ERASMUS UNIVERSITY ROTTERDAM

Erasmus School of Economics

Bachelor Thesis Economics and Business Economics

Social behaviour at work: A trade-off between social interaction and productivity

Name student: T.M. Bode

Student ID number: 467450

Supervisor: Prof. dr. A.J. Dur

Second assessor: Prof. dr. O.H. Swank

Date final version: 7th of August 2020

Abstract

A large share of all workers derives utility from engaging in social behaviour at work. This paper develops a model which acknowledges that workers their preferences for social interaction are heterogeneous. A socially active worker, whose utility is positively affected by social interaction, can choose either to engage in both productive activities and social behaviour or to focus on productive activities only. Both productive and social activities take time and effort, therefore a trade-off between social benefits and productivity exists. It is shown that a socially active worker is more likely to accept a lower wage in order to work with a colleague he can have social interaction with, if he derives a large benefit from social behaviour at work and the monetary and non-monetary benefits of working are small. This result is obtained, regardless of whether the preferences of the workers are observable or not. However, if this is not the case, socially active workers prefer to work alongside a selfish colleague and therefore commit to exerting a higher level of effort. If selfish workers are scarce, socially active workers are willing to sacrifice their additional benefits from working alongside them by paying a premium to their selfish colleague.

Table of Contents

1. Introduction

The opportunity to engage in social behaviour with colleagues, which can vary from engaging in small talk over coffee to developing friendships, is an important motivation to find and keep a job. It has a positive effect on the job satisfaction that workers experience (see among others Riordan & Griffeth, 1995; Hodson, 1997; Ducharme & Martin, 2000). Next to this, it has been found that unemployed people in the Netherlands are driven to find a job mainly by being attracted to social interaction with colleagues and being able to spend their time usefully (Van Echtelt & Hoff, 2008). In addition, Shacklock (2005) shows that social interaction is one of the main job aspects that Australian workers are missing after their retirement.

This paper develops a model that considers a market which consists of organisations that hire two workers. There exist two types of workers: selfish workers and socially active workers. Selfish workers only care about their financial compensation and how much they enjoy working. Socially active workers care about this as well, but in addition they care about social interaction at work. As the model takes into account the existence of both types of workers, it acknowledges that preferences for social interaction among workers are heterogeneous.

The analysis in this paper shows that there exists a trade-off between social interaction and productivity, as both engaging in social behaviour and exerting effort for production cost a worker time and effort. In addition, it shows that in certain cases a socially active worker is willing to give up a part of his monetary and non-monetary benefit from working, in order to have social interaction with his colleague. This can be the case, regardless of whether the organisation that hires the worker can observe his preferences for social interaction. Lastly, it is shown that the composition of the working population influences the equilibrium in which all socially active workers want to work alongside a selfish worker.

The next section of this paper presents an overview of relevant literature and discusses how this paper contributes to it. After this, the model is formally presented in section 3. Section 4 shows the analysis of the model in case the types of the workers are either observable or unobservable. Additionally, section 5 discusses the effect on the analysis if the composition of the working population changes. Section 6 concludes with the most important results of the analysis and provides suggestions for further research.

4

2. Theoretical framework

Kosfeld and Von Siemens (2011) have developed a model to which the model proposed in this paper is related. Their model considers a perfectly competitive economy, in which workers are heterogeneous in their preferences for cooperation. The heterogeneity of these preferences is incorporated in their model through the existence of selfish workers and conditionally cooperative workers. Conditionally cooperative workers can in some cases derive a non-monetary benefit from cooperation. This depends on whether or not they are working alongside a colleague that has a preference for cooperation as well. Individual effort is contractible in this model, whereas cooperative effort is not. Selfish workers will thus never decide to cooperate, as this does not lead to a monetary benefit for them. An important aspect of this model is that the types of the workers are assumed to be private information. Kosfeld and Von Siemens (2011) show that in this model a separating equilibrium emerges in which selfish and conditionally cooperative workers self-select into different types of organisations. This leads to heterogeneity in organisational cultures in this market, as there exist organisations with and without cooperation.

The model developed in this paper shows some similarities to the model described by Kosfeld and Von Siemens (2011). However, the two models also differ on some aspects. Both the similarities and the differences between the two models will now be discussed.

First of all, both models acknowledge the heterogeneity of workers their preferences. The type of preference, however, differs: the model by Kosfeld and Von Siemens (2011) introduces heterogeneity of cooperation preferences, whereas the model developed in this paper introduces heterogeneity of preferences for social interaction. Preferences for social interaction describe whether or not workers derive benefits from engaging in social behaviour their colleagues, where this social behaviour reaches beyond the scope of the workers their job. Even though both cooperation and social activities require interaction between colleagues, it is important to note that a fundamental difference between them exists. Cooperation is assumed to be beneficial for a worker's productivity, whereas social interaction with a colleague is in my model assumed to be beneficial for a worker's utility and, as we shall see, tends to decrease a worker's productivity. It is important to keep this fundamental difference in mind.

Secondly, both models are analysed in the case where the preferences of the workers, and thus their types, are either observable or unobservable. The unobservability of cooperation preferences is a widely discussed topic in economic literature, see for example Heinz & Schumacher (2017). Therefore, Kosfeld and Von Siemens (2011) use the outcomes of their model under the assumption of complete information purely as a benchmark. However, in my model it can be plausible that the preferences for social interaction of the workers are actually observable. For instance being talkative, showing interest in other people and showing certain body language might reveal a worker's preferences for social interaction. Most of the times, these traits can be easily noticed by others. This contrasts with cooperation preferences as considered by Kosfeld and Von Siemens (2011), as it is harder to learn about these preferences from easily observable traits.

Another similarity between the two models is the emergence of a perfect sorting equilibrium in which both types of workers self-select into different types of organisations. This leads to a difference in corporate cultures in the market.

An important difference between the two models is that the organisations within the model of Kosfeld and Von Siemens (2011) use incentive pay schemes, as individual effort is observable in their model. In the model that is developed in this paper, individual effort is not observable, and no incentive pay schemes are used. In my model, workers will receive a fixed financial compensation once they are hired. This financial compensation can differ across different types of organisations. Also in contrast to the paper of Kosfeld and Von Siemens (2011), this paper displays a variant of the model in which a varying composition of the working population will be considered.

