The Effects of Sickness Insurance Policies on Labor Market Outcomes

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2 Introduction

Since Otto von Bismarck introduced a state sponsored sickness insurance system in Germany in 1883 a large flora of different kinds of sickness insurance systems have been adopted around the world (Treble and Barmbby, 2011). This paper will inquire into the effects of the dual system now in place in Sweden, where for the first two weeks of a workers sickness absence the firm will have to bear the cost of the sickness insurance. If the individual remains sick after two weeks the government will step in and take over the responsibility of financing the sickness insurance. These two systems will be modeled as separate systems. While no two countries systems are exactly the same, Korpi and Palme (1998) have been able to categorize social insurance institutions into five general categories based on the basis of entitlement, the principle that decides the benefit level and if the system is run through employer-employee cooperation. While the systems that will be analyzed in this paper will be modeled after the Swedish system the results ought to be able to be generalized to other countries systems that also fit their description of an encompassing social insurance institution.

This paper will theoretically examine how the different incentive structures between the systems affect labor market outcomes using augmented Mortensen-Pissarides models. The results will be quantified by simulating the Swedish labor market. The results show that sickness insurance systems in general have very small effects on the labor market and that the differences between the sickness benefit and the sick pay system are shown to be quite small. Both systems lead to a lower equilibrium gross wage. The sick pay system has no effect on the equilibrium unemployment rate, while the sickness benefit system can, under certain circumstances, have a positive effect on employment.

3 Background

3.1 Earlier studies

Most earlier studies on the sickness insurance system have focused on the effects of the insurance on worker absenteeism, suggesting that an increase in the generosity of the system increases the risk of the worker being absent (Broström et al., 2002; Hall and Hartman, 2010; Johansson and Palme, 1996, 2001; Paola et al., 2009). These effects are shown to be highly pro-cyclical, meaning that when the risk of being unemployed is high, workers tend to avoid being absent (Arai and Thoursie, 2005; Askildsen et al., 2005; Hesselius, 2007). However a more generous sickness insurance decreases the incentives for presenteeism (being at work while being sick) which puts the rest of the labor force at risk of becoming ill, (Chatterji and Tilley, 2002; Skatun, 2003) which implies that there exists a tradeoff between the incentives for absenteeism and presen-
There exists a small literature trying to answer the normative question of how an optimal sickness insurance system ought to be designed. For example Treble (2009) argues that if firms offered job contract bundled with a sick pay insurance it would lead to an efficient outcome. However Engström and Holmlund (2007) find, when running simulations comparing a government-provided sickness insurance system with a private, that the employers would provide an insurance that would be too generous in comparison with what would be socially optimal. These studies however compare government systems with free market systems. This paper will instead compare a governmentally run system with a governmentally mandated system.

3.2 The Swedish sickness insurance system

The brief history of the Swedish sickness insurance system is as follows. During the 19th century there existed a growing number of voluntary sickness insurance organizations, which were usually closely linked to the teetotalism movement, Christian denominations or labor unions. The responsibility for the sickness insurance system then gradually shifted over to the government until in 1955 when a law creating a public sickness insurance system, financed through taxation, was put into effect. However, in 1991 the sick pay law was enacted giving the employers the responsibility to finance the sickness insurance for the first 14 days of a worker’s absents. For a more comprehensive description of the history of the Swedish sickness insurance system see Lindqvist (1990).

The system works as follows. The first day of being sick a worker does not qualify for any sickness insurance. However for the remaining days up until the 14th day of sickness the firm that employs the worker is mandated

![Figure 1: Amount of sickness benefit days taken out in a year. (source: Försäkringskassan (2010a))](image)
to provide sick pay corresponding to 80% of the worker’s wage. If the worker remains sick beyond the 14th day, the responsibility is shifted to the government and the sickness benefit system, where a person can receive up to 77.6% of their gross wage for 364 days, given that their gross wage is less or equal to 330 000 kr. So for people with lower income the sickness benefit system works as a replacement ratio, while for higher incomes it is better modeled as a lump sum. If the person is still sick after 364 days they can either apply for a continuation of the sickness benefit on a normal level. However in order to be entitled to continue on the normal level the individual must have a serious illness. If a person is not entitled to continue on the normal level they can apply for sickness benefit on the continuation level for 550 days, but the replacement ratio is the lowered to 72.75% of the individual’s gross wage. A person earning less than 10600kr a year does not qualify to any sickness benefit. An unemployed person can only get up to a maximum of 480 kronor a day in sickness benefit, which corresponds to the unemployment benefit.

Social insurances make up a large part of the government’s budget. The

![Figure 2: The per annum cost of the sickness benefit system. (source: Försäkringskassan (2010b))](image)

Nobel laureate Paul Krugman has put it as such that ”the government is an insurance company with an army”. In any given year more than 40 million sick days are taken out in Sweden, which we can see in figure 1 and while the cost of the insurance system has come down over the recent year we can see in figure 2 that it still costs more than 20 billion a year.

4 The model

This paper develops two augmented versions of the Mortensen-Pissarides model first introduced in Mortensen and Pissarides (1994) and later further developed in Pissarides (2000). It will allow for workers to be sick and receiving assistance
through a sickness insurance system. So instead of the ordinary assumption in the Mortensen-Pissaridies model the value of having a job will be an expected pay-off of having a job or being away on sick leave. The Mortensen-Pissaridian framework is suitable for analyzing questions regarding social insurances as it is easily modified to capture the differences in incentives between systems. It has earlier been used to analyze questions such as the effect of paid parental leave (Lundberg, 2011), automatic unemployment insurances (Nilavongse, 2010) and reduced payroll taxes for youths (Jans, 2011).

