do not exist or the cost F is too high. Deriving the optimal contracts for every regime yields[19]

Proposition 1 *When the employer uses only the public exchange, optimal contracts may have the following properties, depending on the relative size of β and d:*
(1) A good worker's information rent is partially or fully destroyed by the loss of human capital.
(2) A bad worker earns an information rent.
(3) Optimal screening involves first best contracts.

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[19]The sufficiency conditions of the maximization programs in this and the next section are satisfied if $\phi_{yy\theta} \le 0$.

Proof see Appendix. □

In order to explain the results of Proposition 1, the five possible regimes are described in some detail. The formulas characterizing the optimal contract in every regime are relegated to the Appendix.

For $\beta \in [\beta_1, 1]$ where the public employment exchange is fairly efficient, a good type's participation constraint is not binding. Her information rent at the public exchange is greater or equal to her expected loss of human capital, $\overline{U}_1 = \phi(\underline{y}_1, \underline{\theta}) - \phi(\underline{y}_1, \overline{\theta}) \geq [(1-\beta)/\beta]d$,[20] which defines β_1 when it holds as an equality. Thus, in regime 1 the standard screening contract results, involving less than optimal output of a bad type and information rents of a good type. For parameter values $\beta \in [\beta_2, \beta_1)$ in regime 2 the inequality $\phi(\underline{y}_1, \underline{\theta}) - \phi(\underline{y}_1, \overline{\theta}) < [(1-\beta)/\beta]d \leq \phi(y^*, \underline{\theta}) - \phi(y^*, \overline{\theta})$ is satisfied. A good type's loss of human capital is greater than her information rent at $\underline{y}_1$, but smaller than her rent at y^*. Thus, the participation constraint $\overline{IR}$ becomes binding. The employer has to increase her wage, which losens the incentive constraint $\overline{IC}$. Output $\underline{y}_2$ can be increased and is optimal if a good type's information rent is equal to her expected loss of human capital. Hence, both a good type's participation and incentive constraint are binding. Output of a bad type is still below its efficient level.

When the efficiency of the public exchange is lower again, i.e. $\beta \in [\beta_3, \beta_2)$, a good type's wage at the employment exchange must be increased up to a point where she has no incentive to mimic a bad type even if a bad type produces the efficient output y^*. This is the case when the expected loss of human capital exceeds the expected information rent, $[(1-\beta)/\beta]d > \phi(y^*, \underline{\theta}) - \phi(y^*, \overline{\theta})$. The menu of contracts offered at the employment exchange is equivalent to the first best menu with symmetric information, i.e. production of both types is efficient and information rents are zero (regime 3).

When the efficiency of the employment exchange is characterized by $\beta \in [\beta_4, \beta_3)$, a good type's contract becomes so attractive that a bad type has an incentive to mimic her. Thus, her incentive constraint is binding upwards. This is the case as $\phi(\overline{y}_3, \overline{\theta}) - \phi(\overline{y}_3, \underline{\theta}) + [(1-\beta)/\beta]d > 0$. Put in words, a bad type's loss from pretending to be a good type and producing $\overline{y}_3$ is smaller than the gain of $[(1-\beta)/\beta]d$. Therefore, a good type's output is distorted upwards in order to make the contract less attractive for a bad type. Note that in regime 4 a bad type's participation constraint and incentive constraint are binding over a (possibly nondegenerate) interval of β parameters because $\overline{y}_4$ is adjusted for every $\beta \in [\beta_4, \beta_3)$ so as to make a bad type indifferent between both contracts while keeping her rent at zero.

For a very inefficient public exchange with $\beta \in (0, \beta_4)$, a bad type's incentive

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[20]Subscripts i, $i = 1, ..., 5$, denote optimal wage and output schemes under regime i.

to mimic a good type is even stronger such that $\phi(\overline{y}_4, \overline{\theta}) - \phi(\overline{y}_4, \underline{\theta}) + [(1 - \beta)/\beta]d > 0$. This means that a bad type wants to produce $\overline{y}_4$ in order to reap the compensation for human capital depreciation of a good type. Her wage is increased in order to induce truth–telling. Thus, a bad type earns a rent.

