The Labor Market Effects of the Austrian Severance Pay Reform Revisited - A Theoretical Analysis

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Abstract

The paper analyzes the 2002 reform of the Austrian severance payment system towards a regime of individual savings accounts funded through regular firm contributions. We present parsimonious labor market models to capture the fundamental labor market aspects of this specific reform. We show that if firms are credit constrained job creation and job destruction should increase leaving an unambiguous employment effect. We further show that employment reallocation through job-to-job quitters should increase in the new system implying productivity gains from labor reallocation while output is at the same time reduced again because of dampened investment into worker-specific human capital. Concerning this last trade-off, a first-best solution is not attainable in any of the two systems (nor a mixture). A second-best is characterized by a sufficiently small but positive classical severance payment regime.

Keywords: employment protection, severance pay reform, job creation and destruction margins, labor market turnover, credit constrained firms

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1 Introduction

In 2002 Austria saw a fundamental reform of its severance pay system which received a lot of international attention. A classical severance pay regime featuring a direct payment from a firm to a worker in case of a non-worker triggered split was replaced by a system of individual savings accounts. Latter implies that firms have to contribute on a regular basis into a severance insurance funds instead of paying only in case of dismissal. For the worker the consequence is that entitlements to severance pay are not lost in case of a voluntary quit. The reform was expected to have wide ranging labor market implications which we will partially analyze theoretically in this paper. Empirical evaluations of the Austrian severance pay reform were carried out by Hofer (2007) and Hofer et al. (2012). Walther (1999) discusses many implications of the reform from a theoretical perspective although his arguments are hardly formalized. In principle the theoretical effects of a severance pay system are well understood, see e.g. the surveys on employment protection literature by Lazear (1990), Addison and Teixeira (2003) and Skedinger (2011). The novel contribution of this paper is to model this for the specific Austrian case with a comparison of the theoretical effects of the new versus the old system which delivers testable predictions for empirical analyses. In addition we are derive normative results for certain aspects of the severance pay system.

We focus our analysis to direct labor market implications by highlighting two fundamental (stylized) characteristics of the new severance pay system. First, while severance pay used to be paid only if the split was not worker-triggered, workers now always receive severance pay. Second, severance pay was only paid when a worker was actually laid-off, while firms now pay a regular contribution fee and are insured against a severance pay shock. We use two separate parsimonious models to analyze two very important set of aspects of the reform. First, we use a static version of a Diamond-Mortensen-Pissarides model with endogenous job creation and job destruction (see Mortensen and Pissarides, 1994 or Pissarides, 2000) similar to Schuster (2012) to shed light on the trade-off between gains from insurance and the bonding effect. Gains from insurance can occur for liquidity constrained firms that were hiring to little in the old system because of the fear of suffering a severance pay shock in bad times. On the other hand the old system was dampening job destruction by directly linking the payment to the firing decision. In the second part, we focus on the role of the reform on job-to-job transitions and discuss the trade-off between gains from reallocation and incentives to invest into human capital. The new system implies productivity gains from higher reallocation of labor but on the other hand leads to lower firm investment into human capital. There are aspects which we do not cover in our analysis. First, the new account system resembles a fully funded pension pillar, see

Koman et al. (2005). The contributions are administered by an insurance and invested which can have indirect consequences on the labor market through capital markets. This indirect link is excluded from our analysis. Second, it seems that to overall generosity of severance pay was reduced with the adaption of the new severance pay system. The new regulation demands that firms pay a contribution of 1.53 % of the payroll into a severance pay fund. However, the expenditure on severance pay before the reform was higher, about 2.5 % of the total wage bill in 1997 (see Hofer, 2007). In our analysis we isolate the effects of changing the fundamental nature of the severance pay system by assuming an actuarially fair switch between the regimes. A cut in generosity should be thought of as an additional reform that would have to be put on top. Third, there is a literature on the role of severance pay is an unemployment insurance instrument voluntary offered by risk-neutral firms to risk-averse workers, see e.g. Pissarides (2010). These type of voluntary severance packages are not considered in our models where employment contracts are solely characterized by the wage and mandatory severance payment is a policy instrument by the government.

