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Incentives and Regional Coordination in Employment Services

Summary

This paper presents a game theoretical model that addresses the trade off between regional coordination and incentives in the mediation of unemployed in the Netherlands.

Due to yardstick competition, municipalities have financial incentives to reduce unemployment, but are not likely to cooperate with each other to have the scale advantages of a regional labour market. On the other hand, a regional public employment service, like the CWI in the Netherlands, has a higher probability and value of matching, but it lacks the incentives to exert the optimal mediation effort. The model is calibrated with information on vacancies and CWI clients for the Netherlands, in order to get an impression whether it is optimal to have a public employment service in the context of this model. Finally, various institutional settings, like a privatised employment service and a performance contract for the employment office, are considered.

Contents

1 Introduction[1]

1.1 Employment Services in the Netherlands

During the last five years the administration of social security in the Netherlands has been changed substantially. The changes are the result of two new laws. Firstly, on January 1, 2002 the new social security act SUWI[2] was introduced (see for more information the box "SUWI & CWI"). This act aimed at a more distinctive distribution of social security activities among public organisations and employer and employee organisations. One of the most notable features of the new act is the establishment of the new public employment service CWI[3]. During the first six months of unemployment the CWI helps the unemployed finding a job, mostly by offering mediation services. Most CWI offices cover a number of municipalities; in large cities the CWI office covers only one or part of a municipality. Secondly, the new social assistance act WWB[4], introduced in 2004, sets out the organisation and financing of social assistance. Decision-making is decentralised and municipalities receive a fixed amount from the central government for the payment of the benefits. The transfers from the government are based on yardstick competition. Yardstick competition relates the performance of a municipality to other municipalities. Outperforming other municipalities leads to financial gains, since the lump sum amount is based on the average performance of all municipalities.[5] Municipalities can retain any amounts saved on unemployment benefits. Therefore, they have a strong incentive to reduce the number of social assistance recipients.

Early evaluations of the WWB show that the increase in welfare benefits is around 2 percent lower as a result of yardstick competition and more unemployed found a job.[6] So the financing structure indeed gives the municipalities an incentive to reduce unemployment. Also the SUWI act has been evaluated recently.[7] Although the situation is better than before the introduction of the law, there are still problems in the coordination between the various organisations. In this thesis I address the lack of coordination in employment services between the CWI and the municipalities.

[1] This thesis was written during an internship at the CPB Netherlands Bureau for Economic Policy Analysis. I would like thank my supervisors Paul de Bijl and Pierre Koning from the CPB and Sander Onderstal from the University of Amsterdam for their critical support and Luuk Buit and Roel van Elk for their help on form and contents. I am grateful to seminar participants at the CPB and Klaas Beniers from the Ministry of Social Affairs for valuable comments.

[2] In Dutch: Structuur Uitvoeringsorganisatie Werk en Inkomen; SUWI

[3] In Dutch: Centrum voor Werk en Inkomen

[4] In Dutch: Wet Werk en Bijstand

[5] See for example Shleifer (1985)

[6] See Stegeman and Van Vuren (2006) and Ministerie van Sociale Zaken en Werkgelegenheid (2007)

[7] See Ministerie van Sociale Zaken en Werkgelegenheid (2006)

SUWI & CWI explained

On 1 January, 2002 the new social security act SUWI was introduced. The basic structure is as follows. There are 132 CWI offices in the Netherlands. Most CWI offices cover a number of municipalities, some cover one or part of a municipality. A benefit applicant goes to the CWI to apply for a benefit. If he meets the requirements, the CWI will register him. If the applicant is disabled or has worked enough in the past, he is eligible for an unemployment insurance. The public organisation UWV pays the insurance. If he is not disabled nor has worked enough in the past, he is eligible for a social assistance benefit. The municipality where he lives pays him the benefit.

During the first six months of unemployment the CWI will help the unemployed to find a job. The help of the CWI takes the form of extensive mediation: the unemployed can have consults with a CWI worker and he can look into the vacancy section in the CWI offices and at the website of the CWI. The CWI is responsible for monitoring unemployment benefit recipients in this period. Most of the unemployed find a job within this period. In the first quarter of 2007 64% of the unemployed found a job within the first six months of unemployment.[8]

If the unemployed has not found a job after the first six months, the municipalities or the CWI become responsible for the employment services. Their support is more intensive and often re-integration into the labour market is necessary.

The central government finances the CWI and UWV. The financing does not depend on their results. Since the introduction of the new social assistance act in 2004 the amounts the municipalities receive are partly based on their results.

Multiple organisations perform the mediation tasks. The CWI mediates, while the municipalities perform administration tasks and re-integration after the first six months of unemployment. The municipalities have a strong financial incentive to reduce the number of unemployed, but the municipalities do not directly control the mediation of the unemployed during the first six months of unemployment. When helping unemployed to find a job, the CWI does not take into account that municipalities gain from the effort of the CWI as there are no returns to job matches as the municipalities have. The mediation effort of the CWI is lower than the municipalities would opt for if they were responsible for the mediation task.[9]

A possible solution to this problem is to transfer the mediation task in the first half year of unemployment to the municipalities as well.[10] Former state secretary of Social Affairs Rutte

[8] See CWI (2007)

[9] See Ministerie van Sociale Zaken en Werkgelegenheid (2007b, p.66)

[10] In practice, not only the CWI collects vacancies, also municipalities may search for vacancies for their own unemployed in order to gain from the lower expenditures on social benefits. See Section 6.

proposed this in 2003.[11] Still, although this proposal solves the incentive problem, it creates another problem: lack of regional coordination.[12]

Regional coordination on the labour market is important in the social security system and is one of the reasons for the creation of the CWI.[13] [14] Since workers and vacancies are heterogeneous, employers, job seekers and overall welfare benefit from a labour market which is larger than the local labour markets. The number of relevant vacancies the CWI has available is larger than an individual municipality has available for their own unemployed. Moreover, in general when there are more vacancies available a worker can be matched to a job with better fitting characteristics. Therefore, the CWI increases allocative efficiency in the labour market.

If the municipalities coordinate their activities by sharing vacancies they found but cannot match to their own unemployed, they will create a regional labour market without the CWI. However, it is uncertain whether the municipalities will share the unused vacancies. Ministerie van Sociale Zaken en Werkgelegenheid (2007b) quotes a local civil servant: "There is a tension between local and regional policies. Good matching requires regional policies. [...] There is competition between municipalities."[15] If the municipalities do not cooperate, they cannot benefit from the regional labour market. Another possibility in the absence of the CWI is that the municipalities set up a regional employment office themselves. But the municipalities still have an incentive to favour their own unemployed. The municipalities should discipline themselves in advance by rules that ensure the independence of the employment office. This leads to a comparable principal-agent problem as between the municipalities and the CWI.

From the discussion about the relation between the CWI and the municipalities a trade off emerges. At the one hand, in the current situation the CWI facilitates the formation of a regional labour market, but it does not have the incentives to provide the optimal mediation effort like the municipalities. On the other hand, the municipalities have financial incentives to reduce unemployment, but they are unlikely to cooperate to form a regional labour market. So only one of two goals can be reached: the CWI has the advantage of coordination; the municipalities have the advantage of incentives.

The current government wants to "stimulate the CWI, UWV and municipalities to coordinate their activities and to improve the quality and effectiveness of the services and re-integration by result agreements."[16] This should lead to 190 million EUR savings annually on the costs of the social security system. This thesis can contribute to the ongoing discussion about the design of the social security system and about the role of the CWI in this process.

[11] See *Volkskrant*, 13 August 2003

[12] Another problem is that small municipalities might not have the skills to perform the mediation task. I do not discuss this issue in my thesis.

[13] See for example Raad voor Werk en Inkomen (2006)

[14] See *Het Financieele Dagblad*, 23 June 2006

[15] Ministerie van Sociale Zaken en Werkgelegenheid (2007b, p.67)

[16] See www.kabinetsformatie20062007.nl

1.2 Research Question and Methodology

The previous discussion leads to my research question:

Given that the WWB act implies that municipalities are lump sum financed, what yields higher welfare: municipalities providing the employment services or a regional public employment service doing so?

My research method is to model the effect of incentives and coordination on unemployment and welfare. I split the employment services in two categories: searching for vacancies and the matching process. My model deals only with searching and matching activities on the labour market that make use of the mediation services of the employment office. So I ignore the efforts of (un-)employed and firms themselves to find each other.

In my model there are two municipalities which both have one unemployed and in both jurisdictions one vacancy can be found. I consider two setups. In the first setup the municipalities look for vacancies, try to match the vacancies to their own unemployed and have to decide whether they want to share vacancies they themselves have not used. I show that the municipalities will not exchange their unused vacancies, so the regional labour market will not function. In the second setup a Public Employment Service (PES), like the CWI, searches for the vacancies. The PES is less effective in searching than the municipalities. This reflects the proposition that the PES does not have the optimal incentives. The vacancies and unemployed are pooled and, if possible, matched. The probability a match will occur is larger in the common pool than when the municipalities match their unemployed and vacancies. I find an expression that shows for what value of the variables the welfare levels of the setup with and without a PES are the same. The optimal setup depends on two central parameters: the effectiveness of search and the effectiveness of matching.

I extend my model in several directions. In the first extension I consider the effects if the game is played more than once. Next I consider the effects when I lift the assumption that the municipalities have one unemployed and at most one vacancy. Both extensions point to ways to increase the realism of the model. A first conclusion is that the advantage of the regional labour market is smaller than predicted in the basic model, because both coordination between municipalities and a larger size of the labour market increase the attractiveness of the setup where the municipalities perform the mediation task themselves. In a third extension I include the costs of searching in the model. Economies of scale increase the attractiveness of a setup with a PES.

I calibrate my model using information from the Dutch statistical office, from the CWI and from the literature. This calibration gives an impression of the advantage of the PES over the

municipalities in providing the employment services, stemming from the value of a regional labour market.

The model can be applied to other economic issues than described in this thesis. For example the re-integration market for long-term unemployed in the Netherlands shows a similar trade off as in the mediation sector for short-term unemployed. The difference is the current situation: in the re-integration sector the municipalities are responsible for the employment services, so the incentives are well aligned. However, they might not coordinate their activities regionally. Another application is joint research centres. Firms can save on costs if they set up a joint research centre, but if there are moral hazard problems between the participating firms, they may not create a joint research centre without coordination. On the other hand, an independent research centre might have lower incentives to do research than the firms would like.

1.3 Structure of the Thesis

The remainder of the thesis is organised as follows. An overview of the relevant literature is given in Section 2. In Section 0 I develop the model. In Section 4 I consider some extensions to the basic model. I calibrate the model of Section 0 in Section 5. I conclude in Section 6 in which I also discuss the possibilities for future research and present some policy options.

2 Literature

In this section I discuss the literature that is related to my thesis. The model which I develop in Section 3 builds on concepts from search and matching models and non cooperative game theory. Furthermore, my research is related to literature on the performance of the public employment service (PES) and active labour market policies and to literature dealing with issues about the regional labour market. In this section I show what the relation is between my research and existing literature. In Section 2.1 I discuss the search and matching models. Section 2.2 discusses the role of non cooperative game theory in my model. Section 2.3 shows the place of my research within the literature about the performance of the PES and about the regional labour market. In Section 2.4 I conclude and show what my model adds to the existing literature.

2.1 Search and Matching Models

My thesis combines search and matching models with game theory.

Search and matching models examine the matching process on the labour market.[17] The labour market is not seen as an aggregate market where workers and jobs are matched instantaneously, but as a market where workers and jobs have to search for each other and meet pair-wise to see whether the other is acceptable. This process of searching and matching takes time and therefore causes unemployment. The number of matches on the labour market is explained by a matching function which relates the number of matches to the number of vacancies and unemployed and to exogenous variables.[18] Also in my model the matching function is a central instrument to explain unemployment. The important exogenous variable in my model is the institutional design of the employment services. Whether the employment services are provided by the municipalities or by a regional employment office determines both the number of available vacancies and the effectiveness of the matching process.

Contrary to standard search and matching models I ignore the behaviour of unemployed and firms in order to be able to focus on the role of the employment office. This has two implications. First, my model deals only with part of all search and matching activity on the labour market. Second, the wage-bargaining process and the value from matching for workers and firms are ignored. Only value for the government is considered and the value from matching results from lower expenditures on welfare benefits. Another difference is that my model does not seek to explain the job creation and job destruction process. Therefore, it takes the number of vacancies and unemployed as given. Unlike in most papers on the matching function, my model uses a discrete time period for a limited number of unemployed and

[17] See for an overview on the search and matching models Mortensen and Pissarides (1999)

[18] See for an overview on the literature on the matching function Petrongolo and Pissarides (2001)

vacancies to allow for precise modelling of the matching process of the PES and the municipalities.

Most search and matching models view the workforce as homogeneous. These models are built on the assumption that in the labour market a suitable match is always available, but unemployed and firms have to search for the match. Some search and matching models like Pissarides (1979) introduce heterogeneity of workers in their incentives to search. I include the heterogeneity of workers in a different way. Since in my model the unemployed do not search for vacancies, but the employment office or the municipality do so, the heterogeneity of workers is not reflected in the search process. As in Coles and Smith (1998) the heterogeneity of workers is reflected in the matching process. They discuss the matching process from a marketplace model. Coles and Smith (1998) assume that before a meeting takes place, the unemployed and firms have searched all current options and if the meeting is not a success, they have to wait until new workers and jobs flow in to have a new opportunity of matching. My model takes an intermediate position between the standard search and matching model and the marketplace model. On the one hand my model differs from the standard search and matching model in the respect that it can be the case that there is no suitable match available during the current period. On the other hand my model differs from Coles and Smith (1998) in the respect that unemployed and firms do not search all current options before a meeting so that it is possible that after a failed meeting another meeting from among the current stock of unemployed or firms is successful.

My matching function relates the matching probability to the number of unemployed and vacancies. These numbers depend on whether the labour market is considered locally or regionally, as in Coles and Smith (1996). However, the matching function used in Coles and Smith (1996) is designed to empirically check the returns to scale in job search, while I explicitly open the 'black box' of the matching function by modelling the working of the matching process and the role of heterogeneity of firms and workers.