Another related model has been developed by Corneo and Rob (2003). It considers both public and private firms. The utility of workers is positively affected by engaging in social behaviour. Workers differ in their preferences for this behaviour and these preferences are private information. Each worker divides his effort between individual tasks and cooperative tasks. During individual tasks, it is possible for the organisation to observe the effort of the worker. Observing effort is harder in cooperation tasks, as the division of effort exerted by each participating worker is not always clear. Thus, organisations only base their incentive pay on individual effort. However, workers can still have an incentive to cooperate, as they enjoy the social interaction that cooperation entails and think that cooperation is instructive. Corneo

and Rob (2003) find, firstly, that when organisations increase the intensity of their incentive pay, workers increase their total amount of effort exerted and, additionally, decide to allocate more effort to individual tasks. Secondly, they find that public organisations offer weaker incentive schemes than private organisations, as public firms aim to maximise welfare, which consists of its profits and the utility of each hired worker. Welfare is negatively affected by increasing the intensity of incentive schemes through the loss of informational rents.

Firstly, both the model of Corneo and Rob (2003) and my model consider social interaction to be beneficial for workers their utility and consider that workers their preferences for it are heterogeneous. However, social interaction only plays a role in the model of Corneo and Rob (2003) through participating in cooperative tasks, whereas in my model engaging in social behaviour is an activity workers can decide to engage in. Secondly, both models cover the case in which preferences of workers are private information. Thirdly, an important difference is that the model of Corneo and Rob (2003) makes a distinction between public and private organisations. Public organisations aim to maximise welfare, whereas private organisations aim to maximise their profit. My model only focuses on private organisations, as they are profit-maximising and do not take the utility of their workers into account. Lastly, an important difference is the observability of individual effort and the usage of incentive schemes by Corneo and Rob (2003), which my model does not incorporate.

The theoretical framework proceeds as follows. Section 2.1 will discuss the definition and heterogeneity of preferences for social interaction. After that, it will elaborate on the observability and screening of these preferences. Lastly, section 2.2 will discuss some literature on the effects of social behaviour for organisations.

2.1 Preferences for social interaction: definition, heterogeneity and observability

In this paper, preferences for social interaction describe whether or not a worker derives utility from engaging in social behaviour with a colleague. It is important to note that these preferences do not entail concepts such as altruism, inequity-aversion or reciprocity. These concepts are covered by social preferences, which are amongst other things shaped by biological mechanisms, cultural influences and cognitive and emotional development (Lévy-Garboua, Meidinger and Rapoport, 2006). It is important to keep in mind that this paper merely concerns preferences for social interaction.

As was mentioned in the introduction, there exists empirical evidence that workers can experience a preference for social interaction at work. It is plausible that the extent to which workers want to engage in social behaviour at work differs, as some people enjoy social interaction better than others. It can thus be assumed that preferences for social interaction are heterogeneous. The model developed in this paper incorporates the heterogeneity of preferences for social interaction by considering the existence of both selfish workers and socially active workers.

This paper firstly analyses the model in case it assumes the observability of the types of workers, and thus their preferences for social interaction. Secondly, the analysis assumes the unobservability of these preferences. The existing literature considering cooperation mainly considers individual preferences to be unobservable, for example Kosfeld and Von Siemens (2011) and Heinz and Schumacher (2017). Analysis of models assuming the observability of preferences therefore mainly function as a benchmark in these papers. However, in this paper, the analysis of the model with complete information might be an interesting case, as it can be plausible that preferences for social interaction are observable to others. It may be possible to observe whether a person enjoys engaging in social interaction, as he may be talkative or show certain body language. This is different compared to for example cooperation, as it can be more difficult to see whether or not a person enjoys cooperating with colleagues on certain tasks. However, as will be seen in the analysis of the model which considers the observability of preferences, socially active workers get paid a lower wage if they engage in social behaviour at work. Therefore, socially active workers might have an incentive to hide their preferences of the organisations by engaging in social behaviour secretly, as they now might get paid a higher wage while still enjoying social benefits. In case the unobservability of preferences for social interaction is assumed, there exists a screening problem. Organisations have an incentive to screen the market, in order to increase their profits. Kosfeld and Von Siemens (2011) describe a similar screening problem. They find that organisations can screen the market by offering varying wages. Based on workers' prior beliefs, different types of workers self-select into different types of organisations. Therefore, a separating equilibrium emerges with two types of organisations. These organisations differ in the wage they offer, their level of cooperation and their corporate culture. Considering the above-mentioned, both assuming the observability and unobservability can lead to plausible outcomes of my model.

2.2 Effects of social behaviour on organisations

As Kosfeld and Von Siemens (2011) described, the heterogeneity in preferences of workers can lead to a separating equilibrium in which organisations with different corporate cultures exist. In their paper, the corporate cultures are based on the achieved level of cooperation. In some organisations, where only selfish workers are hired, no cooperation is achieved. However, in other organisations, where only conditionally cooperative workers are hired, cooperation does occur. The level of cooperation has consequences for the productivity of the workers and therefore for the revenue of the organisation. As can be seen in section 4, this can also be the case in this paper: different types of organisations can exist in a separating equilibrium. Organisations differ in the level of social interaction that their workers engage in. In this separating equilibrium based on preferences for social interaction, it might be hard for organisations that hire two socially active workers, who are less productive, to compete with organisations that hire two selfish workers, which exert a higher level of effort. However, Dur and Sol (2010) have shown that stimulating relationships between colleagues can be beneficial for an organisation, as this allows the organisations to attract and retain workers with a preference for social interaction while paying them a lower wage. Even though Dur and Sol (2010) have incorporated altruism in their model and this is not the case in the model developed in this paper, the before-mentioned result remains valid. Organisations that hire less productive socially active workers might be able to compete with organisations that hire more productive selfish workers, through offering their workers a lower wage.

3. Model

Consider a world market in which a certain homogeneous good is being sold for a given price p. This world market is perfectly competitive. Therefore, there are no entry and exit barriers and the expected profit of organisations that are active in this market is equal to zero.

The organisations that operate in this market consist of two workers each.[1] There are enough organisations to offer every worker in the economy a job. All organisations offer their workers the same type of work. An organisation's revenue depends on the predetermined price p and the level of effort that its workers choose to exert, which is denoted by the continuous variable e. Additionally, each organisation decides on the wage w that it is willing to pay its two workers. The profit function of any organisation i in this world market is:

$$\pi_i = p(e_1{}^* + e_2{}^*) - 2w_i \tag{1}$$

In this model, the labour market is rigid. Workers have to put in substantial time and effort to find a job. Therefore, after workers have found a job, they will stay at that organisation. In addition, it is very hard for an organisation to fire a worker.