2 Theoretical analysis

This section describes aspects of the Austrian severance payment reform in a stylized form from a purely theoretical perspective, focusing especially on the labor market implications. We concentrate our analysis on the relevant key characteristics of the old and the new severance payment regimes which we define in this context as follows. The *classical severance payment* regime (old system) is characterized by a one-time severance payment S paid by the firm at the moment of a non-worker-initiated split to the worker. In contrast we define the *severance payment insurance* regime (new system) as a system where a firm pays a contribution fee Σ on a regular basis and a worker receives severance payment S independently of how the split is triggered. Changes in the timing of eligibility are neglected. We contrast the implications of those two systems for two different aspects separately. First, we look at the effects on employment and unemployment. This is done by providing a parsimonious model of job creation and job destruction. Naturally, here the focus is put on the decisions of the firm. Second, we discuss the implication of both systems of labor turnover through job-to-job quitters, which in contrast focuses more on the quitting decision of the worker.[1] Further, we analyze the effect of changes in a worker's quitting decision on the human capital investments of their employers.

Both aspects could certainly be modeled in a single framework. We chose to model

[1] In reality one obviously also obverses quitting into unemployment (or non-participation) which we do not address here.

them separately to keep the models as simple as possible in order to highlight the key mechanisms of both regimes.

2.1 Gains from insurance versus the bonding effect

The first aspect concerns the trade-off of the gains from insurance against severance payment shocks for the firm in the new system versus the bonding effect of the old system. The gains from insurance occur only when firms are in some form finance-constrained. In that case in the old system firms could be ex-ante discouraged to hire more workers because there is no insurance against a bad shock like paying severance payment to an unproductive worker who is laid off which exceeds the surplus this firm has earned with this match.[2] On the other hand the new system lacks a direct connection of the lay-off decision of the firm and the financial consequences of paying severance pay. In order to demonstrate the relevance of credit constraints we first present a small theoretical model without and then including these constraints.

2.1.1 A model without credit constraints

We use a parsimonious static Diamond-Mortensen-Pissarides model with a job creation and a job destruction margin similar to Schuster (2012). The horizon of the static model is one period. There is a mass V of simple firms which can make the decision of posting one vacancy. Firms are competitive, which means that there is free entry to the labor market but posting the vacancy entails costs c for a firm. We will assume that V is sufficiently large in order to exclude a situation where the number of actually posted vacancies v is equal to V, i.e. $v < V$. At the beginning of the game firms post vacancies which are matched with unemployed workers according to a matching technology, which captures the fact that search in the labor market is time and cost consuming. Once matched, worker-firm pairs differ in productivity y which is revealed after the match is formed, i.e. they are drawn from the distribution $F(\cdot)$. Depending on the realization of productivity y and the bargained wage w a match is destroyed again. The employment duration before the firing decision can be thought of as having time measure zero while we still capture the important influencing factors concerning the job creation and destruction margin.[3] If an unproductive worker is laid off the firm has to pay a severance payment of size S. In contrast, a contribution to the severance payment insurance system implies payment of Σ in any case, i.e. independently of whether a worker is eventually fired or not. Hence, from perspective of the firm a classical severance payment regime (old system) is $S > 0$

[2] In reality this risk was reduced as severance payment was and still is increasing in tenure.

[3] In comparison to a dynamic model with periodic shocks to the worker-firm specific productivity (e.g. Mortensen and Pissarides, 1994), the shock we model corresponds to the 'inside' shock, i.e. an update of y for an existing worker-firm pair.

and $\Sigma = 0$, while the new system implies $S = 0$ and $\Sigma > 0$.[4] If a worker is not fired production starts (in our interpretation continues) and the firm earns a profit of $y - w$. The following list illustrates the assumed timing. Further assumptions are then explained in the course of solving the model.