4.1 Matching

The matching function, \( M(V, U) \), says how likely a match between a worker and a firm is. It is a function dependent on the number of vacancies, \( V \), and unemployed people \( U \). It is generally assumed to be a concave function homogeneous of degree one. It is also assumed that the matching function is increasing in both unemployment and vacancies, \( \frac{\partial M}{\partial U} > 0 \) and \( \frac{\partial M}{\partial V} > 0 \). This implies that if there are more vacancies or more unemployed people a match is more likely to happen. We will normalize the labor force size to unity, \( L = 1 \). Implying that the vacancy rate, \( v = \frac{V}{L} \), is equal to the number of vacancies, \( V = v \) and the unemployment rate will equal the number of unemployed people, \( u = \frac{U}{L} = U \). The probability of filling a vacant job in a single time period is:

\[
M(V, U) = M(1, \frac{V}{U}) = m(\theta) \quad \text{where} \quad \theta = \frac{V}{U}
\]

is the labor market tightness. By differentiating \( m(\theta) \) with respect to \( \theta \) we get that \( m'(\theta) = -\frac{\partial M(1, \frac{V}{U})}{\partial U} \frac{U^2}{V^2} < 0 \). This implies that an increase in the labor market tightness decreases the probability that a vacancy is filled within a specific time period. The probability that an unemployed worker is matched with a job is

\[
\frac{M(V, U)}{U} = \frac{V}{U} M(V, U) = \theta m(\theta).
\]

By differentiating this expression with respect to the labor market tightness we get \( \frac{\partial m(\theta)}{\partial \theta} = m(\theta) + \theta m'(\theta) = \frac{\partial M(1, \frac{V}{U})}{\partial \theta} > 0 \), which says that an increase in labor market tightness increases the probability of a worker finding a job.

5 Sickness benefit

\( V_e \) is the discounted value function of having a job for a representative worker at a single point in time and \( r \) is the discount rate. With the probability \( 1 - \psi \) the worker is healthy and therefore on the job and receiving the wage \( w \), which is taxed at the rate \( \tau \). With the probability \( \psi \) the worker is sick and receives the lump sum sickness benefit of \( \xi \) which also is taxed at the rate of \( \tau \). The probability of a worker being sick, \( \psi \in [0, 1] \), is assumed to be exogenous in both the models.\(^1\) The sick leave state is dependent on being employed in order

\(^1\)There exists empirical evidence that the generosity of the sick leave insurance affects the level of sick leave (Henrekson and Persson, 2004). Also the unemployment rate has been found to be negatively linked to the level of absenteeism in general (Leigh, 1985). But since
to capture the fact that being employed is a prerequisite to receiving any form of sick leave assistance above the level of the unemployment benefit. With the probability $q$, which is the job separation rate, the worker will lose his job and instead receive the value of being unemployed, $V_u$, and with the probability $1 - q$ they will remain on the job.

$$
V_e = \frac{1}{1 + r} \ast [(1 - \psi)(1 - \tau)w + \psi(1 - \tau)\xi + qV_u + (1 - q)V_e] \quad (1)
$$

While unemployed the worker will receive the exogenous income of $z$ which is also taxed at the rate $\tau$. The probability of the unemployed person finding a job is $\theta_m(\theta)$ implying that the probability of remaining unemployed is $(1 - \theta_m(\theta))$. There is an implicit assumption being made here that there exists no interaction between the probability of finding a job and being sick, i.e. being sick will not affect an individual’s chance of getting hired.

$$
V_u = \frac{1}{1 + r} \ast [(1 - \tau)z + \theta_m(\theta)V_e + (1 - \theta_m(\theta))V_u] \quad (2)
$$

$\Pi_e$ is the value to the firm of having an employee. With the probability $1 - \psi$ the worker is not sick and produces the value $y$ while receiving the wage $w$ leaving the firm with the expected profit of $(1 - \psi)(y - w)$. At the rate of $q$ jobs will be destroyed and the firm will instead receive the value of having a vacancy, $\Pi_v$, implying that at the rate of $1 - q$ the job will not be destroyed and the firm will continue receiving the value of $\Pi_e$.

$$
\Pi_e = \frac{1}{1 + r} \ast [(1 - \psi)(y - w) + q\Pi_v + (1 - q)\Pi_e] \quad (3)
$$

Having vacancies creates costs for the firm which is captured in the model by $h$. $m(\theta)$ captures the chance of the firm being matched with a suitable worker implying that $(1 - m(\theta))$ is the probability of the slot remaining vacant.

$$
\Pi_v = \frac{1}{1 + r} \ast [-h + m(\theta)\Pi_e + (1 - m(\theta))\Pi_v] \quad (4)
$$

### 5.1 Bargaining

When a worker is matched with a firm the surplus, $S$, is created. This surplus will equal the sum of the worker and the firms rents, $S = V_{ei} - V_u + \Pi_{ei} - \Pi_v$, where $V_{ei}$ is value of having a job, $V_u$ is the workers value of being unemployed, $\Pi_{ei}$ is the firms value of having an employee and $\Pi_v$ is the firms value of having a vacancy. The worker and the firm will then bargain over the wage in order to maximize their own rents $V_{ei} - V_u$ being the rent of having a job for the measuring these effects is not the goal of this paper is assumed that the sick leave rate is driven by exogenous factors, such as actual sickness, important sporting events(Thoursie, 2004) or the weather(Connolly, 2008).
worker and $\Pi_e - \Pi_v$ the rent for the firm. It is assumed here that the worker is risk-neutral.\(^2\) This will be modeled using the following Nash-bargaining:

$$\max_{w_i}(V_{ei} - V_u)^\gamma(\Pi_{ei} - \Pi_v)\^{1-\gamma}$$ \hspace{1cm} (5)