The model consists of two types of workers. The two types differ in their preference for social interaction at work, therefore the model acknowledges that preferences for social interaction are heterogeneous. Both types of workers account for one half of the total working population. This assumption, however, will be changed in section 5.

The first type of worker is a selfish worker. Selfish workers only care about their wage, which is denoted by the variable w, and how much they like working, which is denoted by the variable β. Additionally, a selfish worker incurs some costs which depend on the level of effort that the worker exerts and are described in the third term of the utility function. The utility function of a selfish worker is:

$$U_{SE}(e) = w + \beta e - \frac{1}{2}e^2 \tag{2}$$

---

[1] Allowing organisations that hire one worker as well would change the outcomes of the model. However, for simplicity, it is assumed that every organisation hires two workers. This is likely to be realistic, as productive activities of organisations with only one worker are less efficient than those of organisations with two workers, because the latter benefits from economies of scale.

The second type of worker is a socially active worker. Socially active workers care about their financial compensation and how much they enjoy working as well, like selfish workers. They also incur the costs relating to the level of effort they exert. However, in contrast to selfish workers, they also care about social interaction at work, the extent to which is denoted by γ. A socially active worker chooses whether or not he will engage in social behaviour at work. He does so by setting s_1 equal to either s^* or zero.[2] At the same time, the socially active worker's colleague makes the same decision through the variable s_2. If both colleagues decide to engage in social behaviour and therefore set their s_1 and s_2 equal to s^*, the socially active worker derives a social benefit equal to γ times s^* squared. However, the socially active worker then also experiences some costs of this social interaction, as engaging in social behaviour takes time and effort as well. It is assumed that two socially active colleagues always engage in social behaviour with each other.[3] The utility function of a socially active worker is:

$$U_{SA}(e, s_1) = w + \beta e + s_1 s_2 \gamma - \frac{1}{2}(e + s_1)^2 \tag{3}$$

It is important to note that the γ of selfish workers is equal to zero, as they derive no utility from social interaction. Hence, they set their s to zero. This explains the difference between the utility functions of selfish workers and socially active workers.

---

[2] In contrast to what has been done in this model, the variable s_1 can also be made to be a continuous variable. This way, a socially active worker is able to choose the extent to which he wants to engage in social activities. However, combined with the structure of the model as it is, there would be no diminishing returns to investing in effort and social activities and this would lead to a corner solution. In this corner solution, a socially active worker would choose to invest all his time and effort either in working or in social activities, not a combination of these two activities. As this is not very realistic, it has been decided to make the variable s_1 discrete.

[3] It is plausible that socially active workers experience some difficulty with committing to productive activities only while working alongside a socially active colleague, as it is not likely that two socially active colleagues do not engage in any social behaviour with each other. In order to be able to commit to productivity only, socially active workers need to work alongside a selfish colleague, as will be shown in the analysis.

4. Analysis of the model

Section 4.1 presents the optimal levels of effort exerted by the two different types of workers. Section 4.2 shows results for the model when the types of the workers are observable for their colleagues and organisations. Then, in section 4.3, the unobservability of the types of the workers for organisations is introduced and the results of this change are presented. Lastly, in section 4.4, the previous sections will be compared.

4.1 Optimal levels of effort

First, the optimal levels of effort will be derived for both types of workers, by deriving the first order condition of a worker's utility function with respect to effort e. The optimal level of effort for a selfish worker is:

$$e_{SE}{}^* = \beta \tag{4}$$

The optimal level of effort for a selfish worker thus only depends on how much he enjoys working. Financial compensation is received regardless of whether or not the worker actually exerts effort, which is why it does not influence the optimal level of output. Thus, the worker will only exert effort to the extent that he enjoys working.

The optimal level of effort of a socially active worker depends on the type of colleague he has to work with, which is assumed to be observable. If the colleague is also a socially active type, both s_1 and s_2 will be set to s^*, as the workers will engage in social behaviour with each other. In this case, the optimal level of effort for a socially active worker is:

$$e_{SA|SA}{}^* = \beta - s^* \tag{5}$$

However, if the colleague of a socially active worker is a selfish type, this colleague sets s_2 equal to zero. As a reaction to this, the socially active worker sets s_1 equal to zero as well. The socially active worker now has the same optimal level of effort as a selfish worker:

$$e_{SA|SE}{}^* = \beta \tag{6}$$

The optimal level of effort for a socially active worker thus depends on how much he enjoys working. Additionally, it depends on whether the socially active worker decides to engage in social behaviour or not, which in turn depends on the type of colleague this socially active worker has. As both exerting effort and engaging in social behaviour takes time and effort, there exists a trade-off between these two activities.

4.2 Observable types

Suppose that workers themselves, their colleagues and the organisations in this economy can observe the type of a worker and thus can see whether a worker is selfish or socially active. If this is the case, two different equilibria are possible. The equilibrium strategies and the condition under which these equilibria emerge will be discussed in the following sections.

4.2.1 Equilibrium with perfect sorting

The first equilibrium that is possible is based on perfect sorting: the two types of workers will apply for a job at different types of organisations and therefore separate themselves. This way, socially active workers will be able to engage in social behaviour together. In equilibrium, two types of organisations will exist: organisations that employ only selfish types and organisations that employ only socially active types.

The assumption of perfect competition implies that each organisation earns an expected profit equal to zero. According to the profit function described in expression 1, this means that the sum of the wages that an organisation pays its workers should be equal to the total revenues the company earns, which depend on the level of effort that is exerted by the organisation's workers:

$$2w_i = p(e_1^* + e_2^*) \tag{7}$$

First, the organisations that have hired two selfish workers (after this: organisations of type A) will be discussed. Its two selfish workers will exert the optimal level of effort that has been described in expression 4: β. Therefore, the wage that organisations of type A pay to their selfish workers is:

$$w_A^* = pe_{SE}^* = p\beta \tag{8}$$

Secondly, the organisations that have hired two socially active workers (after this: organisations of type B) will be discussed. As this type of organisation hires two socially active workers, these workers will engage in social behaviour with each other and set their s_1 and s_2 to s^*, as has been assumed. In addition, the socially active workers will exert the optimal level of effort that has been described in expression 5: $\beta - s^*$. Therefore, the wage that organisations of type B pay to their socially active workers is:

$$w_B^* = pe_{SA|SA}^* = p(\beta - s^*) \tag{9}$$

In order for the situation that has been described in this section to be an equilibrium, none of the organisations or workers must have an incentive to deviate from the above-mentioned strategies.