Stage 1. A mass 1 of workers starts out as unemployed.

Stage 2. Firms can enter the labor market according to a free entry condition by posting one vacancy each at cost c.

Stage 3. Workers are hired according to a matching technology $\mathcal{M}$ and become eligible to severance payment in case of dismissal.

Stage 4. Firms have to pay a contribution to the severance payment insurance system of $\Sigma \geq 0$.

Stage 5. A value of production y, i.e. a realization of a given random variable Y, is revealed to each firm leading to firing of the most unprofitable workers.

Stage 6. In case of separation firms have to pay severance payment $S \geq 0$. Production is started with the remaining workers, which implies that wage w is paid by the firm in exchange of receiving value of production y.

The model is solved by backward induction.

Wage bargaining implies that workers get a share of the job surplus according to the bargaining weight ω. The wage schedule[5] is then given as

$$w = w_0 + \omega\,(y - w_0) = (1 - \omega)w_0 + \omega y. \tag{2.1}$$

This deserves some explanation. The exogenous outside income is denoted w_0, which can be thought of as home production or unemployment income, etc. However, the specification also nests the case of fixed wages if $\omega = 0$ which reduces the wage equation to $w = w_0$. In this case w_0 has to be interpreted as some exogenously given wage. Further, note that (2.1) does not include any of the two policy instruments S or Σ. The contribution rate Σ is not part of the wage schedule because at the point of bargaining it is already sunk, hence, it is not part of the match surplus at the point of firing. S is missing because of the following argument. Eligibility to severance pay usually does not start with day

[4]Note that in this context S refers to the one-time severance payment done by the firm. Hence, $S = 0$ does not imply that a worker would receive no severance payment. In case of the new system a worker receives the severance payment from an insurance funded by the contribution payments Σ.

[5]This is almost identical to the wage derived from a Nash bargaining game in a dynamic model (see e.g. Pissarides, 2000) with the only difference that a term related to the continuation value is missing.

one but only during the course of employment (even if this phase in our simplistic model is normalized to zero). Hence, in the beginning of the working phase S is not part of the outside option of a worker and hence of the wage, while later it is (especially in the new system when workers are eligible even if they themselves trigger a split). However, in respect of the Austrian labor market we assume an institutional setting that prevents this form of strategic bargaining which would imply that the wage jumps that instant the worker becomes eligible to severance pay. Instead, we assume that bargaining is limited to changes in productivity (in line with the so-called 'Benya-formula') which justifies the specification in (2.1).

Job destruction. A worker is laid off whenever the continuation value of the job, i.e. value of production minus wage, is smaller than the loss from paying severance pay, i.e.

$$y - w < -S \quad \Rightarrow \quad \underline{y} = w - S \quad \Leftrightarrow \quad \underline{y} = w_0 - S/(1-\omega), \tag{2.2}$$

where $\underline{y}$ is the cut-off level for firing. Hence, every job with productivity lower than $\underline{y}$ is destroyed. The job destruction rate consequently is given as

$$F \equiv F(\underline{y}). \tag{2.3}$$

The contribution rate Σ therefore has no influence on the job destruction rate as it is sunk by that point in time. The severance payment S, on the other hand reduces the job destruction rate. In mathematical terms this is

$$\frac{dF}{d\Sigma} = 0 \qquad \frac{dF}{dS} = -\frac{f(\underline{y})}{1-\omega} < 0, \tag{2.4}$$

where $f(\cdot)$ denotes the pdf of $F(\cdot)$.