Of course, the profitability of employing a worker is low when the employment exchange is very inefficient and there is no private agency. In particular, it becomes very expensive to compensate a good type for her loss of human capital.

Corollary 1 *When β is small enough, the employer will not offer a contract for a good type because costs are higher than benefits.*

Proof Consider

$$\tilde{\Pi}_5 = \beta[\nu(\overline{y}_5 - \phi(\overline{y}_5, \overline{\theta})) + (1 - \nu)(\underline{y}^* - \phi(\underline{y}^*, \underline{\theta}) - \phi(\overline{y}_5, \overline{\theta}) + \phi(\overline{y}_5, \underline{\theta}))]$$
$$-\nu(1 - \beta)d$$

where $\tilde{\Pi}_5$ denotes the employer's indirect profit in regime 5. The profit from offering a contract for a bad type only, $\beta(1 - \nu)(\underline{y}^* - \phi(\underline{y}^*, \underline{\theta}))$, is positive even for a very small β, but it can become negative for a good type. $\square$

In this case, only one contract is offered, $(\underline{y}^*, \underline{w}^*)$, which is not acceptable for a good type. Excluding a good type if the employment agency is very inefficient reverses the standard result that exclusion of a bad type can be optimal when the probability of a good type is very high.

Since the objective function is concave and the constraints define a convex set, moving from regime 1 to 5 yields a continuous solution for $y(\beta)$ and $w(\beta)$ on $(0, 1]$.

Note that it is not the possibility to bypass the public exchange which makes screening with first best contracts optimal and allows a bad type to earn rents (as in Laffont and Tirole [8]).[21] It is the inefficiency of the public exchange together with the different propensities of types to lose human capital, which is sufficient for first best screening contracts. In the next section it is shown that when the private agency is used, the optimality of first best screening contracts holds for a wider range of parameter values, but a bad type's opportunity to earn rents is destroyed.

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[21]In the analysis of Laffont and Tirole [8] the binding participation constraint of a high valuation consumer is due to his ability to switch to the bypass firm. Here, it is the employer who decides whether to use the public exchange or to bypass it. But when a good worker's participation constraint becomes binding because she loses too much human capital at the inefficient employment exchange, it may be so expensive to compensate her for this loss that switching to the private agency is optimal for the employer.

3.2 Using the public exchange and the private agency

Now consider under which conditions the employer decides to use the private agency. Here, bypass means that the private agency is used to hire good types whereas bad types are still hired via the public employment bureau.

The conditions for regimes 1 to 5 when only the public exchange is used depend on the relationship between β, d, and information rents (which are determined by the function $\phi(\cdot)$, the probability ν, and the types $\overline{\theta}$ and $\underline{\theta}$). However, the optimality of bypass also depends on F, the cost of using the private agency. Therefore, for every regime a critical F can be derived at which the employer is indifferent between bypass and no bypass. In addition, optimal contracts can be computed for every bypass regime. The main features of these contracts are summarized in

Proposition 2 *When the employer uses both the public exchange and the private agency, optimal contracts may have the following properties, depending on the relative size of β and d:*
(1) A good worker's information rent is partially or fully destroyed by the unattractiveness of a bad type's contract offered at the employment exchange.
(2) A bad type of worker never earns an information rent.
(3) Optimal screening involves first best contracts for a wider range of parameter values than without bypass.

Proof see Appendix. □

In the following, the bypass regimes are described briefly. The exact characterization of the optimal contracts can be found in the Appendix.

Consider a fairly efficient employment exchange with $\beta \in [\beta_1, 1]$ such that a good type earns an information rent.[22] The employer uses a private agency whenever

$$F < (1 - \beta)[\overline{y}^* - \phi(\overline{y}^*, \overline{\theta}) - \overline{U}_1]. \tag{14}$$

Bypass is optimal if the cost of using the private agency is smaller than the expected loss from no match with a good type. Note that bypass is more likely with full information because the employer's profit from a good type (hired at the public exchange) is lower under asymmetric information than under full information due to information rents. Thus, the loss from no match with a good type at the public exchange is also lower under asymmetric information, which makes the private agency comparatively less attractive. Production is the same as in regime 1 without bypass, that is output of a

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[22]The critical parameter β_1 is defined by $[(1 - \beta)/\beta]d = \overline{U}_1$ as in regime 1 without bypass.

good type is not distorted and a bad type produces less than the optimum. The information rent of a good type at the private agency is the same as her expected rent 1 at the public exchange.