Where $\gamma \in [0,1]$ is the relative bargaining power of the worker. The idea here being that one of the parties make an offer of consisting of a wage and the other partner can either accept or reject the offer. At one point one of the parties will make a take it or leave it offer and if the other partner decide to not agree on a wage the job will destroyed and they will receive the values associated with being unemployed or having a vacancy. In a symmetric equilibrium, where we assume that all firms and workers are identical and neither of them has market power, implying that $w_i = w$ for all matches, we get the following first order condition:

$$\gamma(\Pi_e - \Pi_v) = (1 - \gamma)(V_e - V_u)$$ \hspace{1cm} (6)

This can be rewritten as:

$$V_e - V_u = \gamma(\Pi_e - \Pi_v + V_e - V_u) = \gamma S$$ \hspace{1cm} (7)

Since all rents must go to either of the parties this implies that:

$$\Pi_e - \Pi_v = (1 - \gamma)S$$ \hspace{1cm} (8)

### 5.2 The solution of the model

Solving the model is then very straightforward using the earlier explained bargaining process.\(^3\) We get the following labor demand:

$$\frac{h}{m(\theta)} = \frac{(1 - \psi)(y - w)}{r + q}$$ \hspace{1cm} (9)

The wage curve will look as follows:

$$w = \frac{\gamma y (1 - \psi)[r + q + \theta m(\theta)] + (1 - \gamma)(1 - \tau)(z - \psi \xi)(r + q)}{(1 - \psi)[(1 + \gamma \tau - \tau)(r + q) + \gamma \theta m(\theta)]}$$ \hspace{1cm} (10)

By substituting the wage curve into the expression for labor demand we will get the vacancy supply curve (henceforth known as the VS-curve), which gives us the point where the wage curve and labor demand are in equilibrium:

$$\frac{h}{m(\theta^*)} = \frac{(1 - \gamma)(1 - \tau)[(1 - \psi)y + \psi \xi - z]}{(1 + \gamma \tau - \tau)(r + q) + \gamma \theta^* m(\theta^*)}$$ \hspace{1cm} (11)

\(^2\)There exists empirical evidence that people are not risk-neutral in all circumstances(Kahneman and Tversky, 1979). However, the results about rent-sharing derived in this section have been proven by Osborne and Rubinstein (1990) to hold for other assumptions about risk-preferences though $\gamma$ can no longer be interpreted the same way.

\(^3\)see appendix A for how to solve the model.
Combining this with the short run\(^4\) Beveridge curve which shows the relationship between vacancies and unemployment, where \(u\) is the unemployment rate, we get the equilibrium unemployment rate.\(^5\)

\[
u = \frac{q}{q + \theta m(\theta)} \tag{12}
\]

### 5.3 Comparative statics of the sickness benefit model

In the sickness benefit model the only thing that differs in the labor demand curve in comparison with the original Mortensen-Pissarides model, equation (9), is the fact that it now depends on the probability of a worker being sick, \(\psi\). By taking the partial derivative of the labor demand curve with respect to the probability of a worker being sick we get that:

\[
\frac{\partial w_{Ld}}{\partial \psi} = -\frac{(r + q)h}{(1 - \psi)^2 m(\theta)} < 0.
\]

This implies that as the probability of a worker being sick increases, the firm wants to lower his wage in proportion to the forgone value that would have been created given that the sickness rate did not increase. This results lies in line with earlier research by Allen (1981b,a, 1983) claiming that firms are willing to accept higher degrees of absenteeism given that they are compensated through lower wages. An increase in the probability of a worker being sick affects the wage curve in the following way:

\[
\frac{\partial w_{wc}}{\partial \psi} = \frac{(z - \xi)(r + q)(1 - \tau)(1 - \gamma)}{(1 - \psi)^2[(1 + \gamma \tau - \tau)(r + q) + \gamma \theta m(\theta)]} \tag{13}
\]

This is negative given that \(\xi > z\). We have an ambiguous effect of the probability of being sick, \(\psi\), on labor market tightness, since an increase of \(\psi\) would lead to a lower labor demand, decreasing labor market tightness, while at the same time it could be increasing the value of having a job and thereby shifting out the wage curve, which creates a positive effect on labor market tightness. In order to be able to see what the net effect is we have to take the partial derivative of the equilibrium labor market tightness, equation (11), with respect to \(\psi\). Doing so we get the following expression:

\[
\frac{\partial \theta^*}{\partial \psi} = \frac{(\xi - y)(1 - \gamma)(1 - \tau)}{h \gamma \left[1 - \frac{(1 + \gamma \tau - \tau)(r + q)m'(\theta^*)}{\gamma [m(\theta^*)]^2}\right]} \tag{14}
\]

We can safely assume that this will be negative since the value of an individual’s production, \(y\), ought to be higher than the size of the sickness benefit lump sum, \(\xi\) (have in mind that \(m'(\theta^*) < 0\) as pointed out in the matching section). What this implies is that when the probability of a worker being sick increases the effect on labor demand will dominate the wage curve effect and thereby lower labor market tightness, which would lead to an increase in

\(^4\)since this is a one period model there exists no growth in the labor force and its effect on the unemployment rate can be ignored.

\(^5\)see appendix C for how to derive the short run Beveridge curve.
unemployment. All the effects on the VS-curve can be seen in figure 4. Most of the effects of the sickness benefit system will be on the wage curve.