Proposition 2.1. *The job destruction decision is unaffected by the severance pay insurance premium (Σ), while the job destruction rate decreases in a firm financed severance payment (S).*

Proof. This follows directly from equation (2.4). ■

Job creation depends on the expected profit of a firm which conditional on being matched with a worker is given as follows

$$\pi^e = [y^e - w^e](1-F) - FS - \Sigma \tag{2.5}$$

where y^e denotes conditional expectations of y, i.e. $y^e = E(Y|y > \underline{y}) = \int_{\underline{y}}^{\infty} y\, dF(y)/(1 - F)$. Conditionally expected wage w^e is simply $w(y^e)$. Insert the wage schedule (2.1) evaluated at y^e and eliminate w_0 using (2.2). Rearrange the get

$$\pi^e = (1-\omega)\left[y^e - \underline{y}\right](1-F) - S - \Sigma \tag{2.6}$$

Observe how a rise in the contribution rate decreases conditional expected profits, i.e.

$$\frac{d\pi^e}{d\Sigma} = -1 < 0. \tag{2.7}$$

Further conditional expected profits decrease with the severance payment S

$$\frac{d\pi^e}{dS} = -F < 0. \tag{2.8}$$

Proof. By an envelope argument S has no effect on π^e through changes in $\underline{y}$. In detail, observe that

$$\frac{dy^e}{d\underline{y}} = \frac{f(\underline{y})\left[y^e - \underline{y}\right]}{1-F} > 0. \tag{2.9}$$

Using $d\underline{y}/dS = -1/(1-\omega)$ one can establish that

$$\frac{d\pi^e}{dS} = (1-\omega)\Big[f(\underline{y})\left[y^e - \underline{y}\right] - (1-F)\Big] \cdot \frac{d\underline{y}}{dS} - (1-\omega)f(\underline{y})\left[y^e - \underline{y}\right] \cdot \frac{d\underline{y}}{dS} - 1 \tag{2.10}$$

where parts of the first two terms cancels leaving only $-F$. ∎

We assume that firms can freely enter the labor market and post their vacancies. The more firms enter the labor market the longer they have to wait for a match (or the less likely is an instant match). Hence, the ex-ante homogenous firms post vacancies up to the point where the expected return from filling a vacancy is equal to the costs of posting a vacancy, denoted as c.

$$m^f \pi^e = c, \tag{2.11}$$

where m^f is the probability for a firm of being matched with a worker. This pins down the labor market tightness $\theta \equiv v/1$ and therefore the job creation rate which is given as[6]

$$m \equiv m(\theta) = m\left(\left[m^f\right]^{-1}\left(\frac{c}{\pi^e}\right)\right), \tag{2.12}$$

[6]For an explicit relationship one could consider a typical Cobb-Douglas specification, e.g. $m^f = \mathcal{M}_0\theta^{-\eta}$ and consequently $m = \theta m^f = \mathcal{M}_0\theta^{1-\eta}$. Then labor market tightness is given as $\theta = \mathcal{M}_0^{1/\eta}\left[\pi^e/c\right]^{1/\eta}$ and the job creation rate would be $m = \mathcal{M}_0^{1/\eta}\left[\pi^e/c\right]^{(1-\eta)/\eta}$.

The job creation rate m is increasing in π^e. For a Cobb-Douglas specification as explained in footnote 6 the marginal change is given as

$$\frac{dm}{d\pi^e} = \frac{1-\eta}{\eta}\frac{m}{\pi^e}. \tag{2.13}$$

Consequently, reactions to Σ, S or some x in general can simply be computed using

$$\frac{dm}{dx} = \frac{1-\eta}{\eta}\frac{m}{\pi^e}\frac{d\pi^e}{dx}, \tag{2.14}$$

implying that dm/dx has the same sign as $d\pi^e/dx$. Hence, we have that

$$\frac{dm}{dS} = F \cdot \frac{dm}{d\Sigma} < 0. \tag{2.15}$$

However, one must not conclude that in principle a contribution system is more harmful for job creation than the classical severance payment regime as an actuarially fair conversion between S and Σ is not 1:1 as will be discussed now.