Firstly, organisations of type A must offer the wage described in expression 8, whereas organisations of type B must offer the wage described in expression 9. If any organisation would decide to offer wages to its workers that are lower than the price times a worker's productivity, new competitors will enter the market and offer these workers a slightly higher wage. This process will go on, until the total wages equal the total revenues again. Organisations therefore do not have an incentive to offer lower wages than have been described. They also do not have an incentive to offer a higher wage to their workers, as this would mean that the organisation earns a loss and risks going bankrupt. So, none of the organisations is inclined to offer a wage that deviates from the wages that have been described in expressions 8 and 9. This also means that both organisations of type A and organisations of type B will be able to exist in this world market, even though two selfish workers will exert a higher level of effort than two socially active workers.

Secondly, selfish workers must work at an organisation of type A. Selfish workers derive utility from the wage that they receive and from how much they enjoy the work that they have to do. As the work does not differ across both types of organisations, no difference exists in the worker's preference regarding working at any of the organisations. Therefore, selfish workers will choose to work at the organisation which offers them the highest wage: organisations of type A. Selfish workers will thus not deviate from the strategy that has been described in this section and work at an organisation of type A.

Thirdly, socially active workers must work at an organisation of type B. Therefore, their utility at an organisation of type B must be larger than their utility at an organisation of type A. No difference in costs exists between working at an organisation of type A or of type B.[4] Costs do thus not play a role in the decision of a socially active worker. However, there does

---

[4] When working at an organisation of type A, the socially active worker works alongside a selfish worker. As s_1 is equal to zero, the socially active worker's cost function is equal to $\frac{1}{2}e^2$ and thus equal to $\frac{1}{2}\beta^2$. When working at an organisation of type B, the socially active worker works alongside another socially active worker. Therefore, the socially active worker's cost function is equal to $\frac{1}{2}(e + s^*)^2$, which is equal to $\frac{1}{2}((\beta - s^*) + s^*)^2$. This results in the cost function $\frac{1}{2}\beta^2$ as well. It can be concluded that the costs of a socially active worker do not differ between the two types of organisations.

exist a difference in the benefits this worker experiences at the different types of organisations. At an organisation of type A, a socially active worker will get paid a higher wage. The additional wage that the worker will get paid is:

$$w_A{}^* - w_B{}^* = p\beta - p(\beta - s^*) = ps^* \tag{10}$$

Additionally, as the level of effort exerted by a socially active worker at an organisation of type A is higher than at an organisation of type B, this worker enjoys a larger benefit from enjoying his work at an organisation of type A:

$$\beta e_{SA|SE}{}^* - \beta e_{SA|SA}{}^* = \beta^2 - \beta(\beta - s^*) = \beta s^* \tag{11}$$

At an organisation of type B, a socially active worker will thus get paid a lower wage and derives a smaller benefit from enjoying his work, however he does get to engage in social behaviour and thus enjoys a social benefit equal to $s^* s^* \gamma$. Combining the three above-mentioned elements, a socially active worker will not deviate from the above-mentioned strategy and thus work at an organisation of type B, if the following condition holds:

$$s^* s^* \gamma > s^*(p + \beta) \Leftrightarrow s^* \gamma > p + \beta \tag{12}$$

Whether or not a socially active worker deviates from the above-mentioned strategy, and thus whether or not a perfect sorting equilibrium exists, thus depends on three factors. This follows from condition 12.

Firstly, it depends on the size of the social benefit that socially active workers derive from engaging in social behaviour at work. The larger this social benefit, the more likely that these workers will settle for a lower wage at an organisation where they can engage in social behaviour with socially active colleagues. In contrast, the smaller this benefit, the more likely that socially active workers want to work at organisations where they get a higher wage and derive a larger benefit from enjoying their work.

Secondly, the choice of the socially active workers depends on the price p, which is determined by circumstances in the product market. The lower this price, the more likely that the condition is met and that a perfect sorting equilibrium exists. However, the higher this price, the higher the chance that socially active workers prefer to work with a selfish colleague and thus that such a perfect sorting equilibrium does not exist. The price p can for instance be influenced by the demand in the product market: if the demand for the good is high, its price goes up and therefore, wages of the workers in this economy increase. In this case, the additional wage a worker can earn by working alongside a selfish worker is higher and

therefore the worker experiences a higher incentive to deviate from the perfect sorting equilibrium.

Thirdly, the choice of the socially active workers depends on how much he enjoys working, which is denoted by β. The larger β, the higher the chance that a socially active worker enjoys working and thus exerting effort that much, that he wants to work alongside a selfish worker to commit to a higher level of effort. This will increase the benefit it derives from enjoying work, βe.

It can be concluded that both monetary and non-monetary benefits of working and engaging in social behaviour play a role in the decision of socially active workers. It is more likely that a perfect sorting equilibrium exists in case of a large social benefit that socially active workers derive from working with a socially active colleague, a small price p and a small factor of enjoying work β.

4.2.2 Equilibrium with mixture

If the condition $s^*\gamma > p + \beta$, stated in expression 12, does not hold, socially active workers prefer the increase in their wage and in the additional benefit of enjoying work over a social benefit of engaging in social behaviour at work. In this case, an equilibrium with mixture emerges. In this equilibrium only one type of organisation exists, which hires one selfish worker and one socially active worker.

The optimal level of effort of selfish workers stays the same as was described in expression 4 and is thus equal to β. However, the optimal level of effort of socially active workers is then subsequently affected. Now that a socially active worker is working alongside a selfish worker who sets his s_2 equal to zero, the socially active worker sets his s_1 equal to zero as well. A socially active worker now has an optimal level of effort that has been described in expression 6, also equal to β. Working with a colleague that is of the selfish type thus makes a socially active worker commit to exerting a higher level of effort and not engaging in social behaviour at work.