Figure 3: The equilibrium wage and labor market tightness in the sickness benefit model

By differentiating the wage curve, equation (10), with respect to the size of the sickness benefit payment, $\xi$, we get that:

$$\frac{\partial w_{wc}}{\partial \xi} = -\frac{(1 - \gamma)(1 - \tau)(r + q)\psi}{(1 - \psi)((1 + \gamma\tau - \tau)(r + q) + \gamma\theta m(\theta))} < 0$$ (15)

This implies as the sickness benefit becomes more generous the value of having a job will increase, which creates a downwards pressure on the wage workers will be demanding in the bargaining since it is now more valuable to have a job. Taking the cross-partial derivative with respect to $\psi$ we get that:

$$\frac{\partial^2 w_{wc}}{\partial \xi \partial \psi} = -\frac{(1 - \gamma)(1 - \tau)(r + q)}{(1 - \psi)^2((1 + \gamma\tau - \tau) + \gamma\theta m(\theta))} < 0$$ (16)

This says that the downward pressure on wages, stemming from an increase in the sickness benefit generosity, will become stronger as the probability of a worker being away on sick leave, and thereby realizing the value of the sickness benefit program, increases. All the effects on the wage curve and labor demand can be seen in figure 3.

The effects of increased taxation have an ambiguous effect on the wage curve.

$$\frac{\partial w_{wc}}{\partial \tau} = \frac{\gamma[(r + q + \theta m(\theta))(1 - \psi) + \psi(1 - \gamma)(r + q)]}{(1 - \psi)((1 - \gamma)(1 - \tau)(r + q) + \gamma[r + q + \theta m(\theta)])^2}$$ (17)

However if we make the reasonable assumption that $(1 - \psi)y + \psi\xi > z$, which seems reasonable since the value a person produces while working ought to
be larger than the exogenous income of being unemployed and the size of the sickness benefit payout is usually larger or at least equal to the unemployment benefit, then it will be negative implying that increased taxation leads to workers demanding higher wages.

5.4 Financing the sickness benefit

One of the problems with comparing the two sickness insurance regimes is that in the sick pay model all the value in the model stems from inside the model, while in the sickness benefit model it is possible to add value to the system by increasing the generosity of the sickness insurance without financing it. In order to make the models comparable we will therefore have to add a financing condition. Given that the government decides to balance their budget, which is a reasonable assumption to make in a one-period model, the implied financing condition of the model will look as follows:

\[ (1 - U^*) \psi \xi = (1 - U^*)(1 - \psi)\tau w^* + (1 - U^*)\tau \psi \xi + U^* \tau z \]  
(18)

This states that the sum of all the sickness benefit pay-outs must equal the implied tax revenue. What we will assume then is that the government does not set the tax rate, but instead takes it as given, and instead sets the size of the sickness benefit pay-out, \( \xi \), as to balance the budget constraint. We can solve equation (18) for \( \xi \) and get the following expression:

\[ \xi = \frac{(1 - \psi)\tau w^*}{(1 - \tau)\psi} + \frac{U^* \tau z}{(1 - U^*)(1 - \tau)\psi} \]  
(19)
We can also rewrite this so it only depends on exogenous variables. We then arrive at the following expression for the equilibrium sickness benefit pay-out:

$$\psi \xi^* = y \frac{\gamma \tau (1 - \psi)(1 - \tau)}{(1 - t)[r + q + \gamma \theta^* m(\theta^*)]}$$

$$+ z \frac{\tau [(1 + \gamma \tau - \tau)(r + q)q + [(1 - \gamma)(1 - \tau)(r + q) + \gamma q \theta^* m(\theta^*)]}{(1 - \tau)\theta^* m(\theta^*)[r + q + \gamma \theta^* m(\theta^*)]}$$

(20)

5.5 The sickness benefit model when the unemployed have no income

If we assume that $z = 0$, then the VS-curve for the sickness benefit model will look as follows:

$$h = \frac{(1 - \gamma)(1 - \tau)[(1 - \psi)y + \psi \xi]}{(1 + \gamma \tau - \tau)(r + q) + \gamma \theta^* m(\theta^*)}$$

(21)

The balanced government budget constraint will then be:

$$\psi \xi = y \frac{\gamma \tau (1 - \psi)(1 - \tau)(r + q + \theta^* m(\theta^*)]}{(1 - t)[r + q + \gamma \theta^* m(\theta^*)]}$$

(22)

By substituting for $\psi \xi$ in the VS-curve we get:

$$h = \frac{(1 - \gamma)(1 - \tau)(1 - \psi)}{(1 + \gamma \tau - \tau)(r + q) + \gamma \theta^* m(\theta^*)}$$

$$+ y \frac{\gamma \tau (1 - \psi)(1 - \tau)(r + q + \theta^* m(\theta^*)]}{(1 + \gamma \tau - \tau)(r + q) + \gamma \theta^* m(\theta^*)}$$

(23)

This can be rewritten as:

$$h = \frac{(1 - \gamma)(1 - \psi)}{r + q + \gamma \theta^* m(\theta^*)}$$

(24)

What we then can see is that when there is no exogenous income when unemployed and the government balances the budget, then taxes have no effect on the equilibrium labor market tightness. The only way that can be upheld when taxation changes is that the effect stemming from increased taxation is neutralized by the increased generosity effect. Since both of these effects affect only the supply side of the market this implies that the wage curve is not shifted.

6 Sick pay

The difference between the sick pay system and the sickness benefit system explained in section 5 is that in the sick pay system the firm that employs a

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6 See appendix D for how to derive this. 