Effects on employment. Employment e is given as the mass of workers which are matched and at the end of the game not laid off, i.e.

$$e = m(1-F). \tag{2.16}$$

This has the expected properties

$$\frac{de}{dm} = (1-F) > 0 \quad \text{and} \quad \frac{de}{dF} = -m < 0, \tag{2.17}$$

i.e. employment is increasing in the job creation rate and decreasing in the job destruction rate. An actuarially fair conversion of the two policy instruments Σ and S is given by the following constraint

$$m\Sigma + mFS = \Omega, \tag{2.18}$$

where Ω is the total amount of severance pay received by workers in the economy. As changes in Σ and S have different effects on the job flow margins and therefore the tax bases we focus on indefinitely small conversions between the instruments keeping Ω constant implies

$$d\Sigma = -FdS. \tag{2.19}$$

Equivalently, one could state that without tax base effects the conversion of 1 euro of insurance premium is equivalent to $1/F > 1$ euros of severance payment in expectation, as 1 euro of insurance premium has to be paid in any case (conditional on matching) while

$1/F$ euros have to be paid only with probability F (conditional on matching).

Proposition 2.2. *Assume firms are* ***not finance constrained****. Given an actuarially fair conversion of insurance premium (Σ) and severance pay (S) both have marginally the same effect on job creation. However, a severance pay mechanism reduces job destruction. Hence, for marginal changes a severance pay system is more beneficial for employment.*

Proof. The relative effect on job creation follows from (2.15), (2.18), proposition 2.1 and (2.17). ∎

The next section will show that the result is not as unambiguous if firms are credit constrained, i.e. when there can profit from the insurance characteristic of the new system.

2.1.2 A model with credit constraints

We now analyze a slightly altered model in which we introduce credit constraints for the firms and analyze the consequence this has for our conclusions concerning the labor market effects of the old versus the new severance payment system. We make the following assumptions.

All assumptions are identical to before except the following. Firms are endowed with initial capital k in a heterogenous way according to the distribution function $G(\cdot)$ defined over the set V, i.e. the mass of firms. We assume that all firms are finance constrained in the following way. They do not create jobs according to expected profits but instead according to a worst-case rule, i.e. only those firms post vacancies that have enough initial assets to survive a worst case outcome as they are not allowed to run into debt and cannot default. This is obviously an extreme form of constraint but it serves to illustrate the main mechanism and is qualitatively robust to milder forms of limitations. For example one could assume that only a share $\chi \cdot V$, with $\chi \in (0, 1)$, faces this constraint which will quantitatively shrink down the impact but does not qualitatively alter our results. The finance constraints imply that job creation might be rationed, i.e. the free entry condition does not hold and the only firms above a certain threshold for initial assets, denoted as $\underline{k}$, post vacancies. Before we discuss this in more detail note that job destruction is unaltered and still given by the equations (2.2) and (2.3) from the previous section.

Proposition 2.3. *The job destruction conclusion from proposition 2.1 is independent of whether firms are finance constrained or not.*

Proof. This directly follows from equations (2.2) and (2.3). ∎

Note that proposition 2.3 is true in our static setting, but not in a dynamic DMP-model like Mortensen and Pissarides (1994). In the dynamic model job destruction also depends on the labor market tightness (which is affected by credit constraints) because finding a new match after a split is part of the outside option. Hence, the job destruction curve is upward sloping in the θ-$\underline{y}$-space implying that a drop in job creation is always slightly compensated by a drop in job destruction. This is not the case in the static model where the job destruction curve is just a horizontal line in the θ-$\underline{y}$-space. However this does not implies any important qualitative restrictions for our analysis.

Job creation can now be limited as firms have no (or limited) access to insurance markets. An extreme but illustrative assumption of the mechanism is that firms have to operate in a way that their initial capital endowment is sufficiently large to cover costs of a worst case scenario. This implies that instead of operating based on expected values, firms have to compute the values of all possible ex-post realizations. In principle one can distinguish four different outcomes. We denote the ex-post resources of a firm as Π.