2.2 Non Cooperative Game Theory

I make use of non cooperative game theory, as presented for example in Mas-Colell et al. (1995). The players in my model are not unemployed or firms, but the PES and the municipalities. The outcome of my model is the unemployment rate and this outcome depends on the decisions taken by the municipalities and the PES.

In the following situations I use game theory. Firstly, if the municipalities provide the employment services, the outcome of the matching process depends on the choices made by the

municipalities and their ability to cooperate. The relationship between the municipalities takes the form of a Prisoner's Dilemma.[19]

Secondly, principal-agent theory helps to understand the relationship between the PES and the municipalities. The municipalities want the PES to act in their interest by exerting the optimal level of search effort. However, if drawing up perfect contract is impossible it is a problem for the municipalities to let the PES act in their interest. The situation can be compared to the situation where the government has to decide whether to provide a service in-house or to contract out the service, as discussed in Hart et al. (1997). Hart et al. (1997) show that whether a service should be provided by a public organisation or by a private party depends on the importance of cost innovation and quality innovation. A private organisation has the residual control rights and therefore focuses generally too much on cost reduction which might deteriorate quality. So privatisation is only optimal if cost reductions can be limited by contracts or competition. Keeping the service in-house is optimal if quality innovation is unimportant, if government procurement is sensitive to corruption and if non-contractible cost reductions have a large negative impact on quality. In my thesis the municipalities care about both the quality (regional labour market effect) and the costs (incentive effect) of the employment services. However, unlike in Hart et al. (1997) the PES does provide enough quality by facilitating the regional labour market which leads to a better matching process. Hart et al.'s (1997) model differs from mine in the sense that the PES is a public organisation which does not care for profits as a private organisation does. As in Hart et al. (1997) the public employment office focuses too less on costs. In general the relationship between the PES and the municipalities is not a principal-agent problem in the strict sense, since in my thesis the municipality is not the principal who can influence the behaviour of the PES by drawing up a contract, but it is the central government which decides on a contract with the PES.

In Section 6 I apply principal-agent theory more directly. The policy option to privatise the CWI and to auction the license to mediate is related both to principal-agent theory and to auction theory.[20] The policy option to write a performance contract with the PES is related to principal-agent theories as discussed in Hart et al. (1997), Martin and Grubb (2001) and Crémer (1995). Following Hart et al. (1997) writing a performance contract with the PES might shift the focus of the PES from quality to cost reduction. Based on the evaluation of experiments with performance contracts for the PES, Martin and Grubb (2001) argue that mechanisms that introduce incentives for the PES increase the effectiveness of the PES. Using the central result of Crémer (1995) one can argue that the incentives of the PES to exert effort will be lower if the municipality knows whether the results of the employment services were due to efforts of the PES or due to factors the PES cannot influence. The finding of Crémer (1995) is helpful in deciding which performance indicators should determine the payoffs of the PES.

[19] See e.g. Selten (1978)

[20] See for an overview on auction theory Milgrom (2004)

Finally, the matching function in my model makes use of tools like games in extensive forms.

2.3 Empirical literature

2.3.1 The performance of the PES

My thesis asks the question whether the activities of the PES should be performed at a local or at a regional level. However, a first issue is whether the activities performed by the PES are effective at all. In other words, does the PES help to reduce unemployment? This issue has received considerable attention in the empirical literature and is part of the literature on the effectiveness of active labour market policies.[21] Martin and Grubb (2001) report that among all active labour market policies labour market training, subsidised employment in the private sector and the employment services provided by the PES can be effective. However, the impact of the policies depends on the target group and is in general small.

The employment services of the PES can be split in low-intensity counselling and high-intensity monitoring and job search assistance. Counselling takes the form of helping unemployed drawing up a resume and application letter and informing them how to search for vacancies. Monitoring means that the PES checks whether the unemployed exerts enough effort to find a job. The model I develop in this thesis focuses on the job search assistance provided by the PES. This service consists of help with the search for suitable vacancies and help with the application procedure.

Counselling does not have an impact on the job search effectiveness of unemployed, as Van den Berg and Van der Klaauw (2006) show. On the other hand, high-intensity employment services are effective instruments to increase the outflow from unemployment, although in general the effect is small.[22] However, if the unemployed make use of the job search assistance provided by the PES, this comes at the expense of informal job search. Furthermore, Ashenfelter et al. (2005) show that monitoring the search efforts of unemployment is not effective and they conclude that job search assistance remains as the only effective instrument for the PES to reduce unemployment. The effectiveness of the employment services differs for target groups and to be effective job search assistance needs to be complemented with other policies. Still, as Koning (2007) shows, the job search assistance provided by the PES is a cheap and cost-effective labour market instrument.

The conclusion that appears from the papers on the performance of the PES is that the services offered by the PES, especially intensive job search assistance, have a small but significant negative impact on unemployment. Therefore, the value of the PES to society is

[21] See for an overview on the effectiveness of active labour market policies Martin and Grubb (2001)

[22] See for example Van Ours (1994), Gorte and Kalb (1994), Gregg and Wadsworth (1996), Dolton and O'Neill (1996) and Meyer (1995).

positive. However, the value of the PES as an institution to facilitate the regional labour market remains unexplored.

2.3.2 Regional labour market

The research question asks whether the employment services should be provided at a local level or at a regional level. Therefore, my research is related to regional labour market theory. Coles and Smith (1996) argue that if there are constant returns to scale in the number of unemployed and firms searching on a local labour market, there might increasing returns to scale on the regional labour market, since the unemployed and firms can search in the neighbouring market as well. In other words, the number of matches is larger if the firms and unemployed search both locally and in the neighbouring labour markets. However, Coles and Smith (1996) do not find empirical support for increasing returns to scale. Does this evidence imply that the regional labour market has no value? No, because the approach of Coles and Smith (1996) and my model differ in the definition of the local labour market. Coles and Smith (1996) define the local labour market as a travel-to-work area and look for spill over effects only between the travel-to-work areas. It makes sense they do not find significant spill over effects, since by definition most workers do not travel to work beyond the borders of their travel-to-work area. In my model the travel-to-work area is a regional labour market which consists of local markets. It is plausible to expect increasing returns to scale, if unemployed and firms do not only meet locally but also within the whole travel-to-work area.

Another spill over effect between adjoining labour markets is present if the unemployed-vacancy ratios are different in the labour markets. Burda and Profit (1996) and Burgess and Profit (2001) show that differences in the unemployed-vacancy ratio between regional labour markets have an effect on the matching probabilities in the regional labour markets and on migration between municipalities. Although Burda and Profit (1996) and Burgess and Profit (2001) do not explain how the matching probability is determined, the insights of these models might be helpful in extending my model to account for differences in unemployment rates between municipalities as discussed in Section 6.

As I have argued, giving the responsibility to provide the employment services to the municipalities leads to higher efforts to reduce unemployment. Giving the mediator task to the municipalities has other effects as well. Lundin and Skedinger (2006) argue that giving the responsibility for active labour market policies to the municipalities leads to efficiency gains since the municipalities have first-hand knowledge about the situation on the labour market. However, inefficiencies will arise if municipalities use their labour market policies to increase or maintain the population, leading to geographical lock-in effects. Although Lundin and Skedinger (2006) address effects of decentralisation of the employment services, they do not go into the issue of the role of the PES on the regional labour market.

2.4 Conclusion

In this section I have shown how my research is related to existing theoretical and empirical literature. Theoretically my thesis builds firstly on search and matching models and has the matching function in common with the search and matching models. A notable difference with standard search and matching models is that in my model workers and jobs are heterogeneous. The second building block is non cooperative game theory, in particular principal-agent theory. The empirical literature firstly shows that in general the PES is useful in reducing unemployment and secondly that there are spill over effects between labour markets.

However, as far as I know my thesis is the first which analyzes the PES as an institution that facilitates the regional labour market. My model gives an intuitive story for the differences in the returns to scale in the matching process between a regional labour market and a local labour market. It is complementary to the literature on the matching function in its attempt to model the 'black box' of the matching process. Next, my paper helps to clarify the mechanisms at work when thinking about how to give incentives to those who have the responsibility to provide the employment services.

3 Basic Model

In this section I develop a model to evaluate the welfare effects of the setups with and without a public employment service (PES). In Section 1 I discussed the two goals which are relevant in the discussion about who should provide the employment services. The first goal is creating a well-functioning regional labour market and the second goal is to align incentives and responsibilities. The setup with a PES reaches the goal a well-functioning regional labour market. The setup without a PES reaches the goal of aligned incentives and responsibilities.

The setup of this section is as follows. First I give the main features and assumptions of the model in Section 3.1. In Section 3.2 I discuss the setup where there is no PES, but where the municipalities search for vacancies for themselves. Next, in Section 3.3 the PES searches for vacancies. In Section 3.4 I compare both setups and answer the question which of the two setups yields higher welfare. Section 3.5 concludes.

3.1 Setup and Assumptions

Consider a model with two municipalities called M_1 and M_2. The municipalities form a regional labour market. In Section 3.3 there is also a region-wide public employment service. The municipalities interact in a single period. Municipalities act non-cooperatively and their own payoff is their sole interest.

3.1.1 Unemployed and vacancies

Both municipalities have one unemployed labelled u_i for M_i, i=1,2.

In Section 3.2 the municipalities independently find a vacancy with probability γ, $0 \leq \gamma \leq 1$. So the number of vacancies v_i can be 0 or 1. There are four possible situations: $\{v_1, v_2\} \in \{ \{1, 1\}, \{1, 0\}, \{0, 1\}, \{0, 0\} \}$. The probabilities these events occur are respectively γ^2, $\gamma(1-\gamma)$, $\gamma(1-\gamma)$ and $(1-\gamma)^2$. The probability that a vacancy is found is called the contact rate. The contact rate is exogenous. Municipalities search for vacancies only within their own jurisdiction. Therefore, the probability a municipality finds a vacancy does not depend on the searching of the other municipality.

In Section 3.3 I introduce a PES that searches for the vacancies. The PES can find at most two vacancies. Its contact rate is η, $0 \leq \eta \leq 1$. So the probabilities the PES finds respectively two, one and zero vacancies are η^2, $2\eta(1-\eta)$ and $(1-\eta)^2$. the PES searches for one vacancy in the jurisdiction of the first municipality and for the second vacancy in the jurisdiction of the second municipality.

Assumption 3.1 $0 \leq \eta \leq \gamma$.

Assumption 3.1 states that the PES is at most as effective as the municipality in searching for vacancies. It reflects the proposition that the municipalities have a strong financial incentive to search for incentives, which the PES lacks. I assume that this makes the PES less effective in searching. For example, the civil servants of the municipalities call firms to ask whether the firm has a vacancy, while the PES officer waits until a firm notifies the PES that the firm has a vacancy.

3.1.2 Meeting and matching

The matching process reflects the value of a regional labour market. I have designed the matching process in a way that gives the PES an advantage in matching over the municipalities. Since the matching process is different for the setups with and without a PES, a detailed description of the matching process is postponed to Section 3.2 and Section 3.3.

Any meeting between an unemployed and a firm which has a vacancy will result in a match with probability α, $0< \alpha<1$. This probability is called the offer-acceptance probability. The offer-acceptance probability is smaller than one because workers and jobs are heterogeneous. Not every worker will have the characteristics required for the job. So not everyone is hired after a job interview. Instead of explicitly modelling the characteristics of workers and the requirements of the jobs, I assume there is a fixed offer-acceptance probability. The term meeting refers to an unemployed going to a job interview. Matching is the term for a successful meeting: the unemployed is hired. The matching process is the process of meeting and matching.

3.1.3 Payoffs

If an unemployed is not matched to a vacancy at the end of the period, the municipality has to pay the unemployed a social assistance benefit, which is normalised at one. If the municipality has no unemployed left, it does not have to pay anything.

The value of a vacancy which is left at the end of the period is δ, $0 < \delta < 1$. The value of δ is larger than zero because the municipality can keep the vacancy for a next period. In that period the municipality might need it for its unemployed. It would then save a benefit. δ is smaller than one, since it is not certain it can use the vacancy and save a benefit in the next period. It is not certain because in the next period the municipality may find another vacancy. If a municipality has no vacancy left, the value is zero. In the setup without a PES, this value is part of the payoff of the municipality. In the setup with a PES, the above reasoning holds as well, but now the PES controls the vacancies. The value is part of general welfare; it does not directly contribute to the payoffs of the municipalities, since they do not control the vacancies. The PES has no profit motive so it does not value the unused vacancy.

Municipalities do not value a match apart from the saving on benefits nor do they value a match between their own unemployed and a vacancy from their own jurisdiction more than a match between their own unemployed and a vacancy from the other municipality.

The payoff is the sum of the cost of the unemployed and the value of the vacancy. For example, if a municipality has both a vacancy and an unemployed left its payoff is (δ-1). If it has only an unemployed left, its payoff is -1. If it has neither a vacancy nor an unemployed left its payoff is 0. Note that δ-1 < 0: municipalities prefer a success of a meeting above a failure. Welfare is the sum of the payoffs of both municipalities and, in the setup without a PES, the value of the unused vacancies. Expected payoff is the payoff of the outcome multiplied by the probability the outcome occurs, given the strategies of the municipalities.

3.1.4 Informational assumptions

The municipalities and the PES ex ante know 1) the contact rate, 2) the matching probability and 3) the corresponding payoffs. The municipalities and the PES have full information about the working of the matching process. The municipalities have private information about the number of vacancies they have found, about their choices made and about the outcome of the matching process.

3.1.5 Timing

The exact timing of the game depends on the presence of a PES. Therefore, details of the timing will be given in Section 3.2 and Section 3.3. The general timing is as follows.

t = 0: Searching process: Nature determines the number of vacancies and the participants observe the number of their vacancies.

t = 1: Matching process takes place.

t = 2: Participants receive their payoff.