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worker has the responsibility to finance the sickness insurance if the worker becomes sick. For the model this implies that all taxes are removed from the value functions. Instead the cost $-\psi \xi$ is added to the firms value function for having an employee, equation (27).

$$V_e = \frac{1}{1 + r} [(1 - \psi)w + \psi \xi + qV_u + (1 - q)V_e]$$  \hspace{1cm} (25)$$

$$V_u = \frac{1}{1 + r} [z + \theta m(\theta) V_e + (1 - \theta m(\theta)) V_u]$$  \hspace{1cm} (26)$$

$$\Pi_e = \frac{1}{1 + r} [(1 - \psi)(y - w) - \psi \xi + q\Pi_v + (1 - q)\Pi_e]$$  \hspace{1cm} (27)$$

$$\Pi_v = \frac{1}{1 + r} [-h + m(\theta)\Pi_e + (1 - m(\theta))\Pi_v]$$  \hspace{1cm} (28)$$

Solving the model the same way as for the sickness benefit model we get the following results\(^7\):

Labor demand:

$$\frac{h}{m(\theta)} = \frac{(1 - \psi)(y - w) - \psi \xi}{r + q}$$  \hspace{1cm} (29)$$

The wage curve:

$$w = y \frac{\gamma [r + q + \theta m(\theta)]}{r + q + \gamma \theta m(\theta)} + z \frac{(1 - \gamma)(r + q)}{(1 - \psi)(r + q + \gamma \theta m(\theta))} - \frac{\psi \xi}{1 - \psi}$$  \hspace{1cm} (30)$$

By substituting in the wage curve into the labor demand equation we get the following expression for the VS-curve:

$$\frac{h}{m(\theta^*)} = \frac{(1 - \gamma)[(1 - \psi)y - z]}{r + q + \gamma \theta^* m(\theta^*)}$$  \hspace{1cm} (31)$$

6.1 Comparative statics of the sick pay model

Taking the partial derivative of the labor demand curve, equation (29), with respect to $\xi$ we get that \(\frac{\partial w_{Ld}}{\partial \xi} = -\frac{\psi}{1 - \psi} < 0\). This implies that as the sick pay becomes more generous the firms’ costs for paying for it becomes larger and they therefore will have fewer vacancies at a given wage since it is not profitable to hire as many workers as before. Taking the cross-partial derivative with respect to $\psi$ we get that \(\frac{\partial^2 w_{Ld}}{\partial \xi \partial \psi} = -\frac{1}{(1 - \psi)^2} < 0\), which implies that as the probability of a worker being sick increases the expected cost of an increase in the generosity of the sick pay insurance, which then increases the negative effect of an increase in the sick pay payment on labor demand. The effects on the wage curve of the sick pay system are quite straightforward. \(\frac{\partial w_{wc}}{\partial \xi} = -\frac{\psi}{1 - \psi}\) says that as we increase the generosity in the sick pay system the value of having a job increases implying that workers will be willing to work for a lower

\(^7\)see appendix B for further explanation on how to solve the model
wage.

An increase in the probability of a worker being sick, $\psi$, will affect the demand for labor in the following way:

$$\frac{\partial w_{Ld}}{\partial \psi} = -\frac{\xi}{(1 - \psi)^2} - \frac{h(r + q)}{m(\theta)(1 - \psi)^2}$$

(S32)

Since an increase in the probability of a worker being sick increases the expected cost of sick pay for the firm while at the same time depriving the firm of the value that would have been created if the worker had been present the firm will want to employ fewer people, implying that labor demand shifts in. The effects on the labor supply is however ambiguous.

$$\frac{\partial w_{uc}}{\partial \psi} = \frac{z(1 - \gamma)(r + q)}{(1 - \psi)^2(1 - \gamma + \gamma \theta m(\theta))} - \frac{\xi}{(1 - \psi)^2}$$

(S33)

Since an increase in the probability of a person being sick, $\psi$, shifts In the labor demand curve while at the same time having an ambiguous effect on the wage curve, thereby possibly creating both a positive and a negative effect on labor market tightness, we have to use the equilibrium labor market tightness expression in order to sign the net effect.

$$\frac{\partial \theta^*}{\partial \psi} = -\frac{(1 - \gamma)y}{h[1 - \frac{(r+q)m'(\theta^*)}{m(\theta^*)^2}]} < 0$$

(S34)

This shows that the negative effect on labor market tightness stemming from the decreased labor demand will dominate the effect from the wage curve leading to a decrease in the equilibrium labor market tightness, which implies that the unemployment rate will increase. The effects on labor demand and the wage curve are summed up in figure 5.

An increase in the size of the sick pay pay-out, $\xi$, will have a negative effect on the equilibrium wage level since the effect on both labor demand and labor supply is negative. However the effect on labor market tightness, $\theta$, however since the pay-out size does not affect the VS-curve it will have no effect on the equilibrium labor market tightness. This implies that the effects on labor market tightness will cancel each other out and only a wage effect will persist, as illustrated in figure 6. Since the unemployment rate is determined by the equilibrium labor market tightness and the short run Beveridge curve, and the generosity of the sick pay system, $\xi$, does not affect either of them, this implies that the size of the sick pay pay-outs have no effect on the equilibrium unemployment rate. The mechanism behind this is as follows. When the government mandates that the firms must increase their sick pay this redistributes value from the firms to the workers. However since their bargaining position does not change the value of each of the parties rents must remain the same and since the only channel for adaptation is the wage we end up with a pure wage effect. This effect also holds if you choose to model the sick pay as a replacement ratio instead.

This effect also holds if you choose to model the sick pay as a replacement ratio instead
7 Numerical analysis

7.1 Assuming a functional form for the matching function

To be able to simulate the models we must first assume a functional form of the matching function. As pointed out in the matching function section of as lump sum.
we have assumed that the matching function is homogeneous of degree one. Most empirical studies support this assumption of modeling the matching function as constant returns to scale function (Cahuc and Zylberberg, 2004, p. 520). Especially the Cobb-Douglas function has been shown to explain the data well (Pissarides, 2000, p. 6). However there exists some exceptions such as Blanchard and Diamond (1991). So assuming a Cobb-Douglas function we get the following matching function:

\[ m(v, u) = \alpha v^{1-\eta} u^\eta \]  

where \( \alpha \) captures the efficiency of the matching process and \( \eta \) is the elasticity of matching. This enables us to rewrite the probability of a vacancy being filled as:

\[ \frac{M(V, U)}{V} = m(\theta) = \alpha \theta^{-\eta} \]  