The organisations also notice that when a socially active worker is working alongside a selfish worker, he does not engage in social behaviour and commits to exerting a higher level of effort. Therefore, the socially active worker can be rewarded with a higher wage than in the

equilibrium with perfect sorting. As both the selfish worker and the socially active worker now have an optimal level of effort of β, the wage that each organisation in this equilibrium pays to both workers is:

$$w^* = pe_{SE}^* = pe_{SA|SE}^* = p\beta \tag{13}$$

In this case as well, none of the organisations and workers must have an incentive to deviate in order for the situation described in this section to be an equilibrium.

Organisations in this equilibrium do not have an incentive to deviate from the wage described in expression 13. If an organisation decreases its wages in order to make profits, new entrants will offer higher wages until all profits equal zero again. If an organisation increases its wages, it will make a loss and risk going bankrupt.

Selfish workers still earn the highest wages they can by working at any organisation in this equilibrium. They therefore have no incentive to deviate.

Socially active workers will deviate if expression 12 does hold. If this is the case, socially active workers will actually prefer to work with another socially active worker and will not agree to work with a selfish worker. However, if expression 12 does not hold, a mixture equilibrium, as described in this section, emerges.

4.3 Unobservable types

Suppose that workers know their own type, but that the colleagues and the organisations in this economy cannot observe their type. A screening problem now occurs, as it is unknown to organisations which type of workers it hires. From now on, x will represent the probability that a socially active worker is assigned to an organisation. In contrast, $(1 - x)$ will represent the probability that a selfish worker is assigned to an organisation. As all workers and organisations know the composition of the working population, every actor knows these probabilities. Three possible equilibria, their equilibrium strategies and the condition under which they emerge will be discussed in the following sections.

4.3.1 Main equilibrium based on the expected level of effort

In the first possible equilibrium, organisations cannot distinguish the different types of workers and workers are randomly assigned to the organisations. There exists only one type of organisation.

Each organisation in this equilibrium will hire two workers, which will be assigned randomly to them. The organisations will, however, not know which type of worker they hired, so there are three possibilities: an organisation either hires two selfish workers, one selfish worker and one socially active worker, or two socially active workers. The probabilities of these options are, respectively, $(1-x)^2$, $2x(1-x)$ and x^2. Using these probabilities, the expected level of effort exerted by the workers in the market is defined by:

$$E(e^*) = (1-x)^2 e_{SE}^* + 2x(1-x)e_{SE\ or\ SA|SE}^* + x^2 e_{SA|SA}^* \tag{14}$$

Considering the expected levels of effort defined in expression 4, 5 and 6 and that the working population consists of as much selfish as socially active workers and therefore $x = \frac{1}{2}$ the expected level of effort is equal to:

$$E(e^*) = \beta - x^2 s^* = \beta - \frac{1}{4}s^* \tag{15}$$

Therefore, the wage each organisation offers to its workers is:

$$w^* = p(\beta - x^2 s^*) = p\left(\beta - \frac{1}{4}s^*\right) \tag{16}$$

The actual levels of effort that the workers exert are, however, not equal to the expected level of effort. In equilibrium, two socially active colleagues will still exert $\beta - s^*$ according to expression 5. In addition, two selfish colleagues or one selfish and one socially active worker that work together will exert β, according to expressions 4 and 6. As this is the case, some organisations are unlucky and hire two socially active workers, which, if $x \neq 1$, exert a lower level of effort than expected. Therefore, these organisations pay their workers a wage that is too high and they will make a loss. In contrast, other organisations are lucky and hire two selfish workers or one selfish and one socially active worker, which, if $x \neq 0$, exert a higher level of effort than expected. These organisations pay their workers a wage that is too low and will make a profit.

It is important to note that the above-mentioned reasoning is only true in case x is neither equal to zero nor one. If x would be equal to zero or one, the working population would either consist of only selfish or only socially active workers. Organisations would know this and adjust their wages accordingly. In that case, all profits equal zero and neither organisations nor workers have an incentive to deviate from their strategies.

In order for an equilibrium based on the expected level of effort to exist, the following condition must thus hold:

$$0 < x < 1 \tag{17}$$

In addition, none of the organisations and none of the workers active in this market can have an incentive to deviate.

All selfish workers get paid a wage that is lower than they should receive based on the level of effort they exert, as well as the socially active workers that work alongside a selfish worker. In contrast, two socially active colleagues get paid a wage that is higher than they should receive based on the level of effort they exert. However, there is no choice that any worker can make that would increase his utility in this situation, as every organisation in the market offers the same wage and they are not able to observe the types of the workers. Therefore, none of the workers has an incentive to deviate.

As was mentioned before, there are two types of organisations in this market. Firstly, there are unlucky organisations that have hired two socially active organisations and make a loss. Secondly, there are lucky organisations that have hired either two selfish workers or one selfish and one socially active worker and make a profit. Both types of organisations have an incentive to screen the workers in the market, as this can make them able to offer their workers an appropriate wage and therefore, they can earn a higher profit.

4.3.2 Equilibrium with perfect sorting

As was mentioned in the previous section, organisations have an incentive to try to screen the market. Some organisations will therefore offer a lower wage than was described in expression 16, in order to try to attract socially active workers. The success of this method depends partly on the prior beliefs of socially active workers in the market. If this way of screening is successful, this could be beneficial to the profit of the organisations in the market, as it does not require an investment for the organisations. The equilibrium that could emerge in this situation resembles the perfect sorting equilibrium that has been described in section 4.2.1.

In this equilibrium, two types of organisations will exist: organisations of type A, which hire two selfish workers, and organisations of type B, which hire two socially active workers.

Organisations of type B will start to offer a lower wage than the wage based on the expected level of effort that has been described in expression 16. It is important to note that selfish workers are not interested in working there, because organisations of type B offer a lower wage than organisations of type A. In this equilibrium, only socially active workers are potentially interested in working at an organisation of type B, because of the social benefit they could derive from working there. Organisations of type B know this and therefore, in equilibrium, offer a wage to their workers that is equal to $p(\beta - s^*)$, as described in expression 9. This wage is based on the level of effort that two socially active workers exert while working together, which has been described in expression 5.

As socially active workers self-select into organisations of type B in equilibrium, organisations of type A will hire two selfish workers. In order to attract selfish workers, these organisations will compete with each other by increasing the wage they offer them. In equilibrium, the wage that organisations of type A offer to their workers is equal to $p\beta$, as described in expression 8. This wage is based on the level of effort that two selfish workers exert while working together, which has been described in expression 4.