- No vacancy posted: $\Pi = k$.
- Vacancy posted but not matched: $\Pi = k - c$.
- Matched with a productive worker: $\Pi = k - c + [y - w - \Sigma]$.
- Matched with an unproductive worker: $\Pi = k - c - S - \Sigma$.

Clearly, when we impose a non-negativity constraint on ex-post resources, i.e. $\Pi \geq 0$ one can focus on the last case (which obviously coincides with the third case at the threshold productivity $\underline{y}$). This implies that the cut-off endowment is given as

$$\underline{k} = c + S + \Sigma. \tag{2.20}$$

The number of workers has Lebesgue measure 1, the number of firms (i.e. maximum vacancies) has measure V. Out of V potential vacancies only $v = \theta$ are actually posted which influence the matching probabilities. Let us assume now that the parametric choices imply the following for θ^{fe} which denotes the hypothetical number of vacancies which would be posted in a world without constraints as described in the previous section.

$$\textit{Assumption } 1. \quad \theta^{fe} < V \tag{2.21}$$

$$\textit{Assumption } 2. \quad \theta^{fe} > V\,(1 - G(\underline{k})) \equiv \theta^{fc} \tag{2.22}$$

Assumption 1 was not stated explicitly but already also had to hold in the previous section. Assumption 2 implies that the finance constraint becomes binding, because at most a share of $(1 - G(\underline{k}))$, i.e. the probability of having $k > \underline{k}$, of V will post vacancies.

Job creation is now affected as follows.

$$\frac{dm}{dS} = -\frac{dm}{d\theta} V g(\underline{k}) = \frac{dm}{d\Sigma} < 0, \tag{2.23}$$

where $g(\cdot)$ is the pdf of the distribution function $G(\cdot)$ and $\frac{dm}{d\theta} > 0$ just follows from the specific assumptions concerning the functional form of the matching function.[7] Equation (2.23) states that a euro raised in the severance pay insurance premium (Σ) is equally harmful for job creation as a euro raised in a firm financed severance payment (S). However, as in an actuarially fair conversion for a marginal drop in S, Σ has to be increased by a factor $F < 1$ less in comparison, a classical severance payment regime is more harmful for job creation.

Proposition 2.4. *Assume firms are **finance constrained**. Given an actuarially fair conversion of insurance premium (Σ) and severance pay (S) the latter has a more detrimental effect on job creation. However, a severance pay mechanism also reduces job destruction. Which system is more beneficial for employment is theoretically ambiguous.*

Proof. The relative effect on job creation follows from (2.23) and (2.18). The ambiguity of the employment effect follows from (2.17). ■

To summarize, if firms are not finance constrained the classical severance payment regime (old system) is less harmful for employment than the severance payment insurance regime (new system). However, the effect becomes ambiguous if firms are finance constrained as the old system in comparison implies not only lower job destruction but also lower job creation. Hence, the more prominent finance constraints of firms play a role in an economy the less likely it is that the old system has more positive employment effects than the new system.

2.2 Gains from reallocations versus human capital investment

This section highlights another aspect of the severance payment system reform. In contrast to before we neglect flows in and out of unemployment and focus on the effects of job reallocation within the mass of employed workers, i.e. we look at the workers' quitting decisions leading to job-to-job transitions. Reducing barriers to job reallocation is usually attached to gains in overall productivity. However, we also include the an additional decision margin of the firms concerning human capital investment which will be affected if workers can quit more easily.

[7] For the Cobb-Douglas specification from before we would have $dm/d\theta = (1 - \eta)m/\theta > 0$.