7.2 Calibrating the model

To calibrate the model we start off by normalizing production to unity. The cost of having a vacancy, \( h \), is set to 4.5, the relative bargaining power of the worker, \( \beta \), is set to 0.5 and the real interest rate, \( r \), is set to 0.05 (Kolm and Tonin, 2011). The value of the elasticity of matching, \( \eta \), varies wildly in the literature, from Hall (2005) 0.24 to Shimer (2005) 0.72. We shall follow Gertler and Trigari (2006) and use the average value used, which is 0.5. In 2011 the average labor contract specified that a worker should work 37.2 hours a week. The average amount of sick days per worker where 7.6. Using this
we can calculate that the probability of a worker being sick, $\psi$, is 0.0314. The exogenous income while unemployed, $z$ will be set to 0.25. $q$ and $\alpha$ are calibrated to fit the Swedish labor market using a relative unemployment of 7.5%, a vacancy duration of 1 month and an average unemployment duration of 8.075 months. The values are summarized in table 1.

<table>
<thead>
<tr>
<th>$\alpha$</th>
<th>$q$</th>
<th>$r$</th>
<th>$z$</th>
<th>$\gamma$</th>
<th>$y$</th>
<th>$\psi$</th>
<th>$h$</th>
<th>$\eta$</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.352</td>
<td>0.00943</td>
<td>0.05</td>
<td>0.25</td>
<td>0.5</td>
<td>1</td>
<td>0.0314</td>
<td>4.5</td>
<td>0.5</td>
</tr>
</tbody>
</table>

Table 1: Parameter values

7.3 Numerical analysis results

As we saw earlier increased generosity in the sickness benefit system did not affect unemployment when the unemployed had no income, however if there exists an exogenous income for the unemployed then there exists another source of revenue for the government which can be redistributed to the sick. Since we have assumed that only those who are employed can receive sickness insurance hand outs this implies that the sickness benefit system will have a mechanism redistributing income from the unemployed to the employed, thereby increasing the value of having a job.

<table>
<thead>
<tr>
<th>Pay-out size</th>
<th>0</th>
<th>0.2550</th>
<th>0.5224</th>
<th>0.8026</th>
<th>1.0960</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sickness benefit model</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tax rate</td>
<td>0</td>
<td>0.01</td>
<td>0.02</td>
<td>0.03</td>
<td>0.04</td>
</tr>
<tr>
<td>Labor market tightness</td>
<td>0.0702</td>
<td>0.0705</td>
<td>0.0708</td>
<td>0.0711</td>
<td>0.0714</td>
</tr>
<tr>
<td>Gross wage</td>
<td>0.7921</td>
<td>0.7915</td>
<td>0.7909</td>
<td>0.7901</td>
<td>0.7893</td>
</tr>
<tr>
<td>Net wage</td>
<td>0.7921</td>
<td>0.7836</td>
<td>0.7751</td>
<td>0.7664</td>
<td>0.7577</td>
</tr>
<tr>
<td>Unemployment</td>
<td>0.0918</td>
<td>0.0916</td>
<td>0.0915</td>
<td>0.0913</td>
<td>0.0911</td>
</tr>
<tr>
<td>Sick pay model</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Labor market tightness</td>
<td>0.0702</td>
<td>0.0702</td>
<td>0.0702</td>
<td>0.0702</td>
<td>0.0702</td>
</tr>
<tr>
<td>Wage</td>
<td>0.7921</td>
<td>0.7839</td>
<td>0.7752</td>
<td>0.7661</td>
<td>0.7566</td>
</tr>
<tr>
<td>Unemployment</td>
<td>0.0918</td>
<td>0.0918</td>
<td>0.0918</td>
<td>0.0918</td>
<td>0.0918</td>
</tr>
</tbody>
</table>

Table 2: The Numerical Analysis Results

What we then can see in table (2) is that when we increase the sickness insurance pay-out size then the effect from increased generosity of the sickness insurance will dominate the effect from taxation thereby shifting the wage curve and we get a lower gross wage and higher labor market tightness in equilibrium. Since labor market tightness is still independent of the pay-out size in the sick pay model unemployment will not be affected by a change in $\xi$. As we see this leads to the fact that unemployment is lower in the sickness benefit model than in the sick pay model for any $\xi > 0$. However, these effects are very
small. As we can see in figure 8, increasing the sickness benefit pay-out size from zero to 80% of production value would only decrease unemployment by 0.05 percentage point. The difference in equilibrium net wages is very small between the models. We can however see a tendency in figure 9 that as the sickness insurance become more generous then the net wages will be higher in the sickness benefit model.

8 Conclusions

Given that people would not react on incentives for absenteeism, sickness insurance systems seem to have small effects on the labor market as a whole. Employment effects are either non-existent, such as in the sick pay model or in the sickness benefit model when there exists no exogenous income for the unemployed, or positive as in the sickness benefit model when we have exogenous
income for the unemployed. Increased generosity of the sickness insurance will however lead to lower net wages in all the models.

Under a sickness benefit regime the government can generate larger positive employment effects if they increase the generosity of the insurance without financing it. This is of course impossible in a sick pay system.

There are of course some relevant caveats to these results. First, we have assumed that firms are risk-neutral. However, that might not be the case. To the firms the loss of production value when a worker is away on sick leave in combination with having to finance the sickness insurance, at least in the sick-pay model, might bring a smaller firm to the brinks of bankruptcy. Since having to finance the sickness insurance would increase the volatility in firms’ costs, and if they are risk adverse there could exist an effect on unemployment that will not be captured in the sick pay model. Also, when the firms have a larger responsibility for the sickness insurance they might try to discriminate against workers that are likely to be sick, during the hiring process (Harcourt and Lam, 2007).