In order for this equilibrium with screening to emerge, none of the actors involved must have an incentive to deviate from the above-mentioned strategies. The reasoning behind this is largely similar to the reasoning mentioned in section 4.2.1. However, it does differ with regard to the prior beliefs of socially active workers.

Organisations will not offer a different wage than the wages that have been described in expressions 8 and 9. If an organisation would offer a higher wage than this, it would make a loss. If it would offer a lower wage than this, competitors will offer a slightly higher wage, until the wages equal expressions 8 and 9 again and the expected profits equal zero.

Selfish workers have no incentive to deviate from working at an organisation of type A, as this type of organisation offers the highest wage and none of the organisations differ in the type of work they are offering to their workers.

In order for socially active workers to not have an incentive to deviate and thus to work at an organisation of type B, two conditions have to be met. First of all, the condition stated in expression 12 must hold: $s^*\gamma > p + \beta$. If this condition holds, the socially active worker is more interested in working alongside a socially active colleague, as the social benefit he derives from this is larger than the additional wage and additional benefit he derives from

working alongside a selfish worker and committing to a larger level of effort. However, if this condition does not hold, a perfect sorting equilibrium as described in this section cannot exist, because socially active workers want to work together with a selfish colleague. Now, every worker will apply at an organisation of type A and the equilibrium based on the expected level of effort will emerge. Secondly, the emergence of this equilibrium depends on the prior beliefs of the socially active workers in the market. The reason for this is that the type of any worker is unobservable to all other actors in this equilibrium except for the worker himself. The prior belief of the socially active workers must be that all socially active workers will work at an organisation of type B. If this is the case, socially active workers will actually work there, given that the condition from expression 12 holds, as they have no incentive to deviate from this belief. Consequently, the equilibrium described in this section will emerge. However, if this is not the case and the prior belief is that none of the workers will work at an organisation of type B, socially active workers will think that they will not derive a social benefit from working there either. If this is the prior belief of the socially active workers in this market, none of the workers will actually apply there, and organisations of type B cannot exist in the market. The equilibrium based on the expected level of effort, as described in the previous section, will now emerge.

All in all, it can be concluded that, in case the condition described in expression 12 holds and the prior belief of socially active workers is that all socially active workers will work at an organisation of type B, a perfect sorting equilibrium emerges. In this case, organisations can screen the market by adjusting their wage.

4.3.3 Introduction of socialising facilities

Another possible way to screen the market is to have some organisations offer socialising facilities to their workers. This way of screening does require some of the organisations involved to invest in socialising facilities, however, it can still be profitable for them. In the possible equilibrium with socialising facilities, two types of organisations exist. One type of organisation hires two selfish workers (after this: organisations of type A), the other type of organisation hires two socially active workers (after this: organisations of type B).

Organisations of type B start offering socialising facilities to their workers, in order to make the socially active workers self-select to organisations of type B. To be able to provide these socialising facilities, all organisations of type B must incur a cost c. Therefore, the profit function of any organisation j of type B changes into:

$$\pi_j = p(e_1{}^* + e_2{}^*) - (2w_j + c) \qquad (18)$$

A socially active worker derives a larger social benefit from engaging in social behaviour if he can use the socialising facilities provided by an organisation of type B. Thus, while working at an organisation of type B, the worker's γ will increase to γ_B. It is important to note that $\gamma_B > \gamma$.

The optimal levels of effort exerted by the workers remain the same as described in expressions 4 and 5. Selfish workers exert a level of effort equal to β. Socially active workers exert a level of effort equal to $\beta - s^*$, as the self-selection aimed at in this equilibrium would lead to socially active workers working together and engaging in social behaviour.

The wage that an organisation of type A offers remains the same as described in expression 8. As an organisation of type B incurs costs due to the socialising facilities, the wage that it offers its workers is lower than described in expression 9:

$$w_B{}^* = p(\beta - s^*) - \frac{1}{2}c \qquad (19)$$

The introduction of socialising facilities thus increases the social benefit enjoyed by socially active workers, but it also decreases their wage.

In order for the self-selection of workers to happen and the above-mentioned equilibrium to emerge, none of the organisations or workers must have an incentive to deviate.

None of the two types of organisations is likely to change the wages it offers to its workers, as this will not lead to a higher profit. If an organisation offers a lower wage, new entrants will offer a slightly higher wage, until all profits equal zero again. If an organisation offers a higher wage, it will make a loss and risks going bankrupt.

Selfish workers do not have an incentive to deviate from working at an organisation of type A, as this type of organisation offers the highest wage in the market. Therefore, working at an organisation of type A maximises a selfish worker's utility.

At an organisation of type B, socially active workers are guaranteed to work alongside a socially active colleague, as selfish workers are not willing to settle for a lower wage in order to be able to use socialising facilities. However, in order for the equilibrium that has been described in this section to emerge, two conditions must be met. Firstly, the prior belief of socially active workers must be that socially active workers work at an organisation of type B. If this is not the case, none of the workers will actually work there. Secondly, socially active workers must want to work alongside a colleague that is also of the socially active type. This is the case, if the following condition holds:

$$s^* s^* \gamma_B - \frac{1}{2} c > s^* (p + \beta) \tag{20}$$

Whether or not a socially active worker wants to work alongside a colleague of the socially active type depends on four factors.

Firstly, it depends on the size of the social benefit that a socially active worker derives from socialising with a socially active colleague, while making use of the socialising facilities that are provided by an organisation of type B. The larger this social benefit, the more utility a socially active worker derives from working at an organisation of type B. This makes it more likely that the socially active worker wants to work there.

Secondly, it depends on the size of the cost c that an organisation incurs in order to provide socialising facilities to its workers. The wages that organisations of type B offer to their workers decrease as this cost increases. Lower wages make it less attractive for a socially active worker to work at an organisation of type B, and therefore it is more likely that a socially active worker deviates from the above-mentioned strategy if the cost c increases.

Thirdly, it depends on the price p that is determined by the circumstances of the product market. The lower this price, the smaller the additional wage a socially active worker earns at an organisation of type A, and thus the more likely that the above-mentioned equilibrium emerges.

Fourthly, it depends on how much socially active workers enjoy working, which is denoted by β. The higher β, the more likely that a socially active worker wants to work at an organisation of type A. There, the worker commits to exerting a higher level of effort and therefore it gains an additional benefit from enjoying work. Thus, the smaller β, the more likely that the equilibrium described in this section holds.