The optimal bypass condition for $\beta \in [\beta_3, \beta_1)$ (regimes 2 and 3) is equivalent to the optimal bypass condition (5) in the case of full information because a good type gets the first best contract in all three instances. Condition (5) is satisfied for a higher cost F than condition (14). Thus, the less efficient the public exchange, the more attractive is the private agency. The critical parameter β_2 and optimal contracts in bypass regimes 2 and 3 are the same as without bypass, the only difference being that a good type does not have to be compensated for the expected loss of d at the private agency. When $\beta \in (0, \beta_2)$, optimal screening with bypass is achieved by the menu of first best contracts. This follows from Lemma 1. Hence, there are only three different regimes when the private agency is used. The main result that optimal screening involves first best contracts if $\beta \in (0, \beta_2)$ can be given a simple intuitive explanation. If the employer offers the first best contract of a good type at the private agency, a bad type does not find this contract attractive. When a good type goes to the employment exchange in order to mimic a bad type, she is not compensated for the expected loss of human capital which is greater than her information rent. Therefore, neither of the incentive constraints is binding and output is equal to its first best level. Screening is not achieved by the wage–output scheme, but by the efficiency differential between public and private services and the difference between types with respect to human capital depreciation.

Finally, it can be shown that there is always a degree of inefficiency of the public exchange that makes bypass optimal for the employer and, conversely, a degree of inefficiency at which no bypass is optimal.

Proposition 3 *For any given parameters d and F, there exist two parameter values $\beta^*, \beta^{**} \in (0, 1]$ such that for $\beta < \beta^*$ the employer prefers using both the public and the private agency and for $\beta > \beta^{**}$ the employer uses only the public exchange.*

Proof Denote the employer's indirect profit from the optimal menu of contracts in regime i, $i = 1, ..., 5$, by $\tilde{\Pi}_i$ when he does not use the private agency and in regime j, $j = 1, ..., 3$, by $\tilde{\Pi}_j^r$ when he uses it. As $\lim_{\beta \to 0} \tilde{\Pi}_i = 0$ and $\lim_{\beta \to 0} \tilde{\Pi}_j^r > 0$, bypass is optimal for $\beta \to 0$. If $\beta = 1$, $\tilde{\Pi}_i > \tilde{\Pi}_j^r$ because $F > 0$. The continuity of the employer's indirect profit functions $\tilde{\Pi}_i(\beta), i = 1, ..., 5$, and $\tilde{\Pi}_j^r(\beta), j = 1, ..., 3$, (as y and w are continuous in β, see above) implies that the parameters β^* and β^{**} exist. $\qquad \square$

3.3 Summary of results

The findings of Proposition 1 and 2 can be summarized in the following figures.
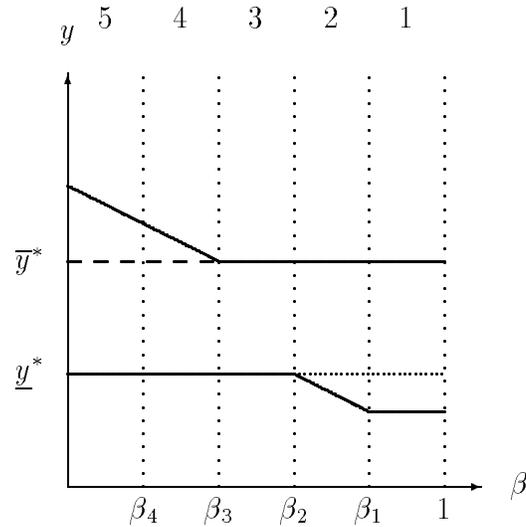

Figure 1: Optimal output scheme

Figure 1 shows first and second best output levels for both types depending on the size of β. First best output is constant in β, but second best output is distorted upwards for a good type at a low β and downwards for a bad type at a high β. When the private agency is used, output of a good type is never distorted (shown by the dashed line).