Given the results in this study a sickness benefit system seems to be preferable to a sick pay system, since it gives a lower or equal unemployment rate, while the wage level hardly varies between the systems. This is of course based on that it is more realistic to model the labor market with the assumption that the unemployed have some sort of income. However further studies are need to conclude how absenteeism, different risk preferences, asymmetric information and modeling the insurance as a replacement ratio affects these results.
References


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## Appendices

### A How to solve the sickness benefit model

In order to get the labor demand we combine equation (3) and (4) with the free entry condition, Π_v = 0, which states that new firms will enter the market until there exists no more profits from having a vacancy. Solving this we get
the labor demand curve, equation (9). We can rewrite the value from being employed, equation (1), as:

\[ V_e - V_u = \frac{(1 - \psi)(1 - \tau)w + (1 - \tau)\psi \xi - rV_u}{r + q} \]  

(38)

And we can rewrite the value of having an employee, equation (3) as:

\[ \Pi_e - \Pi_v = \frac{(1 - \psi)(y - w) - r\pi_v}{r + q} \]  

(39)

The total amount of rents that is bargained over, \( S \), must equal the sum of the rents for the workers and the firms so:

\[ S = V_e - V_u + \Pi_e - \Pi_v = \frac{(1 - \psi)(y - \tau w) + (1 - \tau)\psi \xi - r(V_u + \Pi_v)}{r + q} \]  

(40)

The solution to the bargaining problem will look as such that each of the parties will get their relative bargaining strength times the total rents bargained over. This implies that \( \gamma S = V_e - V_u \). Solving this for \( w \) using the free entry condition, \( \Pi_v = 0 \) we get that:

\[ w = \gamma \frac{(1 - \psi)y - (1 - \gamma)(\psi \xi (1 - \tau) - rV_u)}{(1 - \psi)(1 - (1 - \gamma)\tau)} \]  

(41)

Since \( \gamma S = V_e - V_u \) we can rewrite equation (2) as:

\[ rV_u = (1 - \tau)z + \theta m(\theta) \gamma S \]  

(42)

By substituting in \( S \) and solving for \( rV_u \) we get the following:

\[ rV_u = \frac{z(1 - \tau)(r + q) + \theta m(\theta) * (\gamma (1 - \psi)(y - \tau w) + \psi \xi (1 - \tau))}{r + q + \gamma \theta m(\theta)} \]  

(43)

By Combining equation (41) and (43) we get that:

\[ w = \gamma \frac{y(1 - \tau)}{1 + \gamma \tau - \tau} - \frac{(1 - \gamma)(1 - \tau)\psi \xi}{(1 - \psi)(1 + \gamma \tau - \tau)} \]

\[ + \frac{1 - \gamma}{(1 - \psi)(1 + \gamma \tau - \tau)} \ast \frac{(1 - \tau)z(r + q) + \theta m(\theta)(\gamma (1 - \psi)(y - \tau w) + \gamma (1 - \tau)\psi \xi)}{r + q + \gamma \theta m(\theta)} \]  

(44)

This can be rewritten as:

\[ w + w \frac{(1 - \gamma)\theta m(\theta) \gamma (1 - \psi)\tau}{(1 - \psi)(1 + \gamma \tau - \tau)(r + q + \gamma \theta m(\theta))} = \gamma \frac{y(1 - \tau)}{1 + \gamma \tau - \tau} - \frac{(1 - \gamma)(1 - \tau)\psi \xi}{(1 - \psi)(1 + \gamma \tau - \tau)} \]

\[ + \frac{1 - \gamma}{(1 - \psi)(1 + \gamma \tau - \tau)} \ast \frac{(1 - \tau)z(r + q) + \theta m(\theta)(\gamma (1 - \psi)(y + \gamma (1 - \tau)\psi \xi)}{r + q + \gamma \theta m(\theta)} \]  

(45)
This can also be written as:

\[
\begin{align*}
\frac{w}{(1 - \psi)(1 + \gamma \tau - \tau)(r + q + \gamma \theta m(\theta)) + (1 - \gamma)\theta m(\theta)\gamma(1 - \psi)\tau} &= \\
&= \frac{\gamma y}{1 + \gamma \tau - \tau} - \frac{(1 - \gamma)(1 - \tau)\psi \xi}{(1 - \psi)(1 + \gamma \tau - \tau)} \\
+ \frac{1 - \gamma}{(1 - \psi)(1 + \gamma \tau - \tau)} \cdot \frac{(1 - \tau)z(r + q) + \theta m(\theta)(\gamma(1 - \psi)y + \gamma(1 - \tau)\psi \xi)}{r + q + \gamma \theta m(\theta)}
\end{align*}
\]

(46)

By multiplying both sides with:

\[
\begin{align*}
\frac{(1 - \psi)(1 + \gamma \tau - \tau)(r + q + \gamma \theta m(\theta))}{(1 - \psi)(1 + \gamma \tau - \tau)(r + q + \gamma \theta m(\theta)) + (1 - \gamma)\theta m(\theta)\gamma(1 - \psi)\tau}
\end{align*}
\]

(47)

We get the following expression for the wage:

\[
\begin{align*}
w &= \frac{\gamma y(1 - \psi)(r + q + \gamma \theta m(\theta)) - (1 - \gamma)(1 - \tau)(r + q + \gamma \theta m(\theta))\psi \xi}{(1 - \psi)(1 + \gamma \tau - \tau)(r + q + \gamma \theta m(\theta)) + (1 - \gamma)\theta m(\theta)\gamma(1 - \psi)\tau} \\
+ \frac{(1 - \gamma)(1 - \tau)z(r + q) + (1 - \gamma)\gamma \theta m(\theta)(1 - \psi)y + (1 - \gamma)\gamma \theta m(\theta)(1 - \tau)\psi \xi}{(1 - \psi)(1 + \gamma \tau - \tau)(r + q + \gamma \theta m(\theta)) + (1 - \gamma)\theta m(\theta)\gamma(1 - \psi)\tau}
\end{align*}
\]

(48)

Which simplifies down to the wage curve, equation (10).