2.2.1 A model of employment reallocation

The model setting is again static considerably different to the previous chapter. The model assumptions are as follows. Because we abstract from job flows in and out of unemployment or non-participation we fix the mass of existing firm-worker matches to e. A firm makes an investment i into worker-specific human capital where they have to take the chance that a worker might quit afterwards into account. The qualitative results should not be altered even if only a part of the human capital investment is worker-specific as long as it is not completely match-specific.[8] Productivity y is linearly separable in a non-stochastic human capital related part and a random idiosyncratic match-specific part, i.e. $y = x(i) + \gamma$. The human capital related part is concavely increasing in the size of the investment. For simplicity we assume that the game starts out with a match-specific part that was drawn from a degenerate distribution with expectation 0, i.e. all matches are ex-ante identical. This implies that we have a symmetric equilibrium in which all firms choose the same human capital investment which is easily tractable.[9]. After investments have been made there is opportunity of reshuffling. The precise mechanism which was modeled to isolate the reallocation from the employment effects is described below. For the moment it suffices to think of the reshuffling as an opportunity for firms to contact other workers which allows them to make another productivity draw from the distribution function $Q(\cdot)$. If the new realization of γ is sufficiently high the new match will be productive enough to pay a sufficiently high (bargained) wage to trigger the worker to switch jobs. However, in the classical severance payment system such a worker-triggered quit implies the loss of entitlement to severance pay. In contrast, in the new system a worker does not lose this entitlement. After the reshuffling phase production occurs and at the end of the period all workers retire and receive their severance pay unless they lost the entitlement. To summarize the game features the following stages.

Stage 1. A mass of e ex-ante identical firm-worker pair exist with idiosyncratic productivity normalized to $\gamma = 0$.

Stage 2. The firm makes an investment decision concerning the human capital of the worker by investing $i \geq 0$.

Stage 3. Reshuffling starts with the worker receiving an alternative job offer from

[8]Investments into match-specific human capital obviously has implications for the quitting behavior. Workers become less prone to quit as the human capital investment related productivity part drives a wedge between the old and the new wage (unless the new firm again makes the same investment). The important difference is that this does not imply socially inefficient quitting because there is no externality which is not taken into account by the workers.

[9]If matches already ex-ante differed in productivity we would have to characterize the change in the distribution of i's resulting from the severance payment reform which is more tedious but hardly adds supplementary insight.

another firm with a new productivity γ drawn from the distribution $H(\cdot)$ which is non-degenerate and has expectation value of 0. Through bargaining this implies also a new wage w_{new} for the outside offer. Afterwards she decides whether or not quit.

Stage 4. If a worker quits she receives the new wage (w_{new}) from the new job, if she stays she receives the old wage (w_{old}). In any case the firm has to pay investment costs and the severance payment insurance premium ($\Sigma \geq 0$) and a wage (either the old or the new wage) while receiving the value of output $y \equiv x(i) + \gamma$. If there is no quit the firm instead has to pay severance pay S.

Stage 5. All workers retire. All workers receive severance pay Σ stemming from the insurance regime (new system). Only the workers how did not quit are entitled to the classical severance pay S.

Before the model is solved by backward induction we explain more carefully the assumption underlying the reshuffling process.

Reshuffling. The mass of e atomic firms can be randomly ordered in a one-dimensional space. The reshuffling is started by a single firm-worker match which is destroyed for an exogenous reason (this worker can be and is dropped from the aggregation as it has measure 0). This starts the reshuffling process. The affected firm has now an empty vacancy which it wants to fill by attracting a worker from another existing firm-worker match. For simplicity we assume that every worker can only receive one outside offer from any other firm in the game. We therefore assume the all firms can perfectly observe which worker have already been contacted. A firm will continue to make offers until a worker is found. The offers relate to a new i.i.d. draw from the distribution function $H(\cdot)$ for every contact. Once a worker is found who is willing to leave her old firm, this will leave another firm without a worker which will then start searching and so on until no worker is left that has not been contacted before. This has the following implications: a) every worker received an alternative offer and has to decide whether or not to quit, b) not every firm will have to search for a new worker (only those where the worker actually decided to quit) and c) the firms who lost a worker can fill their vacancy again with probability 1, except for the very last firm which triggers the reshuffling game to stop. This last firm which has measure 0 is excluded from the analysis which does not affect aggregate results. Quitting probability Q is therefore a measure of job turnover within employment e.