Table 3.1 Probabilities and symbols

Probability	Meaning	Symbol
Contact rate (Municipality)	The probability the municipality finds a vacancy	γ
Contact rate (PES)	The probability the PES finds a vacancy	η
Offer-acceptance probability	The probability meeting between an unemployed and a firm results in match	α
Matching probability	The probability the matching process results in a match	μ
Outflow rate	The probability an unemployed finds a job	χ
Value of left vacancy	The value of an unused vacancy in the next period	δ

3.2 Sharing versus Keeping

In this section I model the setup without a PES. The central questions are 1) whether municipalities will cooperate by sharing vacancies they themselves cannot use and 2) what level of welfare cooperation and non-cooperation yield. In Section 3.2.1 I describe the game, in Section 3.2.2 I show that cooperation is not an equilibrium and I conclude in Section 3.2.3.

3.2.1 The game

Before the game starts, when t = 0, Nature draws the values of v_i in the way described in Section 3.1. The municipalities observe the number of vacancies they have found themselves, v_i = 0 or 1, i = 1, 2.

During t = 1, the matching process takes place. When there is no PES, the process consists of three stages.

In Stage 1 the municipalities try to match the vacancy with their own unemployed, provided they have found a vacancy. The meeting is a success with probability α. For the successful municipality the game ends and the municipality receives its payoff. If the meeting is a failure, the municipality participates in Stage 2. If a municipality has not found a vacancy (v_i = 0), it goes directly to Stage 3.

In Stage 2 the municipality has two choices: 1) to share its unused vacancy with the other municipality which can use the vacancy for its unemployed, or 2) to keep the vacancy for the next period. If both municipalities have a vacancy left, they choose simultaneously. Municipalities base their choice whether to share or keep their vacancy on the expected payoffs of both choices and they will choose the strategy which yields the highest expected payoff. The game ends at the end of Stage 2, if none of the municipalities has decided to share its vacancy.

In Stage 3 a municipality can use the shared vacancy of the other municipality to try to match it to its own unemployed. The vacancy and unemployed will meet and this will result in a match with probability α. If the meeting is a failure, the vacancy "returns" to the municipality which has shared it and this municipality receives the value δ.

At t = 2, the game ends and the municipalities receive their payoff, as described in Section 3.1.3.

Figure 8.1 in the appendix shows the game in extensive form.

3.2.2 Strategies, equilibrium and welfare

Municipalities base their decision whether to share or not on the expected payoffs. A dominant strategy is defined as a municipality's strictly best response to any strategy the other municipality might choose.[23]

[23] See Rasmusen (2001)

Proposition 3.1 *In equilibrium the municipalities do not cooperate.*

Proof: If a municipality decides to keep its vacancy, it receives the value of a kept vacancy δ for sure. If a municipality shares its vacancy, there is a chance the other municipality will use it. In that case the sharing municipality receives no value from its vacancy. There is also probability the meeting is not successful or the other municipality does not need the shared vacancy. Then the sharing municipality still receives value δ. But the expected payoff after sharing is smaller than δ. Therefore, the dominant strategy is to keep the vacancy.

The choice of the second municipality does not influence the choice of the first municipality. The first municipality would like the second municipality to share, since then the first municipality has a chance of matching its unemployed. But the choice of the second municipality does not change the ranking of the expected payoffs of the strategies of the first municipality.

The municipalities cannot credibly commit themselves to share. To show this, suppose the municipalities agree in advance that they will share if they have a vacancy to share. Since the municipalities choose simultaneously, they cannot punish a cheating municipality. And since the expected payoffs of keeping are always higher than the payoffs of sharing, it is not in the interest of the municipality to stick to its promise to share.

So for both municipalities not cooperation is the best strategy and in equilibrium the municipalities will not cooperate.

Since the matching process consists of only one meeting between unemployed and firm, the matching probability is equal to the offer-acceptance probability:

$$\mu^{No\ PES} = \alpha$$

Total expected equilibrium welfare, denoted by $\pi^{\text{No PES}}$, is:

$$\pi^{No\,PES} = 2\left[\gamma(1-\alpha)(\delta-1)-(1-\gamma)\right] \tag{3.1}$$

This expression has an intuitive interpretation. The left hand side between the square brackets is the expected payoff if a municipality has a vacancy and an unemployed left at the end of the game. The probability a municipality finds a vacancy is the contact rate γ. The vacancy and unemployed are left with a probability of (1-α) and if this is the case the payoff is (δ-1). If the municipality has no vacancy and unemployed left the payoff is 0, so this has not to be included. At the right hand side, the expected payoff is -(1-γ). This is the probability of having found no vacancy, (1-γ), times the level of the social assistance benefit (-1). The sum is multiplied by two, since there are two municipalities.

Proposition 3.2 *Equilibrium welfare is suboptimal.*

Proof: Expected welfare if both municipalities share is:

$$\pi^{No\,PES;\,Share} = 2\left[\gamma^2(1-\alpha)^2(\delta-1)+\gamma^2\alpha^2(1-\alpha)(\delta-1)-(1-\gamma)\right] \tag{3.2}$$

$$= \pi^{No\,PES} + 2\left[\gamma^2(1-\alpha)^2(\alpha-\alpha\delta)+\gamma(1-\gamma)(1-\alpha)(\alpha-\alpha\delta)\right]$$

Rearranging the terms leads to:

$$\pi^{No\,PES;\,Share} - \pi^{No\,PES} = 2\left[\gamma^2(1-\alpha)^2(\alpha-\alpha\delta)+\gamma(1-\gamma)(1-\alpha)(\alpha-\alpha\delta)\right]$$

$$\pi^{No\,PES;\,Share} - \pi^{No\,PES} > 0$$

$$\pi^{No\,PES;\,Share} > \pi^{No\,PES}$$

Proposition 3.3 *Expected welfare if one of the municipalities cooperates by sharing its vacancies and the other municipality keeps its vacancies is higher than if both agents do not cooperate, but lower than if both agents cooperate.*

Proof:

$$\pi^{No\,PES;\,Share\,\&\,Keep} = \pi^{No\,PES} + \gamma^2(1-\alpha)^2(\alpha-\alpha\delta)+\gamma(1-\gamma)(1-\alpha)(\alpha-\alpha\delta)$$

$$\pi^{No\,PES;\,Share\,\&\,Keep} - \pi^{No\,PES} = \gamma^2(1-\alpha)^2(\alpha-\alpha\delta)+\gamma(1-\gamma)(1-\alpha)(\alpha-\alpha\delta)$$

$$2\left[\gamma^2(1-\alpha)^2(\alpha-\alpha\delta)+\gamma(1-\gamma)(1-\alpha)(\alpha-\alpha\delta)\right] > \gamma^2(1-\alpha)^2(\alpha-\alpha\delta)+\gamma(1-\gamma)(1-\alpha)(\alpha-\alpha\delta) > 0$$

$$\pi^{No\,PES;\,Share} > \pi^{No\,PES;\,Share\,\&\,Keep} > \pi^{No\,PES}$$

Going from {Keep, Keep} to {Share, Share} is a Pareto improvement, but, as I said before, the municipalities will not share. Going from {Keep, Keep} to {Keep, Share} or {Share, Keep} is no Pareto improvement: the “naive” municipality who shares its vacancy lowers his expected payoff if he chooses to cooperate. Therefore, this welfare level is not attainable either.

3.2.3 Conclusion

In the setup without a PES the municipalities have to decide whether they want to share their unused vacancies. I have shown that the municipalities will never share their vacancies. The

regional labour market does not function and the resulting welfare is suboptimal. In fact, the situation where both municipalities have the option to share their vacancies, is an example of a prisoner's dilemma. In Section 3.4 I will compare the welfare of the non-cooperative equilibrium with the welfare when there is a PES. In Section 4.1 I examine the effect on the equilibrium if the game is played more than once.

3.3 Pooling

This section models the current situation in the Netherlands, where the public employment service CWI provides the employment services and facilitates the regional labour market. The PES is a regional institution which collects the vacancies and arranges meetings between unemployed and vacancies. Since the PES pools the unemployed and vacancies, it can arrange more meetings between unemployed and vacancies than the individual municipalities. If there are more meetings the matching probability will be higher. This explains the value of the regional labour market in my model.

The section is organised as follows. In Section 3.3.1 I introduce the common pool and in Section 3.3.2 I calculate welfare.

3.3.1 The common pool

As described in Section 3.1, I assume that in the setup with a PES, the municipalities do not search for vacancies themselves, but the PES collects the vacancies. Again the maximum number of vacancies which can be collected is two. The unemployed and vacancies are pooled and in the next stage the PES randomly assigns the unemployed to the firms with vacancies for meetings.

3.3.1.1 Two vacancies

First I discuss the case where the PES has found two vacancies. This happens with probability η^2. The unemployed can go either both to the same firm for a meeting or both to a different firm. I assume that the probability of to which firm the unemployed is sent is a half, since the PES is indifferent between the firms.

The probability the meeting is a success is α, but only one unemployed can be matched to a vacancy. For example, if both unemployed meet v_1, the probability u_i is matched to v_1 is $\alpha(1-\alpha)$. The probability neither of them is matched to v_1 is $(1-\alpha)^2$.

If the meeting between u_i and the first firm is not successful, u_i can go for a job interview to the other firm, provided u_j has not been matched to that vacancy. Also in the second meeting the probability the meeting is a success with probability α.

The outcome tree in extensive form is shown in

Figure 8.2 in the appendix. I sum the matching probabilities in all possible situations to find μ^{PES} for the case the PES has found two vacancies. If the PES has found two vacancies the matching probability is:

$$\mu_{v=2}^{PES} = 1 - \frac{1}{2}(1-\alpha) - \frac{1}{2}(1-\alpha)^3 \tag{3.3}$$

Proposition 3.4 *If the PES finds two vacancies,* $\mu_{v=2}^{PES} > \mu^{No\ PES}$.

Proof:

$0 < \alpha < 1$

$\Rightarrow (1-\alpha)^3 < (1-\alpha)$

$\Rightarrow \frac{1}{2}(1-\alpha)^3 < \frac{1}{2}(1-\alpha)$

$\Rightarrow \frac{1}{2}(1-\alpha) + \frac{1}{2}(1-\alpha)^3 < (1-\alpha)$

$\Rightarrow 1 - \frac{1}{2}(1-\alpha) - \frac{1}{2}(1-\alpha)^3 > \alpha$

$\Rightarrow \mu_{v=2}^{PES} > \mu^{No\ PES}$

So this shows the advantage of the PES. If two vacancies are found, the unemployed can go to at most two firms for a meeting. If the municipalities provide the employment services they can arrange only one meeting between their own unemployed and vacancy only.

3.3.1.2 One or none vacancies

With probability $2\eta(1-\eta)$, the PES finds only one vacancy. Then both unemployed meet this vacancy. The probability that u_i is not matched to this vacancy is $(1-\alpha)$. This value is the same as in the setup without a PES. The probability that the vacancy is not filled is $(1-\alpha)^2$, which is smaller than in the setup without a PES.

With probability $(1-\eta)^2$ there are no vacancies found and there is nothing to meet and match.

3.3.2 Welfare

After the matching process, the municipalities pay social assistance benefits to unemployed who have not found a job. Expected welfare is the sum of the expected payoffs of both municipalities and of the value of unused vacancies. Total expected welfare, π^{PES} is the sum of

expected welfare if there are two vacancies found, if there is one vacancy found and if there are none found:

$$\pi^{PES} = \eta^2(\delta-1)\left[(1-\alpha)+(1-\alpha)^3\right]+2\eta(1-\eta)\left[\delta(1-\alpha)^2-2(1-\alpha)\right]-2(1-\eta)^2 \qquad (3.4)$$

3.4 Keeping versus Pooling

In Section 3.2 I have shown that without a PES the goal of a regional labour market is not met. In Section 3.3 I have demonstrated the functioning of the common pool. The common pool gives the PES an advantage over the municipalities, but the PES is less effective in searching for vacancies. In this section I show when welfare is higher for the setup with a PES and when welfare is higher in the setup without a PES. The performance of the PES compared to the performance of the municipalities depends on the parameters, especially the contact rate and the offer-acceptance probability. In Section 3.4.1 I first make a general comparison between the welfare levels of the two setups and next I construct a formula to be able to examine the effects of the parameters on the choice between the setups. In Section 3.4.2 I interpret the effect of the parameters on the choice for a setup.

3.4.1 Welfare PES and No PES

In Section 3.2.2 and Section 3.3.2 I found the welfare levels for the setup where there is no PES and where there is a PES. I repeat the expressions here.

$$\pi^{No\,PES} = 2\left[\gamma(1-\alpha)(\delta-1)-(1-\gamma)\right] \qquad (3.1)$$

$$\pi^{PES} = \eta^2(\delta-1)\left[(1-\alpha)+(1-\alpha)^3\right]+2\eta(1-\eta)\left[\delta(1-\alpha)^2-2(1-\alpha)\right]-2(1-\eta)^2 \qquad (3.4)$$

By comparing the outcomes of the formulas I can answer the research question whether the employment service should be provided by the municipalities or by the PES.

A different representation of the formulas gives a first impression.

Table 3.2 Welfare - No PES

Situation		$v_2 = 1$	$v_2 = 0$
	Prob.	**γ**	**1-γ**
$v_1 = 1$	**γ**	(δ-1)(1-α) + (δ-1)(1-α)	(δ-1)(1-α) + (-1)
$v_1 = 0$	**1-γ**	-1 + (δ-1)(1-α)	(-1) + (-1)

Table 3.3	**Welfare - PES**		
Situation		**$v_2 = 1$**	**$v_2 = 0$**
	Prob.	**η**	**1-η**
$v_1 = 1$	**η**	$(\delta-1)[\frac{1}{2}(1-\alpha)+\frac{1}{2}(1-\alpha)^3] + (\delta-1)[\frac{1}{2}(1-\alpha)+\frac{1}{2}(1-\alpha)^3]$	$\delta(1-\alpha)^2 -(1-\alpha) - (1-\alpha)$
$v_1 = 0$	**1-η**	$-(1-\alpha) + \delta(1-\alpha)^2 - (1-\alpha)$	$(-1) + (-1)$

Table 3.2 and Table 3.3 show the four situations which can occur in the two setups. The main point is that in every situation $\{v_1, v_2\}$ the welfare of the PES is at least as high as the welfare of the setup where there is no PES. Let's show this.