However, β not only affects the optimal output level of the contract, but also the probability that production takes place at all. Figure 2 shows expected output in the five regimes. Expected output with full information when only the public exchange is used is a straight line connecting zero with $\overline{y}^*$ and $\underline{y}^*$ at $\beta = 1$. Expected second best production may again be above or below this line. When the public exchange is bypassed, expected output of a good type jumps up to the dashed line.

In Figure 3 first best wage levels are represented by a horizontal line for a bad type while a good type's wage at the public exchange is decreasing in β because she is compensated for the expected loss of human capital. First best wages of a good type hired at the private agency are constant in β. A good type's wage at the employment exchange and at the private agency is above the first best wage in regime 1. Bypass pushes the wage of a good type down to the dashed line in all regimes. Second best wages of a bad type are
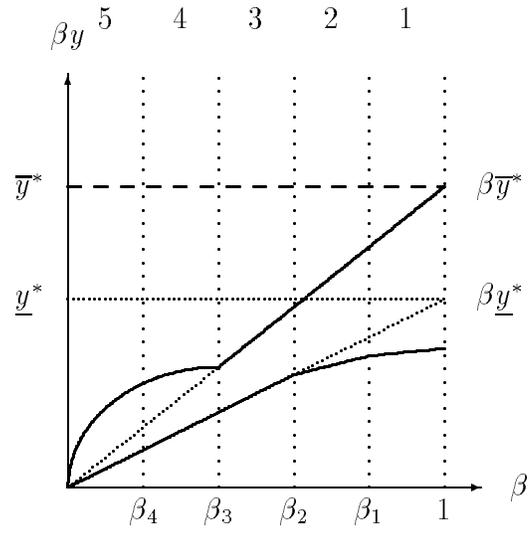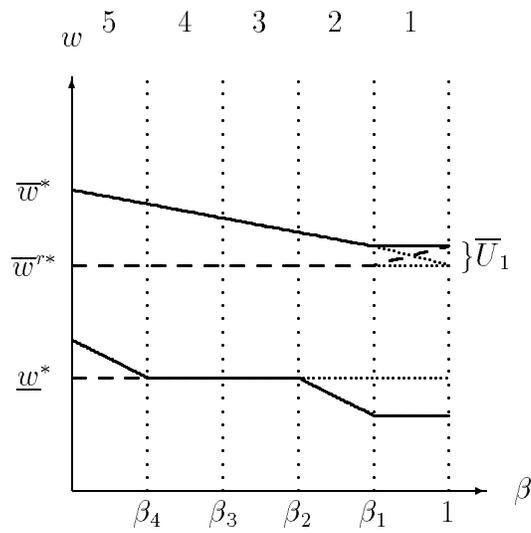
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Figure 2: Expected output

Figure 3: Optimal wage scheme

below the optimum $\underline{w}^*$ in regime 1 and 2 and above the optimum in regime 5, but bypass decreases the wage in regime 5.

The net rent U of a worker contacting an employment agency is defined as the sum of expected benefits from the contract and human capital losses,

$$U := \beta[w - \phi(y, \theta)] - (1 - \beta)d$$

with $d = 0$ for a bad type. Figure 4 shows that a bad type earns a rent in regime 5, but this rent is destroyed when the employer uses the private agency. However, a good type always earns a rent in regime 1.
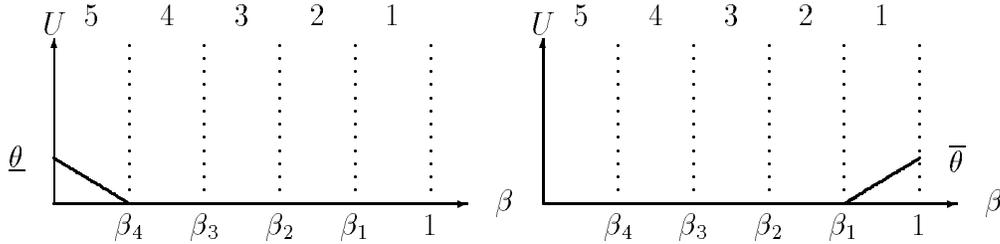

Figure 4: Net rent

4 Conclusion

The paper highlights the screening function of different coexisting matching technologies. A model of asymmetric information is used to explain the allocation of worker types to different employment institutions. It is shown that employers can screen workers by offering different contracts at different institutions for one single job. Using both the private agency and the public exchange may entail efficient production under asymmetric information, but bypass is neither necessary nor sufficient for allocative efficiency. However, the range of parameter values for which optimal screening implies first best production increases when the private agency is used.