In conclusion: it is more likely that the above-mentioned equilibrium exists in case of a large social benefit derived while using socialising facilities γ_B, small costs c of socialising facilities, a small price p and a small benefit of enjoying work β. If the condition described in expression 20 does hold, the above-mentioned equilibrium emerges after the introduction of socialising facilities, if the prior belief of socially active workers is that all socially active workers work at an organisation of type B. However, if this condition does not hold or if the prior belief of socially active workers is that no one will actually work at an organisation of type B, the introduction of socialising facilities does not convince a socially active worker to work at an organisation of type B. Therefore, the above-mentioned equilibrium does not emerge. In this case, the main equilibrium based on the expected value of effort, described in section 4.3.1, will emerge.

The equilibrium with socialising facilities resembles the screening equilibrium that has been described in the previous section. It is useful to look into the difference between these equilibria, because if no difference exists between them, investing in socialising facilities does not have an additional benefit.

In comparison to the screening equilibrium that has been described in the previous section, the screening equilibrium with socialising facilities requires organisations that want to attract socially active workers to make an investment. However, one half of the total cost of this investment is deducted from the wages that these organisations offer to their two workers. Therefore, the profits of these organisations do not differ in these equilibria.

In addition, both equilibria require that the prior belief of the socially active workers is that socially active workers will work at an organisation of type B. This type of organisation offers the lowest wage in both equilibria, but in the second equilibria it offers socialising facilities as well. If this is the case, both equilibria emerge if a certain condition holds. The screening equilibrium described in the previous section emerges if the condition described in expression 12 holds. The equilibrium with socialising facilities emerges if the condition described in expression 20 holds. It can be concluded that an equilibrium with socialising facilities exists, but an equilibrium as described in the previous section does not, if the following condition holds:

$$s^* s^* \gamma_B - \frac{1}{2} c > s^* (p + \beta) > s^* s^* \gamma \tag{21}$$

This is more likely if the difference between γ_B and γ is larger and if the cost c is smaller. In contrast, it is more likely that an equilibrium as described in the previous section emerges and an equilibrium with socialising facilities does not, in case of a small difference between γ_B and γ and a large cost c.

4.4 Comparison of observable and unobservable types

Section 4.2 provided an overview of the two equilibria that can emerge in case the types of the workers in the market are observable. Section 4.3 presented the main equilibrium in case the types of the workers are unobservable, which shows the screening problem that arises due to this unobservability. Subsequently, this section showed that two screening equilibria can emerge, in case some organisations offer lower wages, either with or without socialising facilities, to their workers.

The conditions described in expressions 12 and 20 share a common interpretation of their mutual factors. A larger size of the social benefit, γ, a smaller factor that determines how much a socially active worker likes its work, β, and a smaller price p make it more likely that two socially active workers want to work together. These interpretations are thus the same, regardless of whether organisations can observe the workers their type or not.

The most important difference between these two sections is that the assumption of unobservable types leads to a screening problem. Due to this screening problem, organisations do not know which wage they should offer, which leads to some organisations making a loss and some organisations making a profit in the main equilibrium. Therefore, organisations have an incentive to deviate from this equilibrium, whereas in the model with observable types organisations did not have this incentive. The existence of this screening problem also makes it hard for a mixing equilibrium to emerge within the model that assumes the unobservability of types.

5. Composition of the working population

Until now, it has been assumed that one half of the total working population consists of selfish workers and the other half consists of socially active workers. There was no surplus of any of the types of workers. This chapter will evaluate the changes in the analysis of the model that occur in case of either a surplus of selfish workers or a surplus of socially active workers. Section 5.1 presents the results of the model with a surplus of selfish workers. After that, section 5.2 presents the results of the model with a surplus of socially active workers.

It is important to note that the composition of the working population does not affect an equilibrium with perfect sorting. In case of a surplus of selfish workers in the working population, this would simply lead to more organisations of type A being present in the market. Reversely, in case of a surplus of socially active workers in the working population, more organisations of type B will be present in the market. Both of these situations will not present a new incentive to deviate for any of the actors involved. Therefore, none of the perfect sorting equilibria from section 4.2.1, 4.3.2 and 4.3.3 will be discussed in this chapter.

It must also be noted that the equilibrium of the model that assumes the unobservability of types accounts, which is based on the expected level of effort, accounts for the composition of the working population through x. Therefore, this equilibrium will not be discussed further in this chapter either.

The remainder of this chapter will focus on the effect of the composition of the working population on the equilibrium with mixture that can emerge in the model that assumes the observability of types, discussed in section 4.2.2. This equilibrium emerges in case the following condition, the opposite of condition 12, holds:

$$s^*(p + \beta) > s^*s^*\gamma \Longleftrightarrow p + \beta > s^*\gamma \qquad (22)$$

It is important to keep in mind that in an equilibrium with mixture socially active workers prefer to work alongside a selfish worker, as this makes them commit to a higher level of effort, which gives them an additional wage and an additional benefit derived from enjoying work.

5.1 Surplus of selfish workers

In case of a surplus of selfish workers, the working population consists of more selfish workers than socially active workers. This does not cause a problem in an equilibrium with mixture, as

all socially active workers can work alongside a selfish worker. The remaining selfish workers will work alongside another selfish worker. As selfish workers do not experience a difference in utility between working alongside either a selfish worker or socially active worker, they are indifferent between these two options. As the optimal level of effort of a socially active worker that works with a selfish worker and that of a selfish worker are still equal to β, organisations have no reason to adjust the wages that they offer. A surplus of selfish workers will therefore be no distortion of the equilibrium with mixture as has been described in section 4.2.2.

5.2 Surplus of socially active workers

In case of a surplus of socially active workers, the working population consists of more socially active workers than selfish workers. This causes a problem, because all socially active workers strictly prefer working alongside a selfish worker, but there are not enough selfish workers in the working population. Socially active workers are now willing to pay a certain premium m to selfish workers in order to have them as a colleague. A socially active worker his outside option in this case is to work alongside a socially active colleague. Indifference between working with a selfish colleague and working with a socially active colleague arises in case the following expression is true:

$$s^*(p + \beta) - m = s^*s^*\gamma \tag{23}$$

The premium m that would make a socially active worker indifferent is:

$$m = s^*(p + \beta - s^*\gamma) \tag{24}$$

If the premium is lower than this level, all socially active workers want to pay it in order to be able to work with a selfish colleague. Firms will compete with each other for scarce selfish workers by hiring socially active workers that are willing to give up an increasingly large share of their income, in order to work with a selfish colleague. This will keep on increasing the premium, until, in equilibrium, it is equal to the indifference level described in expression 24. Socially active workers will now receive the same utility from paying a premium described in expression 24 and working alongside a selfish worker, as they will receive from taking their outside option and working alongside another socially active worker.