If $\{v_1, v_2\} = \{1, 1\}$, welfare of the PES is higher than in the setup without a PES, since $[\frac{1}{2}(1-\alpha)+\frac{1}{2}(1-\alpha)^3] < (1-\alpha)$ and since $(\delta-1)<0$.

If $\{v_1, v_2\} = \{1, 0\}$or $\{0, 1\}$, $\delta(1-\alpha)^2 -(1-\alpha) - (1-\alpha) = \delta - 2\alpha\delta + \alpha^2\delta - 2 + 2\alpha > \delta - \alpha\delta - 2 + \alpha = (\delta-1)(1-\alpha) + (-1)$.

And if $\{v_1, v_2\} = \{0, 0\}$, the welfare is the same for both setups.

Should we conclude then that it is better to have a PES? No. The reason is that if the PES has a lower contact rate than the municipalities ($\eta \leq \gamma$), the probability is larger to end up in the situation with the lowest welfare $\{v_1, v_2\} = \{0, 0\}$ where welfare is -2.

So from these tables the trade off is clearly visible: Either increased welfare from a higher matching probability if we opt for a PES or increased welfare from a higher contract rate if we choose to have no PES. Which of the two effects outweighs the other depends on the parameters of the model: α, γ, η & δ. I combine the profit functions in one expression to evaluate the effect of the parameters on the choice of the setup.

Proposition 3.5 *Welfare levels for the setup with and without a PES are the same if*:

$$\gamma^* = \frac{\eta^2(\delta-1)\left[\frac{1}{2}(1-\alpha)+\frac{1}{2}(1-\alpha)^3\right]+\eta(1-\eta)\left[\delta(1-\alpha)^2-2(1-\alpha)\right]-(1-\eta)^2+1}{(\delta-1)(1-\alpha)+1} \tag{3.5}$$

Proof:

$$\pi^{PES} = \pi^{No\ PES}$$

$$\eta^2(\delta-1)\left[(1-\alpha)+(1-\alpha)^3\right]+2\eta(1-\eta)\left[\delta(1-\alpha)^2-2(1-\alpha)\right]-2(1-\eta)^2 = 2\gamma(\delta-1)(1-\alpha)-2(1-\gamma)$$

$$= \gamma\left[2(\delta-1)(1-\alpha)+2\right]-2$$

$$\gamma^* = \frac{\eta^2(\delta-1)\left[(1-\alpha)+(1-\alpha)^3\right]+2\eta(1-\eta)\left[\delta(1-\alpha)^2-2(1-\alpha)\right]-2(1-\eta)^2+2}{2(\delta-1)(1-\alpha)+2}$$

$$= \frac{\eta^2(\delta-1)\left[\frac{1}{2}(1-\alpha)+\frac{1}{2}(1-\alpha)^3\right]+\eta(1-\eta)\left[\delta(1-\alpha)^2-2(1-\alpha)\right]-(1-\eta)^2+1}{(\delta-1)(1-\alpha)+1}$$

Equation (3.5) shows what value of γ yields the same welfare for the setup with and without a PES, for given values of α, δ and η. This value is called γ*.

Proposition 3.6 $\pi^{PES} > \pi^{No\ PES}$ *if and only if* $\gamma < \gamma^*$.

Proof: Suppose initially γ = γ*. This implies $\pi^{PES} = \pi^{No\ PES}$. Then γ decreases. The outflow rate of the municipalities decreases and the probability that the municipalities have to pay a benefit is higher. Their expected payoff is lower and welfare in the setup without a PES has decreased: $\pi^{PES} > \pi^{No\ PES}$.

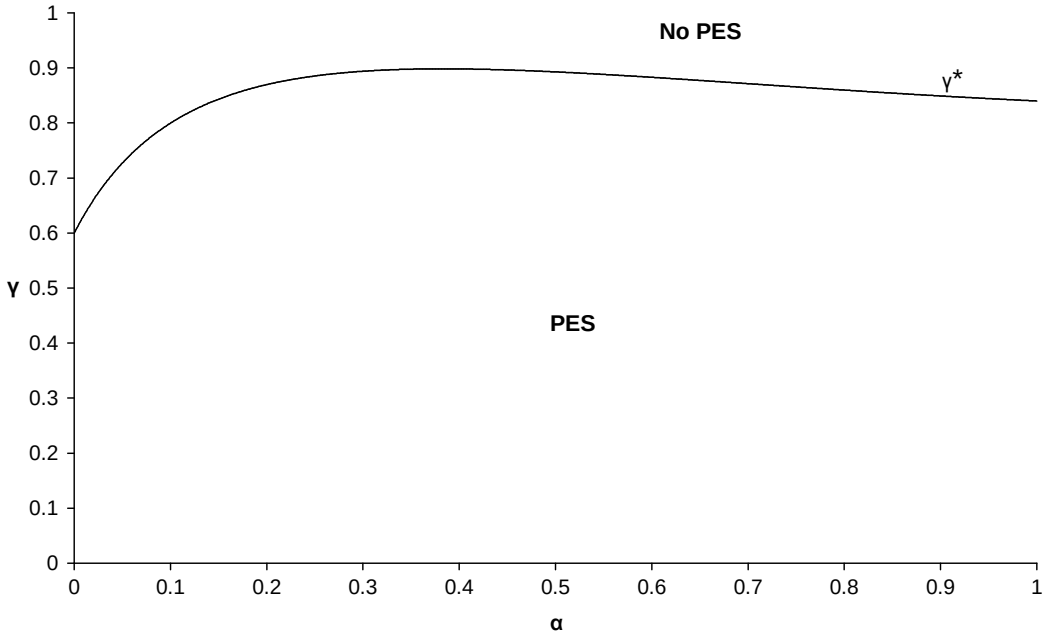
3.4.2 Effect parameters on choice setup

Figure 3.1 shows γ* as a function of α. The figure is based on an example where η is 0.6 and δ is 0.2. Above the line, welfare is higher without a PES. The PES has a higher matching probability, but this does not outweigh its disadvantage of the lower contact rate. Below the line welfare is higher with a PES. In this area the PES has a higher matching probability which outweighs its disadvantage of a lower contact rate. The line is an indifference curve where the advantages and disadvantage of the two setups balance and where the welfare levels are the same. The indifference curve is first upward sloping and then downward sloping for this example. As I will show later, this does not have to be the case for all parameter values.

The basic inside is that a PES is only preferable above the setup without a PES if the inefficacy in searching is relatively small, i.e. η is close to γ.

I discuss the effect of the parameters on γ* in turn.

Figure 3.1 **Critical values of γ***



3.4.2.1 The effect of α on γ*

To have a clear picture of the effect of the offer-acceptance probability α on the setup choice, suppose the contact rates of the PES and the municipalities are the same and equal to one.

In this case the only difference between the setup with and without a PES is the working of the matching process: the common pool yields a higher matching probability.

The benefits of the common pool are the largest for values of α not close to one or zero. This is the case because of the following. At values of α close to one, the benefits from the PES are relatively small since the municipalities have a high matching probability anyway. At low values of α, the advantage of the PES is also relatively small, since the PES is not very helpful in matching: whether there is a PES or not, the matching probability is very low. So for intermediate values of α the effect of the common pool is largest and, to still have the same welfare levels in both setups, the contact rate of the municipalities should be substantially larger than the contact rate of the PES.

Corollary 3.1 *If α increases, γ* first increases and then decreases, ceteris paribus.*

Proof:

$$\eta = \gamma = 1$$

$$\frac{d\gamma^*}{d\alpha} = \frac{(\delta-1)\left[\frac{1}{2} - \frac{3}{2}(1-\alpha)^2 - (\delta-1)(1-\alpha)^3\right]}{\left[(\delta-1)(1-\alpha)+1\right]^2}$$

The denominator is always strictly positive. Define the numerator as N.

If

$$\lim_{\alpha \to 0} N > 0$$

$$\lim_{\alpha \to 1} N < 0$$

&

$$\frac{dN}{d\alpha} < 0$$

then $\frac{d\gamma^*}{d\alpha}$ first increases and then decreases.

$$N = (\delta - 1)\left[\frac{1}{2} - \frac{3}{2}(1-\alpha)^2 - (\delta - 1)(1-\alpha)^3\right]$$

$$\lim_{\alpha \to 0} N = \delta(1-\delta) > 0$$

$$\lim_{\alpha \to 1} N = \frac{1}{2}(\delta - 1) < 0$$

&

$$\frac{dN}{d\alpha} = 3(\delta - 1)(1-\alpha)\left[(\delta - 1)(1-\alpha) + 1\right] < 0$$

3.4.2.2 The effect of η on γ*

Figure 3.2 shows indifference curves for various values of η with δ = 0.2. An increase in the contact rate of the PES increases the attractiveness of a setup with a PES. There is a larger probability the PES finds a vacancy and a higher outflow rate. Expected welfare increases compared to the welfare of the setup without a PES. Therefore, the indifference curve shifts up: to have still the same welfare in both setups, the municipalities should have a higher contact rate.

The horizontal indifference curve for η = 0.8 shows that for some values of α and high levels of η, there is no value of γ for which the welfare without a PES is higher than the welfare with a PES. In these cases, the advantage of the PES can in no way be offset by the advantage of the setup without a PES, since for these parameter values, the PES has a high contact rate itself.

Corollary 3.2 *If η increases, γ* increases*

Proof:

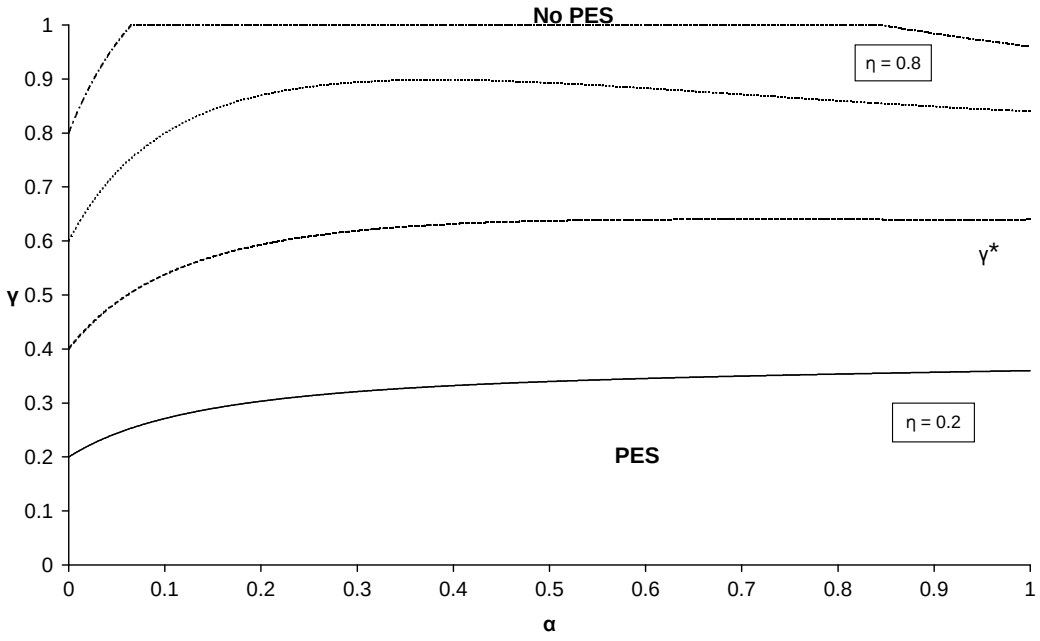
$$\frac{d\gamma^*}{d\eta} = \frac{2\eta(\delta-1)\left[\frac{1}{2}(1-\alpha)+\frac{1}{2}(1-\alpha)^3\right]+(1-\eta)\left[\delta(1-\alpha)^2-2(1-\alpha)\right]+2(1-\eta)-\eta\left[\delta(1-\alpha)^2-2(1-\alpha)\right]}{1+(1-\alpha)(\delta-1)}$$

$$= \frac{\eta\left((\delta-1)\left[(1-\alpha)+(1-\alpha)^3\right]-\left[\delta(1-\alpha)^2-2(1-\alpha)\right]\right)+(1-\eta)\left[\delta(1-\alpha)^2-2(1-\alpha)+2\right]}{1+(1-\alpha)(\delta-1)}$$

$$= \frac{\eta\left(\delta\left[(1-\alpha)+(1-\alpha)^3-(1-\alpha)^2\right]+(1-\alpha)-(1-\alpha)^3\right)+(1-\eta)\left[\delta(1-\alpha)^2+2\alpha\right]}{1+(1-\alpha)(\delta-1)}$$

$$\frac{d\gamma^*}{d\eta} > 0$$

Figure 3.2 The effect of η on γ*



3.4.2.3 The effect of δ on γ*

Figure 3.3 shows indifference curves for various values of δ with η = 0.6. If δ increases, the area where it is optimal to have a PES becomes smaller. Why is this the case?

If δ increases, the value of an unused vacancy increases: if municipalities have a vacancy, they are less worried whether the matching process is successful, since the vacancy is more valuable. For intermediate values of α, the difference in matching probability between the two setups is the highest. Stated differently, in the setup with a PES, in this region the probability

one does *not* use the vacancy is smallest. And therefore, also the probability is smaller that one can benefit from the increased value from an unused vacancy. So for intermediate values of α, an increase in the value of an unused vacancy leads to a larger increase in welfare for the setup without a PES than for the setup with a PES. Even at a lower contact rate we prefer a setup without a PES.

If α is close to zero or one, the value of δ hardly influences the indifference curve. This is the case because the matching probabilities for the setup with and without a PES are almost the same.