In order to get the VS-curve we just substitute in the wage curve, equation (10), into the labor demand, equation (9) and we get equation (11).

### B How to solve the sick pay model

The solving of the sick pay model of course follows the same pattern as the sickness benefit model. So in order to get the labor demand curve we combine equation (27) and (28) with the free entry condition, \( \Pi_v = 0 \) and get the labor demand equation, (29).

We can rewrite the value of having a job, equation (25), as:

\[
V_e - V_u = \frac{(1 - \psi)w + \psi \xi - rV_u}{r + q}
\]

(49)

We can also rewrite the firms asset function of having an employee, equation (27) , as:

\[
\Pi_e - \Pi_v = \frac{(1 - \psi)(y - w) - \psi \xi + r\Pi_v}{r + q}
\]

(50)

The total amount of rents being bargained over, \( S \), must equal the sum of the rents that each of the parties extract:

\[
S = V_e - V_u + \Pi_e - \Pi_v = \frac{(1 - \psi)y - r(V_u + \Pi_v)}{r + q}
\]

(51)
The solution to the bargaining game will look as such that the worker will receive its relative bargaining strength times the total amount of rents bargained over, i.e. $\gamma S = V_e - V_u$. Solving this for $w$ using the free entry condition, $\Pi_u = 0$, and we get:

$$w = \gamma y - \frac{\psi \xi + (1 - \gamma)rV_u}{1 - \psi} \tag{52}$$

We can rewrite the value of being unemployed, equation (26), as:

$$rV_u = z + \theta m(\theta)\gamma S \tag{53}$$

Substituting in $S$ and solving for $rV_u$ we get:

$$rV_u = \frac{z(r + q) + (1 - \psi)\gamma \theta m(\theta)}{r + q + \gamma \theta m(\theta)} \tag{54}$$

Substituting this into equation (52) and we get the wage curve, equation (30).

In order to get the VS-curve we substitute in the wage curve, equation (30), into the labor demand function, equation (29), and get equation (31).

### C Deriving the short run Beveridge curve

$\dot{U}$, is the change in unemployment, $U$ is the amount of unemployed people, $N$ is the size of the labor force and $L$ is the amount of employed people at a given time. In the short run the change in unemployment must equal the difference between the amount of jobs being destroyed, $qL$ and the amount of people being matched with a job, $\theta m(\theta)U$.

$$\dot{U} = qL - \theta m(\theta)U \tag{55}$$

We can divide everything by the size of the labor force in order to get rates.

$$\frac{\dot{U}}{N} = \frac{qL}{N} - \theta m(\theta)\frac{U}{N} \tag{56}$$

The amount of employed people, $L$ must equal the size of the labor force minus the ones that are unemployed, $L = N - U$. Substituting in this and writing the unemployment rate as $\frac{U}{N} = u$ we get:

$$\dot{u} = q(1 - u) - \theta m(\theta)u \tag{57}$$

This can be rewritten as:

$$\dot{u} = q - (q + \theta m(\theta))u \tag{58}$$

We are in a steady state when $\dot{u} = 0$ implying that:

$$u = \frac{q}{q + \theta m(\theta)} \tag{59}$$
D Deriving the equilibrium sickness benefit pay-out

\[ (1 - U^*) \psi \xi = (1 - U^*) (1 - \psi) \tau w^* + (1 - U^*) \tau \psi \xi + U^* \tau z \]  \hspace{1cm} (60)

By solving for \( \xi \) we get that:

\[ \xi = \frac{\tau}{(1 - \tau) \psi} \left[ (1 - \psi) w^* + z \frac{U^*}{1 - U^*} \right] \]  \hspace{1cm} (61)

Then we substitute in the wage curve:

\[ \xi = \frac{\tau}{(1 - \tau) \psi} \left[ \frac{\gamma y (1 - \psi) [r + q + \theta^* m(\theta^*)]}{(1 + \gamma \tau - \tau) (r + q) + \gamma \theta^* m(\theta^*)} + z \frac{U^*}{1 - U^*} \right] \]  \hspace{1cm} (62)

By breaking out \( \xi \) we can write this as:

\[ \psi \xi + \frac{\tau (1 - \gamma)(r + q) \psi \xi}{(1 + \gamma \tau - \tau) (r + q) + \gamma \theta^* m(\theta^*)} = \frac{\tau}{(1 - \tau)} \left[ \frac{\gamma y (1 - \psi) [r + q + \theta^* m(\theta^*)]}{(1 + \gamma \tau - \tau) (r + q) + \gamma \theta^* m(\theta^*)} + z \frac{U^*}{1 - U^*} \right] \]  \hspace{1cm} (63)

The left hand side can then be written as:

\[ \psi \xi \frac{r + q + \gamma \theta^* m(\theta^*)}{(1 + \gamma \tau - \tau) (r + q) + \gamma \theta^* m(\theta^*)} \]  \hspace{1cm} (64)

By substituting in \( U^* = u^* = \frac{q}{q + \theta^* m(\theta^*)} \) and solving for \( \psi \xi \) we get:

\[ \psi \xi^* = y \frac{\gamma \tau (1 - \psi) [r + q + \theta^* m(\theta^*)]}{(1 - t) [r + q + \theta^* m(\theta^*)]} + z \frac{\tau [(1 + \gamma \tau - \tau) (r + q) q + [(1 - \gamma) (1 - \tau) (r + q) + \gamma q] \theta^* m(\theta^*)]}{(1 - \tau) \theta^* m(\theta^*) [r + q + \gamma \theta^* m(\theta^*)]} \]  \hspace{1cm} (65)