There are some serious limitations of the model which should be taken into account. First, as there is no competition among workers, the probability of finding a job does not depend on one's ability or on currently being employed or unemployed. However, empirical research suggests that employed workers have a higher probability of finding a new job than unemployed workers.[23] When workers compete, the optimal screening mechanism exhibits the same

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[23]See for example Lindeboom et al. [11].

output distortions as with one single worker, but lower information rents (separation property).[24] Thus, the results of the paper remain valid if a limited number of workers compete although competition weakens the rent effects of screening via different employment agencies.

Second, the efficiency of the public exchange is exogenous in the model although it is an important question whether competition of private agencies enhances the efficiency of the bureaucracy.

Third, in order to compare overall welfare with and without bypass and to evaluate whether the employer's choice of agencies is efficient, not only the level of production, but also the probability of a match must be taken into account. Thus, from a welfare point of view it can be meaningful to ask whether increasing the efficiency of the employment exchange is desirable, but this is beyond the scope of this model. The model shows, however, that two potential inefficiencies, the asymmetry of information and the slowness of the public exchange, do not necessarily add up or reinforce each other. The effect of the information asymmetry on optimal contracts can be neutralized by an inefficient employment exchange. Thus, the sorting effect of the slow bureaucracy, the cost of increasing the employment exchange's efficiency via regulation, and the cost of frictional unemployment due to delayed matching must be weighed against each other in order to choose the right policy. What should have emerged from the analysis, however, is that regulating the public exchange or deregulating the market for employment services has some unexpected efficiency and distribution effects when asymmetric information is taken into account.

Appendix

Proof of Proposition 1 Solve the constrained maximization program for every possible set of binding constraints. The results are summarized below:

1. In regime 1 with binding constraints $\overline{IC}$ and $\underline{IR}$, optimal contracts are characterized by

$$
\begin{aligned}
\phi_y(\overline{y}_1, \overline{\theta}) &= 1, \quad \phi_y(\underline{y}_1, \underline{\theta}) < 1, \\
\phi_y(\underline{y}_1, \underline{\theta}) &= 1 - \nu(1 - \phi_y(\underline{y}_1, \overline{\theta})) \\
\overline{w}_1 &= \phi(\overline{y}_1, \overline{\theta}) + \overline{U}_1, \quad \underline{w}_1 = \phi(\underline{y}_1, \underline{\theta}).
\end{aligned}
$$

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[24]See Laffont and Tirole [9], Chapter 7, and, for an application, Kübler [7].

2. In regime 2, the solution to the employer's maximization program with the binding constraints $\overline{IC}$, $\underline{IR}$, and $\overline{IR}$ is:

$$\phi_y(\overline{y}_2, \overline{\theta}) = 1, \quad \phi_y(\underline{y}_2, \underline{\theta}) < 1,$$

$$\frac{(1-\beta)}{\beta}d = \phi(\underline{y}_2, \underline{\theta}) - \phi(\underline{y}_2, \overline{\theta}) \quad \text{and} \quad \underline{y}_2 > \underline{y}_1,$$

$$\overline{w}_2 = \phi(\overline{y}_2, \overline{\theta}) + [(1-\beta)/\beta]d,$$

$$\underline{w}_2 = \phi(\underline{y}_2, \underline{\theta}).$$

3. In regime 3, optimal wages and output levels for the binding constraints $\underline{IR}$ and $\overline{IR}$ are:

$$\phi_y(\overline{y}_3, \overline{\theta}) = 1, \qquad \phi_y(\underline{y}_3, \underline{\theta}) = 1,$$

$$\overline{w}_3 = \phi(\overline{y}_3, \overline{\theta}) + \frac{(1-\beta)}{\beta}d, \qquad \underline{w}_3 = \phi(\underline{y}_3, \underline{\theta}).$$