Corollary 3.3 *If δ increases, γ^* decreases.*

Proof:

$$\frac{d\gamma^*}{d\delta} = \frac{\begin{array}{r}[(\delta-1)(1-\alpha)+1]\left(\eta^2\left[\frac{1}{2}(1-\alpha)+\frac{1}{2}(1-\alpha)^3\right]+\eta(1-\eta)(1-\alpha)^2\right)\\ -(1-\alpha)\left(\eta^2(\delta-1)\left[\frac{1}{2}(1-\alpha)+\frac{1}{2}(1-\alpha)^3\right]+\eta(1-\eta)\left[\delta(1-\alpha)^2-2(1-\alpha)\right]-(1-\eta)^2+1\right)\end{array}}{[(\delta-1)(1-\alpha)+1]^2}$$

The denominator is strictly positive. So if the numerator is strictly negative, γ* decreases when δ increases. Denote the numerator by N. Then:

$$N = [(\delta-1)(1-\alpha)+1]\left(\eta^2\left[\frac{1}{2}(1-\alpha)+\frac{1}{2}(1-\alpha)^3\right]+\eta(1-\eta)(1-\alpha)^2\right)$$
$$-(1-\alpha)\left(\eta^2(\delta-1)\left[\frac{1}{2}(1-\alpha)+\frac{1}{2}(1-\alpha)^3\right]+\eta(1-\eta)\left[\delta(1-\alpha)^2-2(1-\alpha)\right]-(1-\eta)^2+1\right)$$

$$=\eta^2\left[\frac{1}{2}(1-\alpha)+\frac{1}{2}(1-\alpha)^3\right]+\eta(1-\eta)(1-\alpha)^2(\alpha+2)+(1-\eta)^2(1-\alpha)-(1-\alpha)$$

$$=(1-\alpha)\left[\eta^2\left[\frac{1}{2}+\frac{1}{2}(1-\alpha)^2\right]+\eta(1-\eta)(1-\alpha)(\alpha+2)+(1-\eta)^2-1\right]$$

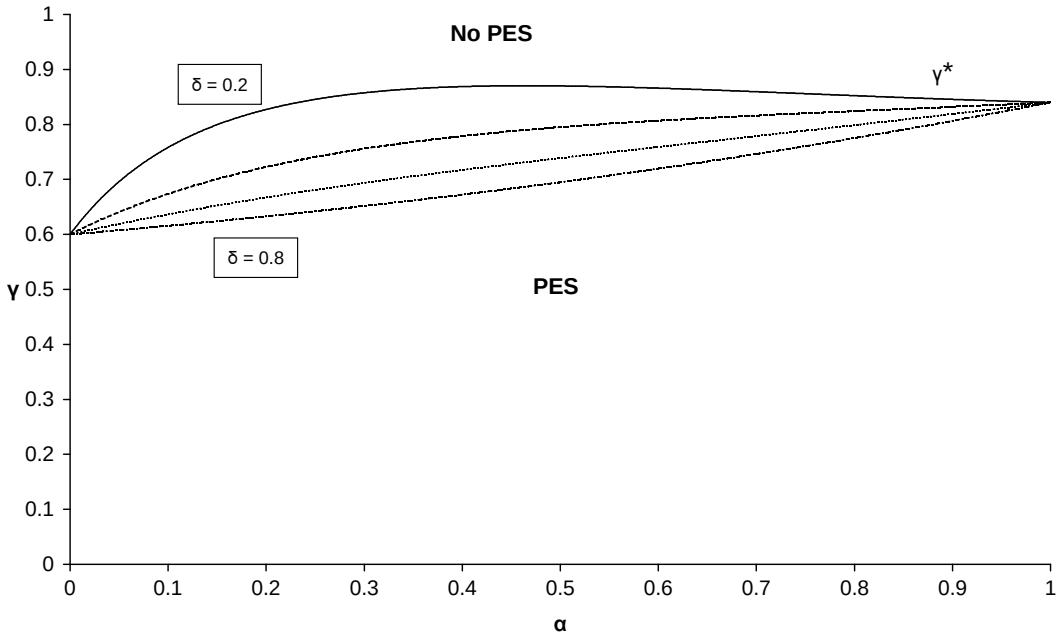
$$=(1-\alpha)\left[\frac{3}{2}\eta^2\alpha^2-\eta\alpha-\eta\alpha^2\right]$$

$$=\eta\alpha(1-\alpha)\left[\frac{3}{2}\eta\alpha-1-\alpha\right]$$

$$=\eta\alpha(1-\alpha)\left[\alpha\left(\frac{3}{2}\eta-1\right)-1\right]$$

$$N \le \eta\alpha(1-\alpha)\left[\frac{1}{2}\alpha-1\right]<0$$

Figure 3.3 The effect of δ on γ*



3.5 Conclusion

The main findings from my model are the following. First, the municipalities will never share their vacancies. Second, the answer to the question whether welfare is higher in the setup with or without a PES depends on the values of the parameters. The lower the contact rate of the PES, the lower welfare in the setup with a PES. The benefits from the regional labour market are the largest for intermediate values of the offer-acceptance probability. A higher value of an unused vacancy implies that we more often prefer the setup without a PES, since the municipalities are less eager to have their vacancies matched.

The next step I take is to extend the model to add some more realism. This is the topic of the next section.

4 Model Extensions

In this section I add some elements to the model developed in Section 0. The extensions should make the analysis more realistic. The model of Section 0 is a one-period model. One of the central conclusions is that the municipalities will not cooperate by sharing their unused vacancies. In Section 4.1 I investigate whether the municipalities will share their unused vacancies if the game is played more than once and I discuss the effect of multiple interactions on the choice between the two institutional designs - a PES or no PES. Another simplification is that the municipalities have only one unemployed and at most one vacancy. The value of the regional labour market depends on this concept. In Section 4.2 I show what the effect of a larger labour market is on the choice of the setup. Thus far I have ignored the costs of searching. In Section 4.3 I discuss the effect of fixed search costs on the choice of the setup. Section 4.4 concludes.

4.1 Cooperation

While my model is a static model which lasts for only one period, in reality the employment services are provided continuously and there is an ongoing in- and outflow of unemployed. The question arises what will happen to welfare if the game is played more than once. The game I have found in Section 3.2.2 is equivalent to a Prisoner's Dilemma. Selten (1978) has shown that, if the discount factor is sufficiently large in an infinitely repeated game, cooperation is a perfect equilibrium outcome. Such equilibrium can be attained for example by a tit-for-tat strategy. However, eternal cooperation is not the only equilibrium. In fact, any equilibrium between full cooperation and no cooperation is an equilibrium.

Still, suppose that the municipalities repeat the game and do not foresee an end to their interactions and have chosen to cooperate, for example because the other municipality has a good reputation.[24] What will happen to the critical value of γ, γ^*?

Proposition 4.1 *If municipalities cooperate, γ^* decreases compared to the situation where the municipalities do not cooperate.*

Proof: Suppose that initially the values of η, γ, α and δ are such that $\pi^{PES} = \pi^{No\ PES}$. According to Proposition 3.5, it holds that $\gamma = \gamma^*$. Then the municipalities start to cooperate. For the given γ, $\pi^{No\ PES;\ Share} > \pi^{No\ PES} = \pi^{PES}$, according to Proposition 3.2. Now we prefer the setup without a PES. Following Proposition 3.6, we only prefer the setup without a PES if $\gamma > \gamma^*$. So γ^* has decreased.

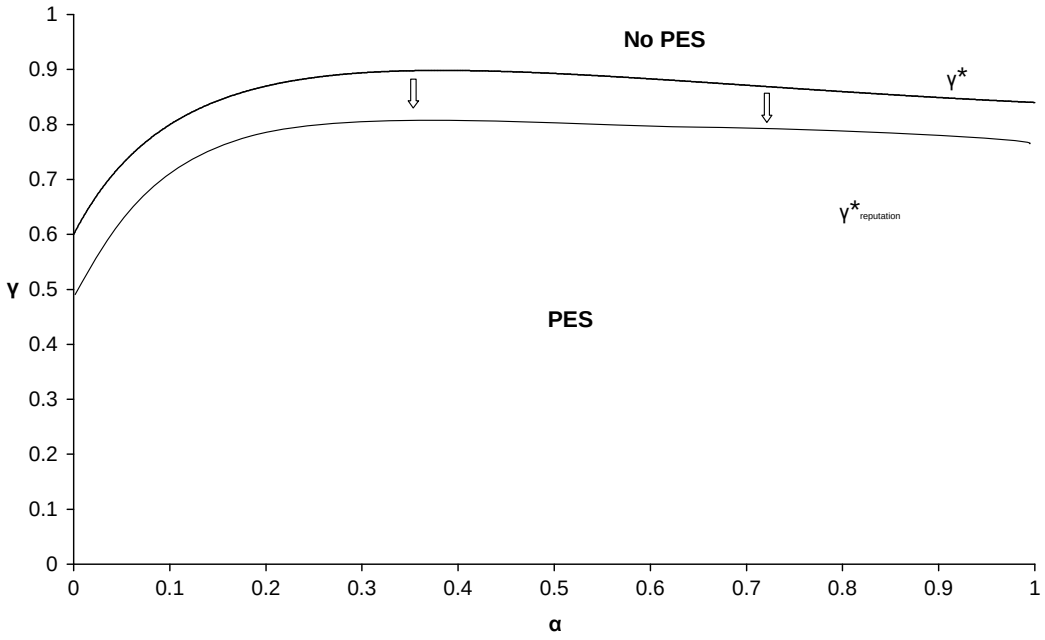
So the disadvantage of the municipalities is smaller because by sharing unused vacancies the municipalities create a regional labour market. Still, the contact rate of the municipalities should

[24] Alternatively, the municipalities might sell each other unused vacancies. The conclusion of this section remains the same.

be higher than the contact rate of the PES to have the same welfare, since the common pool yields a better regional labour market than cooperation between municipalities: The municipalities exchange vacancies only if the vacancies are left over after their own matching process, while the PES allocates the vacancies optimally over the unemployed.

In short, cooperation by sharing unused vacancies can in principle lead to a regional labour market. The regional labour market yields more matches than if the municipalities do not cooperate, but still is inferior to the common pool which the PES creates. Figure 4.1 shows the effect of reputation on the critical value of γ.

Figure 4.1 The effect of reputation on γ*



4.2 Variation in Labour Market Size

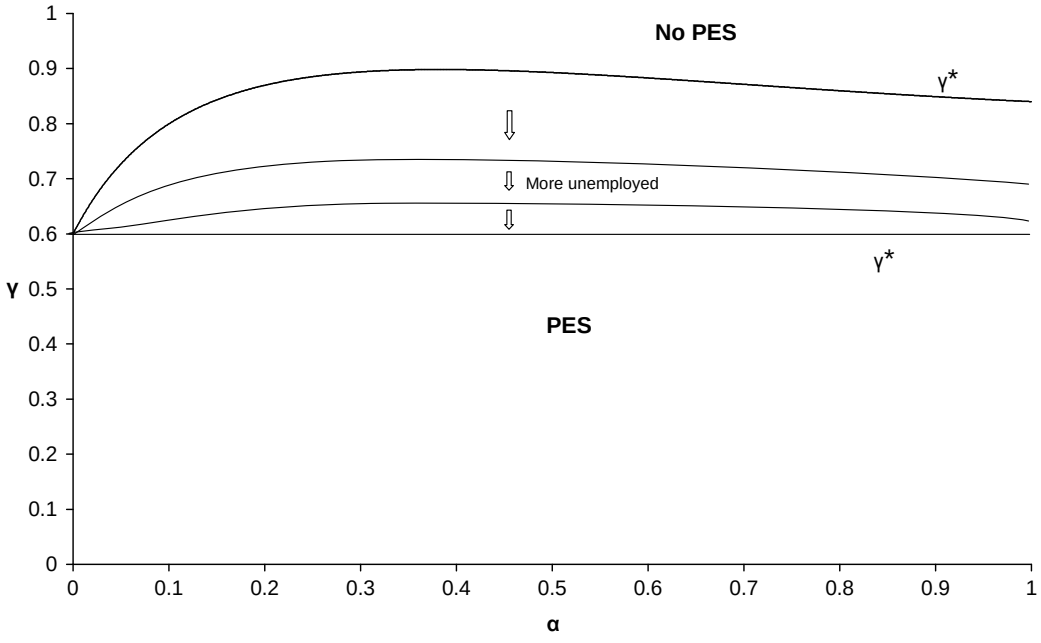
In Section 0 I assumed that the municipalities both have one unemployed and at most one vacancy. In reality the municipalities have numerous unemployed and vacancies. In this section I investigate the effect of a larger labour market on the choice of the setup.

If the municipalities have multiple unemployed they can send their unemployed to more firms. Similarly, if the firms have many vacancies, the firms can have more meetings with unemployed. Therefore, to some extent a municipality forms a common pool on its own. Still, the PES can always send the unemployed to more firms than the municipalities. However, the advantage of the PES over the municipalities diminishes for growing numbers of unemployed and vacancies. Obviously, for some size of the municipality the additional effect of the PES is negligible and other factors, like the (un-)willingness of workers to travel far to their work, dominate the common pool effect.

So if the number of unemployed is large, the matching probabilities of the PES and the municipalities are almost the same. The value of the PES decreases if the labour market is larger. The only difference between the PES and the municipalities as mediator is the contact rate. So if the municipalities have many unemployed and vacancies, the employment services could better be provided by the municipalities, even if the municipalities have only slightly higher contact rates than the PES. Figure 4.2 shows the effect of the size of the labour market on γ*.