In this equilibrium, two types of organisations will exist. On one hand, there are organisations of type B, that hire two socially active workers, on the other hand, there are organisations of type C, that hire one socially active worker and one selfish worker. At an organisation of type

B, the two socially active workers will have an optimal level of effort equal to $\beta - s^*$. Organisations of type B will therefore offer wages equal to $p(\beta - s^*)$, as was described in expression 9. At an organisation of type C, both types of workers will have an optimal level of effort equal to β. Organisations of type C will therefore offer wages equal to $p\beta$, as was described in expression 13.

In order for this equilibrium to exist, none of the actors involved must have an incentive to deviate.

Both types of organisations will not deviate from the above-mentioned wages. If an organisation decreases its wages, new entrants will offer higher wages until the expected profits of each organisation equal zero again. If an organisation increases its wages, it will make a loss and go bankrupt.

Selfish workers will not deviate, as they earn the highest wages they can in this equilibrium. They do not have a preference for the type of their colleague, as this does not influence their level of effort and thus their utility.

There are two types of socially active workers that exist in this market. The first type will work alongside a selfish worker. This type will pay a premium m as described in expression 24. In return, this type commits to a higher level of effort and therefore gains an additional wage and an additional benefit from working. The number of socially active workers of the first type is equal to the number of selfish workers in the market. The remainder of the socially active workers in the market is of the second type and will work alongside another socially active worker. They do not pay a premium and they do not derive an additional wage and an additional benefit from working. However, they do derive a social benefit from engaging in social behaviour with their colleague. In equilibrium, both types of socially active workers will have the same utility. Therefore, none of the two types has an incentive to deviate.

6. Concluding remarks

The model developed in this paper introduces the heterogeneity of preferences for social interaction of workers. Some conclusions can be drawn from its analysis.

First of all, as a socially active worker incurs costs from both exerting effort and engaging in social behaviour, a trade-off between social interaction and productivity exists.

Secondly, a socially active worker is willing to accept a lower wage in return for working alongside a socially active colleague, in case he derives a large benefit from engaging in social behaviour with another socially active colleague and the monetary and non-monetary benefits of working are small. However, if this is not the case, a socially active worker prefers to work alongside a selfish worker and commits to exerting a higher level of effort. This result holds, regardless of whether the types of workers are observable or unobservable.

Thirdly, the composition of the working population has an effect on the mixing equilibrium of the model that assumes observable types. If socially active workers prefer to work alongside a selfish worker but there is a surplus of socially active workers, socially active workers are willing to sacrifice their additional benefits from working alongside selfish workers by paying a premium. In equilibrium, socially active workers are therefore indifferent between working alongside a socially active worker while receiving a social benefit and working alongside a selfish worker while paying a premium.

A few suggestions for further research can be provided. An interesting adjustment to the model developed in this paper could be to make s continuous, as in that case workers can choose the extent to which they want to engage in social behaviour with colleagues and this would fit even better with the heterogeneity of preferences for social interaction. In addition, it would be interesting to examine the model in case selfish workers experience negative externalities when they work alongside a socially active worker. These negative externalities may arise as selfish workers might get distracted or irritated by the attempts a socially active colleague undertakes at engaging in social behaviour. Lastly, it would be interesting to examine the correlation between preferences for social interaction and preferences for cooperation. Developing a model which combines the trade-off between social interaction and productivity with the existing cooperation literature could examine the net effect of social behaviour and cooperation at work.

References

Corneo, G., & Rob, R. (2003). Working in public and private firms. *Journal of Public Economics*, *87*(7–8), 1335–1352. https://doi.org/10.1016/s0047-2727(01)00199-2

Ducharme, L.J., & Martin, J.K. (2000). Unrewarding Work, Co-worker Support, and Job Satisfaction. *Work and Occupations*, *27*(2), 223–243. https://doi.org/10.1177/0730888400027002005

Dur, R., & Sol, J. (2010). Social interaction, co-worker altruism, and incentives. *Games and Economic Behaviour*, *69*(2), 293–301. https://doi.org/10.1016/j.geb.2009.10.013

Heinz, M., & Schumacher, H. (2017). Signalling cooperation. *European Economic Review*, *98*, 199–216. https://doi.org/10.1016/j.euroecorev.2017.06.017

Hodson, R. (1997). Group Relations at Work. *Work and Occupations*, *24*(4), 426–452. https://doi.org/10.1177/0730888497024004003

Kosfeld, M., & Von Siemens, F.A. (2011). Competition, cooperation, and corporate culture. *The RAND Journal of Economics*, *42*(1), 23–43. https://doi.org/10.1111/j.1756-2171.2010.00124.x

Lévy-Garboua, L., Meidinger, C., & Rapoport, B. (2006). Chapter 7: The Formation of Social Preferences: Some Lessons from Psychology and Biology. *Handbook of the Economics of Giving, Altruism and Reciprocity*, 545–613. https://doi.org/10.1016/s1574-0714(06)01007-4

Riordan, C.M., & Griffeth, R.W. (1995). The opportunity for friendship in the workplace: An underexplored construct. *Journal of Business and Psychology*, *10*(2), 141–154. https://doi.org/10.1007/bf02249575

Shacklock, K. (2005). *Shall I stay? The meaning of working to older workers in an organisational setting* (Ph.D. Thesis). Griffith University. https://research-repository.griffith.edu.au/bitstream/handle/10072/23098/55144_1.pdf%3Bsequence=1

Van Echtelt, P., & Hoff, S. (2008). Wel of niet aan het werk: Achtergronden van het onbenut arbeidspotentieel onder werkenden, werklozen en arbeidsongeschikten. The Netherlands Institute for Social Research (SCP). https://www.werkhoezithet.nl/doc/kennisbank/wel_of_niet_aan_het_werk.pdf