4. In regime 4 where $\underline{IR}$, $\overline{IR}$, and $\underline{IC}$ are binding,

$$\phi_y(\overline{y}_4, \overline{\theta}) > 1, \qquad \phi_y(\underline{y}_4, \underline{\theta}) = 1,$$

$$\frac{(1-\beta)}{\beta}d = \phi(\overline{y}_4, \underline{\theta}) - \phi(\overline{y}_4, \overline{\theta}),$$

$$\overline{w}_4 = \phi(\overline{y}_4, \overline{\theta}) + \frac{(1-\beta)}{\beta}d, \qquad \underline{w}_4 = \phi(\underline{y}_4, \underline{\theta}).$$

5. In regime 5, the binding constraints $\overline{IR}$ and $\underline{IC}$ yield

$$\phi_y(\overline{y}_5, \overline{\theta}) > 1, \qquad \phi_y(\underline{y}_5, \underline{\theta}) = 1,$$

$$\phi_y(\overline{y}_5, \overline{\theta}) = \nu + (1-\nu)\phi_y(\overline{y}_5, \underline{\theta}),$$

$$\overline{w}_5 = \phi(\overline{y}_5, \overline{\theta}) + \frac{(1-\beta)}{\beta}d,$$

$$\underline{w}_5 = \phi(\underline{y}_5, \underline{\theta}) + \phi(\overline{y}_5, \overline{\theta}) - \phi(\overline{y}_5, \underline{\theta}) + \frac{(1-\beta)}{\beta}d.$$

$\square$

Proof of Proposition 2 Solve the constrained maximization program for every possible set of binding constraints. The results are summarized below.

1. In regime 1, the optimal contract has the following properties:

$$\phi_y(\overline{y}_1^r, \overline{\theta}) = 1, \quad \phi_y(\underline{y}_1^r, \underline{\theta}) < 1,$$

$$\phi_y(\underline{y}_1^r, \underline{\theta}) = 1 - \nu(1 - \phi_y(\underline{y}_1^r, \overline{\theta}))$$

$$\overline{w}_1^r = \phi(\overline{y}_1^r, \overline{\theta}) + \beta\overline{U}_1 - (1-\beta)d,$$

$$\underline{w}_1^r = \phi(\underline{y}_1^r, \underline{\theta}).$$

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2. In regime 2, the optimal contract is characterized by

$$\begin{aligned}
\phi_y(\overline{y}_2^r, \overline{\theta}) &= 1, \quad \phi_y(\underline{y}_2^r, \underline{\theta}) < 1, \\
\frac{(1-\beta)}{\beta}d &= \phi(\underline{y}_2^r, \underline{\theta}) - \phi(\underline{y}_2^r, \overline{\theta}) \\
\overline{w}_2^r &= \phi(\overline{y}_2^r, \overline{\theta}), \quad \underline{w}_2^r = \phi(\underline{y}_2^r, \underline{\theta}).
\end{aligned}$$

3. In regime 3 with $\beta \in (0, \beta_2)$, the optimal contract satisfies:

$$\begin{aligned}
\phi_y(\overline{y}_3^r, \overline{\theta}) = 1, &\qquad \phi_y(\underline{y}_3^r, \underline{\theta}) = 1, \\
\overline{w}_3^r = \phi(\overline{y}_3^r, \overline{\theta}), &\qquad \underline{w}_3^r = \phi(\underline{y}_3^r, \underline{\theta}).
\end{aligned}$$

Consider the incentive constraints to verify that they are in fact not binding:

$$\begin{aligned}
\beta[\underline{w}^{r*} - \phi(\underline{y}^{r*}, \underline{\theta})] &\geq \overline{w}^{r*} - \phi(\overline{y}^{r*}, \underline{\theta}) \\
\overline{w}^{r*} - \phi(\overline{y}^{r*}, \overline{\theta}) &\geq \beta[\underline{w}^{r*} - \phi(\underline{y}^{r*}, \overline{\theta})] - (1-\beta)d.
\end{aligned}$$

Constraint $\underline{IC'}$ is satisfied because the left hand side is zero and the right hand side is negative. For all $\beta \in (0, \beta_2)$ we know that $[(1-\beta)/\beta]d > \phi(\underline{y}^{r*}, \underline{\theta}) - \phi(\underline{y}^{r*}, \overline{\theta})$. Thus, the right hand side of $\overline{IC}'$ is negative while the left hand side is zero.

$\square$

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