This effect is one of the reasons why in the Netherlands some CWIs have only one municipality in their region. These municipalities are usually large and therefore constitute a common pool in themselves. The largest cities in the Netherlands have even more than one CWI. This model predicts that in cases where a municipality is large enough to form a common pool on its own, it is optimal to give the responsibility of mediation to the municipalities.[25]

Figure 4.2 The effect of the size of the labour market on γ*



Another issue in this context is if the two municipalities are of unequal size. Suppose one municipality has more unemployed and vacancies than the other. Because of diminishing marginal returns to scale the increase in the matching probability for the large municipality is smaller than for the small municipality. Therefore, the large municipality is less interested in the common pool than the small municipality. For the large municipality the critical value of γ is

[25] In some municipalities the responsibility of mediation are - more or less - shared with the municipalities. For example in Amsterdam, the PES shares the responsibility of job mediation with the municipalities by close cooperation in one building. Unemployed have contact with only consultant who decides on behalf of both the PES and the municipalities. (See *Trouw*, 15 August 2007)

smaller than for the small municipality. The effect on welfare is ambiguous, since the situation with labour markets of equal size is not comparable to the situation where the labour markets are of unequal size.

4.3 Search Costs

Until now, I have assumed that searching for vacancies is costless. In this section I extend the model by introducing fixed search costs. Fixed search costs could consist of a department which searches for vacancies. I only consider the fixed search costs. Those costs do not depend on the intensity of search after the search department is put in place. Still, ex ante the costs of searching for two vacancies are higher than the costs for searching for only one vacancy. Therefore the costs for the PES, which searches for two vacancies, are higher than for the individual municipalities. However, it is reasonable to expect economies of scale: the cost of one searching department searching for two vacancies is smaller than the costs of two departments searching both for one vacancy. The costs of the searching department for M_i, i =1,2 [the PES] is denoted by C_i [C]. So $C_i < C < 2C_i$. Parameters with subscript c denote parameters based on the model with search costs included.

The analysis is similar as in Section 3.4, but now I subtract the fixed costs from the profit functions:

$$\pi_c^{PES} = \eta^2(\delta-1)\left[(1-\alpha)+(1-\alpha)^3\right]+2\eta(1-\eta)\left[\delta(1-\alpha)^2-2(1-\alpha)\right]-2(1-\eta)^2-C$$

$$\pi_c^{No\ PES} = 2\gamma(\delta-1)(1-\alpha)-2(1-\gamma)-2C_i$$

$$\Rightarrow \pi_c^{PES} = \pi_c^{No\ PES}$$

$$\eta^2(\delta-1)\left[(1-\alpha)+(1-\alpha)^3\right]+2\eta(1-\eta)\left[\delta(1-\alpha)^2-2(1-\alpha)\right]-2(1-\eta)^2-C = 2\gamma(\delta-1)(1-\alpha)-2(1-\gamma)-2C_i$$

$$= \gamma\left[2(\delta-1)(1-\alpha)+2\right]-2-2C_i$$

$$\gamma_c^* = \frac{\eta^2(\delta-1)\left[\frac{1}{2}(1-\alpha)+\frac{1}{2}(1-\alpha)^3\right]+\eta(1-\eta)\left[\delta(1-\alpha)^2-2(1-\alpha)\right]-(1-\eta)^2+1}{(\delta-1)(1-\alpha)+1}+\frac{C_i-\frac{1}{2}C}{(\delta-1)(1-\alpha)+1}$$

$$\gamma_c^* = \gamma^* + \frac{C_i-\frac{1}{2}C}{(\delta-1)(1-\alpha)+1}$$

Proposition 4.2 *If there are economies of scale,* $\gamma^*_c > \gamma^*$

Proof:

$$\gamma_c^* = \gamma^* + \frac{C_i-\frac{1}{2}C}{(\delta-1)(1-\alpha)+1}$$

If there are economies to scale:

$$2C_i > C \Leftrightarrow C_i - \frac{1}{2}C > 0$$

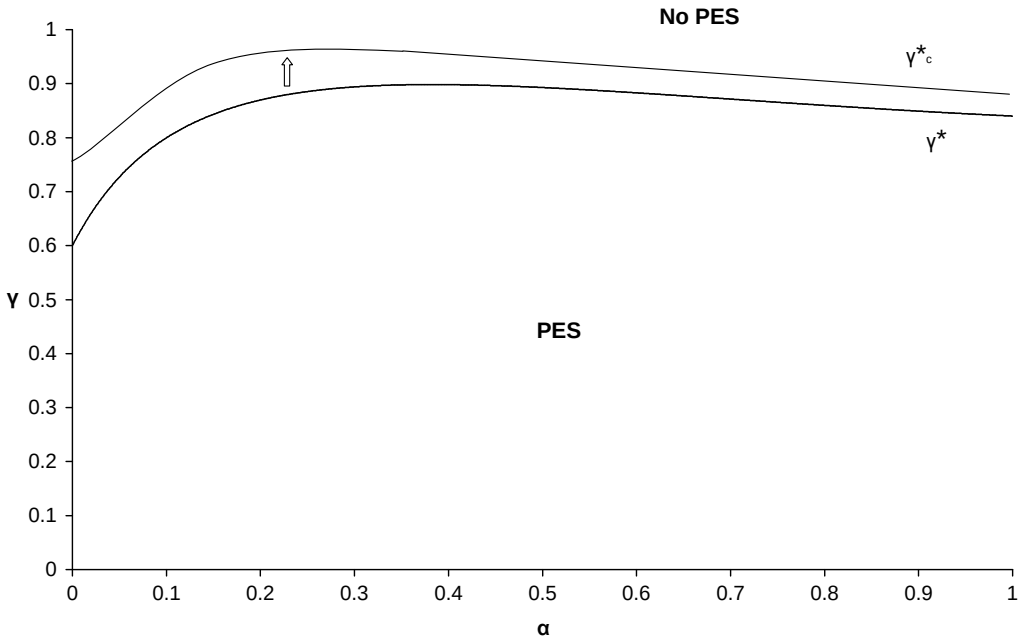
$$\Rightarrow \frac{C_i - \frac{1}{2}C}{(\delta - 1)(1-\alpha)+1} > 0$$

$$\Rightarrow \gamma_c^* > \gamma^*$$

So the indifference curve shifts upward, as Figure 4.3 shows. The introduction of fixed search costs implies that there are more cases where welfare of the PES is higher than the welfare without the PES. The change in the indifference curve from the setup without a PES to the setup with a PES is smaller for larger values of α and δ, since then the denominator increases.

The conclusion of this section is that if there are economies of scale welfare of the PES increases compared to the setup without a PES. Search costs may rise if the responsibility for the employment services is transferred from the PES to the municipalities.

Figure 4.3 The effect of fixed search costs on γ*



4.4 Conclusion

In this section I have considered three extensions. The first extension showed that if the municipalities interact more than once, cooperation between the municipalities will make the

setup without a PES becomes more attractive. In the second extension I argued that the advantage of the PES is smaller if the municipalities have more unemployed and vacancies, since the municipalities form a regional labour market on their own. The last extension showed that in the presence of economies of scale, the inclusion of search costs in the model will lead to higher welfare for the setup with a PES relative to the setup without a PES, since the PES avoids duplication of search costs.

5 Calibration

In this section I calibrate my model of Section 0. In that section I found an expression, Equation (3.5), which compares the welfare levels of the setup with and without a PES. In this section I estimate the variables of this expression to have an impression of the size of the regional labour market effect. By using various data sources and by implementing some of the extensions of Section 4 I can check for the sensitivity of the predictions to various changes in the model and the data.

Ideally, I would like to calculate the value of the contact rate of the municipalities for which the welfare levels in both setups are the same, γ^*, and compare it to an estimate of the actual contact rate of the municipalities, γ. If γ is larger than γ^*, the model predicts that the setup where the municipalities search for vacancies yields higher welfare than the setup where there is a PES. If γ is smaller than γ^* the reverse holds. At present the municipalities do not structurally search for vacancies, so γ is an unknown, hypothetical value. What I can do is calculate γ^* and compare it to the contact rate of the PES, η. This gives an estimate of the magnitude of the regional labour market advantage of the PES and tells us how much more effective in searching for vacancies the municipalities should be to offset the regional labour market advantage of the PES.

The outline of this section is as follows. In Section 5.1 I introduce the data sources. In Section 5.2 I estimate the variables α, δ and η and determine the value of γ^*. In Section 5.3 I perform robustness checks and implement some of the extensions of Section 4. Section 5.4 concludes.

5.1 Data

Lindeboom and Van Ours (1997) give an estimate of the offer-acceptance probability for unemployed who use the Dutch employment office. They define the offer-acceptance probability as "the probability that a contact turns into a match."[26] This offer-acceptance probability is equivalent to the offer-acceptance probability α used in the model of Section 0, where I defined α as the probability that a meeting between an unemployed and a firm that has a vacancy will result in a match. Therefore, I use the offer-acceptance probability of Lindeboom and Van Ours (1997) as an estimate for α.

The Dutch Statistics Office CBS provides information on vacancies in the Netherlands on its online database.[27] I use quarterly information about the number of vacancies over the period 1997 to 2006 to determine the outflow rate. More recent data are based on a different estimation method and are therefore excluded.

[26] Lindeboom and Van Ours (1997, p. 92)

[27] See statline.cbs.nl

CWI (2006) shows statistics about the duration of vacancies. Based on these statistics and on the information on the CWI website I calculate the length of a period in my model. The statistics are based on the situation in 2006.

5.2 Calibration

In this section I calibrate Equation (3.5). I repeat this equation below.

$$\gamma^* = \frac{\eta^2(\delta-1)\left[\frac{1}{2}(1-\alpha)+\frac{1}{2}(1-\alpha)^3\right]+\eta(1-\eta)\left[\delta(1-\alpha)^2-2(1-\alpha)\right]-(1-\eta)^2+1}{(\delta-1)(1-\alpha)+1} \quad (3.5)$$

The three unknown variables are η, α and δ. The variables will be estimated in Sections 5.2.2 to 5.2.5. I estimate the variables first on a weekly basis and then on the basis of one period. First I establish the length of period in Section 5.2.1.

5.2.1 Length of a period

In Section 0 I assumed that a vacancy which is not used during the current period can be kept until the next period. Then it can be used in the matching process once again. If the meeting does not result in a match in the second period, the employer withdraws the vacancy after the second period. So a vacancy can remain unfilled for at most two periods. According to the information on the website of the CWI about 6% of all vacancies were not filled after three months over the period 2003-2004. So an approximation of the length of a period is half a quarter of a year or 6.5 weeks.

In the following, variables based on a period of a week are denoted by subscript *w*, while variables based on a period of 6.5 weeks do not have a subscript.

5.2.2 Offer-acceptance probability (α) and matching probability (μ) per week

The offer-acceptance probability α is drawn from Lindeboom and Van Ours (1997, p.97). The offer-acceptance probability for an unemployed is 29.8% per week if he or she makes use of the PES. The weekly offer-acceptance probability is:

$\alpha_w = 0.2982$

So almost 30% of all meetings between an unemployed and a firm results in a match.

According to the model of Section 0 without a PES the unemployed has at most one meeting. Given that there will be a meeting between an unemployed and a firm, the matching probability μ_w is for both unemployed and firm equal the offer-acceptance probability, about 30%.

If there is a PES, more than one meeting is possible. The matching probability in the setup with a PES is $\mu = 1 - \frac{1}{2}(1-\alpha) - \frac{1}{2}(1-\alpha)^3$. This probability is based on the case where the PES has found two vacancies, which is not necessarily the case in my model. Still I can use this probability, since in practice the PES will always find more than one vacancy and therefore the unemployed can go to more than one meeting. The matching probability should be seen as a construct to model the advantage of the common pool.

The matching probability per week is:

$$\mu_w = 1 - \frac{1}{2}(1-\alpha_w) - \frac{1}{2}(1-\alpha_w)^3 = 1 - \frac{1}{2}(1-0.2982) - \frac{1}{2}(1-0.2982)^3 = 0.47627$$

So if there is a PES, the probability that a vacancy is filled or an unemployed finds a job, given that a vacancy is found, is about 47.6% per week.

5.2.3 Outflow rate (χ) and contact rate PES (η)

The outflow rate is defined as the product of the contact rate and the matching probability:

$$\chi \equiv \mu \cdot \eta$$

I estimate η by using an estimate of χ and the value of μ_w from Section 5.2.2. The reason I do not directly estimate η is that information on the outflow rate is readily available, while the contact rate would have to be constructed by relating the number of vacancies found to the number of unemployed. Although both numbers are available the data it is difficult to determine the relevant number of unemployed. Questions like: “Do long-term unemployed also make use of the vacancies of the PES?” and “What proportion of the long-term unemployed makes use of the vacancies of the services of the PES?” are difficult to answer. Moreover, whereas information about the outflow rate is available for multiple periods, information about the contact rate is available for only one period.

The outflow rate is calculated by dividing the number of filled vacancies by the number of stock and new vacancies:

$$\chi = \frac{\text{filled vacancies}}{\text{stock and new vacancies}}$$

The data on filled vacancies include also withdrawn vacancies. According to CWI (2006), 12% of all vacancies are withdrawn. So the number of filled vacancies is 88% of the number in the database of the CBS. I calculate χ for every quarter from the first quarter of 1997 until the end of 2006. I average the outflow rate to control for business cycle fluctuations. The outflow rate is 0.5102: about 51% of the unemployed finds a job within a quarter and about 51% of the

vacancies are filled within a quarter. The outflow rate χ is 35.7% per period and the weekly outflow rate χ_w is 5.5%.[28]

As a check I exclude the years 1997 and 1998. The years 1999 to 2006 form more or less one complete business cycle. Then the outflow rate falls to 0.5033, so leaving the years 1997 and 1998 does not affect the results much.

Since the matching probability is based on a time period of a week and cannot be extrapolated to a period of 6.5 weeks without any additional assumptions about the number of meetings, I first calculate a weekly contact rate.

$$\eta_w = \frac{\chi_w}{\mu_w} = \frac{0.0549}{0.4763} = 0.115$$

So the PES finds a vacancy during a period of a week with 11.5% chance and during a period of 6.5 weeks the contact rate of the PES is:

$$\eta = 0.527$$

5.2.4 Offer-acceptance probability (α) and matching probability (μ) per period

Using the outflow rate and contact rate per period, I calculate the matching probability based on a period of 6.5 weeks.

$$\mu \equiv \frac{\chi}{\eta} = \frac{0.357}{0.527} = 0.677$$

$$\Rightarrow \alpha = 0.4879$$

So almost half of all meetings between an unemployed and a firm results in match. At first sight, it might seem strange that the offer-acceptance probability per period of 6.5 weeks is larger than the weekly offer-acceptance probability. Over a longer period, more meetings between firms and unemployed are possible. So one would expect that the probability a meeting is successful is lower. However, my model is not designed to accommodate for multiple meetings. The matching probability per 6.5 weeks must be larger than the weekly matching probability. Therefore, the offer-acceptance probability per 6.5 weeks has to be larger than the weekly offer-acceptance probability. An intuitive explanation is that, if there multiple meetings, the probability that an unemployed fits a job is larger and therefore the offer-acceptance probability is larger as well.

[28] The probabilities are calculated with survival analysis. The probability a vacancy is found or the probability that there is a match in the 1/ t portion of the original length of the period is: ln (1-p) / -t, where p is the probability over the whole period.

5.2.5 Value of a left vacancy (δ)

δ is defined as the value of an unused vacancy and depends on the probability the unused vacancy is of use in the next period. This value cannot be observed in any dataset. Therefore, I have to solve δ endogenously. I do this by calculating the probability the vacancy is of use in the next period. In Section 8.2 of the Appendix I show this calculation. The estimate for the value of δ is:

$$\delta = \eta\alpha(1-\alpha) + (1-\eta)\alpha$$

Using α = 0.488 and η = 0.527, δ = 0.3624. Intuitively this value implies that there is about 36% chance the unused vacancy can be used to save a social assistance benefit in the next period.

5.2.6 Critical value of contact rate Municipalities (γ*)

Using α = 0.488, η = 0.527 and δ = 0.362, I can calculate γ*:

$$\gamma^* = \frac{\eta^2(\delta-1)\left[\frac{1}{2}(1-\alpha)+\frac{1}{2}(1-\alpha)^3\right]+\eta(1-\eta)\left[\delta(1-\alpha)^2-2(1-\alpha)\right]-(1-\eta)^2+1}{(\delta-1)(1-\alpha)+1} \tag{3.5}$$

$$= 0.7242$$

According to my model, when the contact rate of the PES is 52.7%, the municipalities should have a contact rate of at least 72.4% to offset the advantage of the PES. My model predicts that the municipalities should be about 37% more effective in searching for vacancies than the PES to yield the same welfare in both setups.

5.3 Sensitivity Analysis of γ*

The outcome of the calibration in Section 5.2 may depend on the data used. Therefore, I use different data sources (Section 5.3.1 and Section 5.3.2) and the extensions from Section 4 (Section 5.3.3 and Section 5.3.4) to check for the sensitivity of γ*. The main finding of this section is that the percentage difference found in the calibration of the basic model is not sensitive to changes in the data sources. The size of the labour market, though influences the effect substantially.

5.3.1 The effect of changes in the outflow rate and the contact rate (η)

In calculating the outflow rate, I did not distinguish between the various channels used for mediating unemployed. However, in reality the CWI is not involved in all matches. If the outflow rate of the CWI differs from the average, this has an influence on the contact rate. Therefore, I use information about the effectiveness of the CWI to see what happens to γ*.

Lindeboom and Van Ours (1997) present in their paper a contact rate.[29] The contact rate they have found for the PES is 2.5% per week, which is lower than 11.5% per week found in Section 5.2.3. A weekly contact rate of 2.5% is equivalent to a contact rate of 15.0% per 6.5 weeks compared to 52.7% in Section 5.2.3. Using $\eta = 0.025$ and $\alpha = 0.2982$, the resulting weekly outflow rate would be around 1.2%, which is not in accordance with the observed outflow rates. Either the contact rate or the matching probability based on the data of Lindeboom and Van Ours is too low. So using the direct measure or the contact rate from Lindeboom and Van Ours (1997) does not give a satisfying result nor does it give a reason not to continue with the contact rate found in Section 5.2.3. An explanation for the lower outflow rates found on the basis of the data of Lindeboom and Van Ours is that the labour market situation in the period on which their data is based in different from the current labour market situation: unemployment was much higher in the 1980s and the early 1990s. Still, the percentage difference between γ^* and η has not changed much: now it is about 45%.

5.3.2 The effect of changes in the offer-acceptance probability (α)

Suppose that the unemployed in the municipalities have such characteristics that it is difficult to match them or that the vacancies require skills that only few unemployed have. This implies that the offer-acceptance probability falls. What is the effect of a fall in α on γ^*?

Reducing α - and changing consequently δ and η, since these variables are based on α - does not change the relative gap between γ^* and η much. For example, a decrease in α from 0.2982 to 0.2 decreases the percentage difference between γ^* and η only from 37% to 36%.

This result supports the finding in Section 3.4.2.1, where I have proven that the attractiveness of the PES decreases if α decreases from an intermediate value. So, in a region where the municipalities face a more problematic matching situation, the attractiveness of the PES increases. The PES is better equipped to operate in a labour market where there is a mismatch between unemployed and vacancies.

5.3.3 The effect of cooperation

In using the equation for γ^* I compared the welfare level in the setup with a PES with the welfare level in the setup where the municipalities provide the employment service but do not cooperate. What happens to the percentage difference between γ^* and η if the municipalities cooperate by sharing their unused vacancies?

Equation (3.2) and Equation (3.4) are the expressions for welfare in the setup without a PES where the municipalities cooperate and welfare in the setup with a PES, respectively. By plugging in the equation for γ^* the values of the variables from Section 5.2, I find that for $\gamma^* = 0.62$ the welfare levels are the same. This implies a percentage difference between γ^* and η of about 18% compared to 37% if the municipalities do not cooperate.

[29] Lindeboom and Van Ours (1997, p.97)

So if the municipalities share their unused vacancies, the municipalities do not have to be 37% more effective in searching for vacancies, but only 18% in order to yield equal welfare in both setups. The reason is that the municipalities can reap part of the benefits of the regional labour market.

5.3.4 The effect of the size of the labour market

As explained in Section 4.2, if the municipalities have many unemployed and vacancies, they form a regional labour market in themselves. Therefore, it is important to note that the advantage of the common pool, which was estimated to be around 37% in Section 5.2, is smaller for larger municipalities. Large municipalities can gain from multiple meetings and a higher matching probability just as the PES can. In fact, the 37% estimate is based on a model with only two unemployed and vacancies. Since in reality there is no municipality with such a small labour market, this estimate should be regarded as an upper limit of the advantage of the PES. The exact difference between the advantage of the common pool for the PES and for the municipalities depends on the size of the labour market in the municipalities.

5.4 Conclusion

In this section I have illustrated how to calibrate the model in Section 0. The calibration is a first, back-of-the-envelope calculation of the advantage of the PES which stems from its regional labour market function. Comparing the values of contact rates of the PES and the municipalities, η and γ^*, found in the different analyses gives an impression of the value of the regional labour market. Table 5.1 gives an overview.

Table 5.1 Values for η, γ* and the percentage difference

	η	γ*	Percentage difference
Basic	0.53	0.72	37.3
Only 1999-2006 data	0.52	0.72	37.5
Contact rate from Lindeboom and Van Ours	0.15	0.22	44.5
Larger labour market	0.53	between 0.53 and 0.72	between 0 and 37.3
Smaller α	0.65	0.88	35.9
Cooperation	0.53	0.62	17.9

My calibration indicates that the advantage of the PES is substantial: about 37%. So the regional labour market, formed by the PES, yields 37% more matches than if the municipalities provide the employment services.

What stands out from the various calibrations is that the percentage difference is rather stable round 37%. Only if the municipalities cooperate by sharing their vacancies the advantage

of the PES is about half of the advantage compared to the case where the municipalities do not cooperate.

This result of the calibration should be interpreted with care. The aim is not to give a framework on which policymakers can decide, but merely to give an impression of the usefulness of the model and of the size of the effects which I have modelled by means of a back-of-the-envelope calibration. The model deals only with a part of the discussion about the social security system in the Netherlands. Furthermore, since the calibration tries to bridge the gap between the real world and a stylised model based on simplifying assumptions, the reliability of the prediction cannot be assured without econometric tests. A question which still has to be answered is the precise effect of the size of the labour market. If the municipalities have many unemployed and vacancies, the municipalities form a regional labour market on their own and the presumed advantage of the PES virtually disappears. In this respect the 37% estimate of the value of a regional labour market should be seen as an upper limit.

6 Conclusion

6.1 Summary

In this thesis I have studied one of the dilemmas in the current organisation of the social security system in the Netherlands. On the one hand, the public employment office CWI facilitates the regional labour market, but it has no strong incentives to exert the optimal mediation effort. On the other hand, municipalities have incentives to reduce unemployment, but without a regional employment office the municipalities may not coordinate their mediation efforts and the regional labour market may not function. Therefore, there is a trade off between incentives and coordination - the central question being whether mediation by the municipalities or by the CWI will lead to higher welfare.

Although there is a substantial body of literature on incentives and decentralisation and on search and matching models, this thesis is the first paper that explicitly explores the regional role of the employment office. In particular, I have developed a game theoretical one-period model with two municipalities in which I model the incentive effects and the value of a regional labour market. First I have proven that in the absence of a regional employment office the municipalities will not create a regional labour market, in the sense that they do not exchange vacancies and unemployed. Next, I have constructed an expression which states under which circumstances the CWI or the municipalities should perform the mediation role. The key trade off is between the higher search efficacy of the municipalities and the higher matching probability of the CWI. Furthermore, I have extended the model to add some more realism to the analysis. On the one hand cooperation between the municipalities and a larger size of the local labour market decrease the advantage of the CWI. On the other hand, economies of scale in search costs enhance the role of the CWI.

To get an impression of the effects of the regional labour market on welfare I have calibrated the model. In the context of my basic model the advantage of the regional labour market is substantial. The municipalities should be about 37% more effective in searching for vacancies to yield the same welfare as the CWI. This percentage should be considered as a first trial and an upper limit, since the extensions have shown that the precise value depends in particular on the size of the municipalities.

6.2 Directions for Future Research

My research is the first attempt to model the CWI as an institution to facilitate the regional labour market. Several issues can supplement my research to enrich the analysis and to increase the realism of my model.

The model does not quantify the limited advantage of the CWI if a municipality is large and forms a regional labour market on its own and thus already benefits from a common pool advantage without a CWI. So the advantages of the CWI are likely to be nullified if the municipality is very large. Instead of a model with only two unemployed and vacancies, the model can be extended by adding multiple unemployed and vacancies to test this conjecture.

Another element which is worthwhile to explore in depth is the variation in unemployment rates between municipalities. Variation in unemployment rates might make the CWI more attractive. On the one hand, the municipality with the lowest unemployment rate now prefers to perform the mediation task itself, because participation in the common pool reduces the probability the vacancy is left until the next period. On the other hand, this disadvantage is counteracted by the advantage of the municipality with the highest unemployment rate, which consists of a higher matching probability.

The model does not allow the CWI and the municipalities simultaneously searching for vacancies. Since we have seen that the CWI does not exert the optimal search effort, it might occur that the municipalities will search for vacancies themselves as well. This might lead to advantageous effects which stem from the increased probability of finding a vacancy. The decreasing importance of the regional labour market is a disadvantage, because vacancies found by the municipalities will not be shared. The role of fixed search costs is relevant in this context, since these may prevent the municipalities from starting to search and thus avoid a welfare deteriorating outcome.

My model implicitly takes into account the heterogeneity in skills of workers and in requirements for jobs in the sense that not every meeting results in a match. However, the heterogeneity of workers may give an additional benefit to the CWI, since the CWI allows for more meetings between unemployed and firms. Thus we might expect that the matched applicant will better fit to the job and is more productive. An extension aimed at quantifying this effect might therefore be considered.

Instead of focusing on the difference in search effort, I could have focused on the difference in stimulating the unemployed to contact firms with existing vacancies. The municipalities have a higher incentive to stimulate the unemployed to contact the firms with vacancies. So the contact rate of the municipalities is higher than the contact rate of the CWI. Thus this approach does not substantially differ from the approach focusing on search effort and, therefore, the implications are the same.

Lastly, the model considers one important element of the discussion about the structure of the social security system of the Netherlands. Still, other arguments may be relevant as well. For example, a decision on the choice of the institutional design cannot do without an analysis of the fixed costs of searching. My model gives a first hint that the CWI may have scale advantages, but further analysis is needed for a full comparison between the CWI and the municipalities.

6.3 Policy Options

In the model considered there is a trade off between incentives and a well functioning labour market: only one of the two goals can be reached. However, if the settings are changed, this does not have to be the case. I present some options which combine the goals of incentives and regional coordination.

The first option is to let the municipalities or the central government negotiate with the CWI on a performance contract. The role of the CWI as a facilitator of the regional labour market is preserved, while the incentives and the responsibility to provide employment services are well aligned. If the CWI is the only party with a network of contacts, such performance contract could yield higher welfare than an auction. Still, the performance contract may yield only a second-best outcome if it impossible to draw up a perfect contract which accounts for all possible contingencies, for example the impact of the business cycle on the performance of the CWI. If the municipalities negotiate with the CWI on the performance contract, coordination problems between municipalities might arise. If the central government negotiates with the CWI on the contract, it is difficult to take local conditions into account.

The second option is to privatise the CWI and auction licenses to license to mediate. The winner of the auction has the responsibility for both searching and matching. In this way the incentives are passed through from the municipalities to the private employment office and the employment office will exert the optimal search effort. At the same time the license holder will create a regional labour market, since the regional labour market maximises the outflow from unemployment. An important requirement for a successful auction is that the bidders operate on a level playing field. The CWI should not be the only bidder with specific knowledge of the labour market. Since in the Dutch labour market there are multiple employment agencies which already have a network of contacts, for example the re-integration agencies and temporary employment offices, this could be a promising avenue for future exploration.

The final option is to give the responsibility to provide the employment services to the municipalities. To be welfare increasing though, the municipalities should not foresee an end to their interactions and the municipalities should still be more effective in searching for vacancies, since the regional labour market the municipalities would form leads to a lower probability of matching than the regional labour market the CWI constitutes.

Several issues complicate the design of an alternative mechanism. I mention these issues only briefly. First, the position of the UWV[30]. The CWI does not only provide the employment services for the municipalities, but also for the UWV. The UWV has no such financial incentives to reduce unemployment as the municipalities. Second, it has to be taken into account whether the municipalities will cooperate in contracting or auctioning the mediation task. Thirdly, one of the goals of the social security act SUWI was to prevent that benefit

[30] See for more information on the UWV the box “SUWI & CWI” in Section 1.

applicants would have to go to several organisations to apply for benefits and mediation. The alternatives presented above may conflict with this goal and need attention in the discussion about the appropriate mechanism.

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8 Appendix

8.1 The Setup without and with a PES

The extensive form shown in Figure 8.1 leads to the welfare level in the setup without a PES displayed in Equation (3.1). The welfare level is the sum of the expected payoffs for all possible outcomes given the choice of the municipalities.

The encircled N stands for Nature. M_1 and M_2 stand for Municipality 1 and 2, respectively. The dotted ellipse round the nodes of M_2 means that the municipalities choose simultaneously. Although M_2 chooses later on in the diagram, it does not know what M_1 has chosen. The payoffs for every outcome are shown at the right of the end nodes. The first term between brackets is the payoff for the first municipality, the second term is the payoff for the second municipality.

The extensive form shown in Figure 8.2 leads to the welfare level in the setup with a PES in Equation (3.4). However, Figure 8.2 only shows the outcome tree in extended form if there are two vacancies found. The payoff for each outcome is between brackets, to the right of the end nodes where the first number between the brackets is the value of the unused vacancies, the second number is the payoff for Municipality 1 and the third number is the payoff for Municipality 2.

Figure 8.1 The setup without a PES

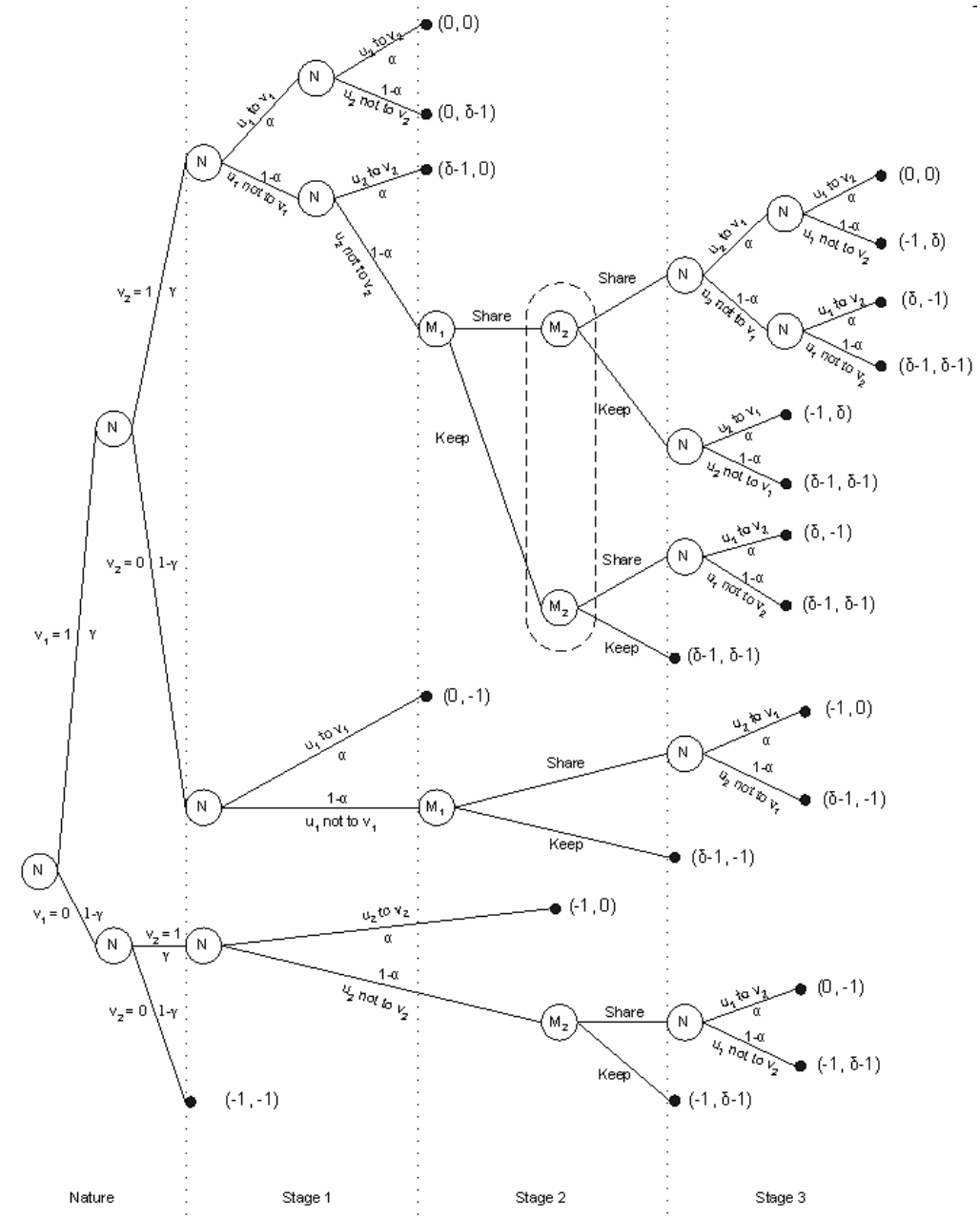
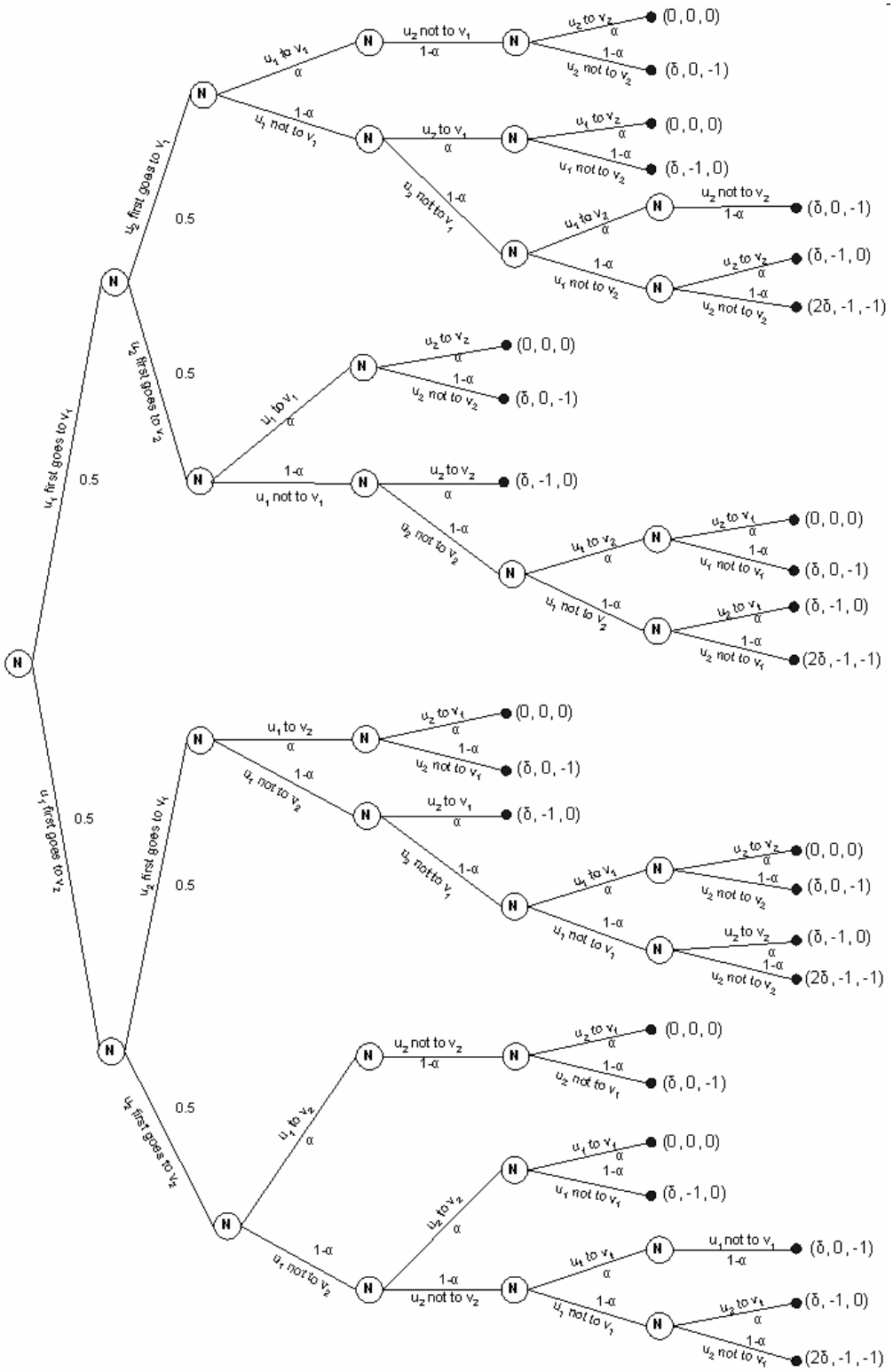


Figure 8.2 The setup with a PES



8.2 The value of δ

In Section 0 I assumed that the value of a vacancy which is not used during the current period is constant. Since my model is a static model, I have not explicitly modelled the next period. Therefore, I could not say anything about the value of δ except that $0 < \delta < 1$. It was no problem that I did not know the value of δ, since I could still prove that the municipalities will never share their unused vacancies.

For the calibration of the model I need a numerical value of δ to estimate γ*. However, there are no data for the value of δ. Therefore, I have to find an alternative way to calculate the value of δ. I estimate δ in the following way.

δ is the expected payoff in the next period of a vacancy not used during the current period. It is the product of the probability the vacancy leads to the saving of a social benefit times the amount of this saving. The amount of the saving is 1. The probability that this amount will be saved depends on the setup (PES or no PES) and the assumptions made about the next period.

I assume the following:

- The values of the parameters in the current period, α, γ and η, are the same in the next period.
- Regardless of whether the PES or the municipality has an unused vacancy left at the beginning of the next period, they will search for vacancies again.
- The unemployed will first meet the vacancies which are found during the current period. Only if the meeting is not a success there will be a meeting between the unemployed and the unused vacancy.[31]
- A vacancy can be kept for only one period. So after two periods, the firms try to find a worker via different means.

In sum: 1) The game as described in Section 3.2.1 and 3.3.1 is played again. 2) At the end of the game the unemployed who have not found a job during the second period can meet the vacancy from the first period.

Furthermore, the value of δ depends on the setup. Since with a PES the labour market works different than without a PES, the probability a vacancy will be of use is different as well.

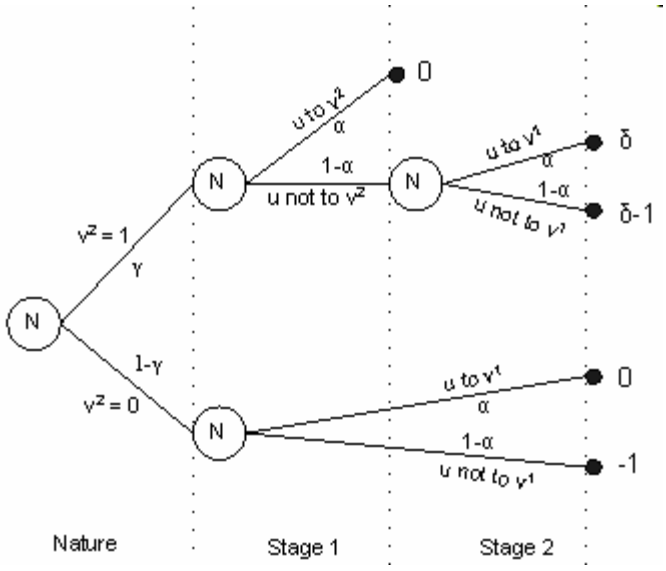
I have proven in Section 3.2.2 that the municipalities will never share their vacancies. So Stage 2 and 3 of the game never occur. What is left is not a game but an outcome tree. The two municipalities do not interact with each other. In Section 3.3 we have seen that the probability an unemployed does not find a job is larger in the setup without a PES than with a PES. So in the setup without a PES the probability the kept vacancy will be used for a meeting is larger. Therefore, the value of δ is larger for the setup without a PES.

[31] Alternatively, I could assume that unemployed first met vacancies from the previous period. However, this gives a less nice expression for δ.

Here I only present the value of δ in the setup without a PES, since the value of δ in the setup with a PES cannot be solved in a straightforward way.

The outcome tree for the setup without a PES is displayed in Figure 8.3. This is the outcome tree for one of the agents. The outcome tree for the other agents is similar. v^j denotes the vacancy found in period j. If the unemployed is matched to v^2, the payoff is zero and v^1 is not needed. Since it cannot be used in the third period, it has no value anymore. If the unemployed is not matched to v^2, he will meet v^1.

Figure 8.3 The setup in the second period with a vacancy from the first period



In two cases the kept vacancy leads to a saving of the social benefit. The first case is where a vacancy is found but the meeting between unemployed and vacancy does not result in a match. The second is where no vacancy is found. The probability that these cases happen is γ(1-α) + (1-γ). So the value of an unused vacancy in the setup without a PES is:

$$\delta^{No\ PES} = \gamma(1-\alpha)\alpha + (1-\gamma)\alpha$$

Again, the value of δ in the setup with a PES is smaller. I estimate an average δ by using the fact that η≤γ:

$$\delta = \eta(1-\alpha)\alpha + (1-\eta)\alpha \qquad (8.1)$$

I will use Equation (8.1) to estimate the value of γ*.