In the process of **wage bargaining** the following wage schedule is derived

$$w = w_0 + \omega\,(y - w_0) = (1-\omega)w_0 + \omega(x(i) + \gamma). \tag{2.24}$$

Again like in the previous section we assume that bargaining is limited to changes in productivity, hence the wage schedules do not directly depend on policy instruments or the human capital investment costs i. As the inital idiosyncratic productivity is $\gamma = 0$ for all matches this implies that in case of not quitting the wage is $w_{old} = (1-\omega)w_0 + \omega x(i)$ while the wage of a new job would be $w_{new} = (1-\omega)w_0 + \omega(x(i) + \gamma)$, where γ is a realization of the random draw from $H(\cdot)$.

The **quitting decision** is driven by the idiosyncratic productivity realizations and independent of the investment decision of the firm because of linearity in the two productivity components. A worker quits a job whenever the following is true

$$w_{old} + \Sigma + S < w_{new} + \Sigma, \tag{2.25}$$

where we assumed that utility is linear. If $\Sigma > 0$ it will be paid to the worker in any case at the end of the game (in retirement) hence it does not influence the quitting decision. The same is true for the human capital investment decision as in symmetric equilibrium all firms invest the same amount which implies that $x(i)$ is the same for all workers. However, the severance payment paid in accordance with the old severance payment system $S > 0$ distorts the quitting decision. After inserting the wages one can rewrite (2.25) as

$$\gamma < \frac{S}{\omega} \quad \Rightarrow \quad \underline{\gamma} = \frac{S}{\omega}, \tag{2.26}$$

where $\underline{\gamma}$ is the indifference productivity which determines the staying rate H and the quitting rate rate Q

$$H \equiv H(\underline{\gamma}) \quad \text{and} \quad Q = 1 - H. \tag{2.27}$$

Clearly, the staying rate is increasing in the classical severance payment (S) while it is unaffected by changes in the payment under the new system (Σ)

$$\frac{dH}{dS} = \frac{h(\underline{\gamma})}{\omega} > 0, \qquad \frac{dH}{d\Sigma} = 0, \tag{2.28}$$

where $h(\cdot)$ is the corresponding pdf of distribution function $H(\cdot)$.

The **investment decision** is derived from solving the firms' profit maximization problem

$$\pi^e = \max_i \left\{-i - \Sigma + (1-H) \cdot [\bar{y} - w(\bar{y})] + H \cdot [x(i) - w_{old}] - S]\right\}, \tag{2.29}$$

where $\bar{y}$ is average value of production. In a symmetric equilibrium we have $\bar{y} = x(i) + \gamma^e$, the important difference is that an individual human capital decision has only an influence on right hand side but not on the average value of production, i.e. from an individual firm's perspective $d\bar{y}/di = 0$. This externality is also the reason why there is underinvestment in human capital. The individual investment decision is therefore given by

$$1 = H(1-\omega)\frac{\partial x}{\partial i} \qquad \Rightarrow i^*_{de} \tag{2.30}$$

Using the implicit function theorem the change in optimal investment behavior w.r.t. the staying rate is

$$\frac{di}{dH} = -\left[H^2(1-\omega)\frac{\partial^2 x}{\partial i^2}\right]^{-1} > 0, \tag{2.31}$$

which follows from the concavity assumption, i.e. $\partial^2 x/\partial i^2 < 0$. With respect to the policy instruments the following can be established

$$\frac{di}{d\Sigma} = 0, \qquad \frac{di}{dS} = -\left[H^2(1-\omega)\frac{\partial^2 x}{\partial i^2}\right]^{-1} \cdot \frac{h(\underline{\gamma})}{\omega} > 0. \tag{2.32}$$

In the next section we will now contrast this with the social optimum.

2.2.2 Social optimum and public policy

The social welfare function simply maximizes total output as workers are risk-neutral. The problem is stated as follows

$$\begin{aligned} &\max_{i,\underline{\gamma}} \quad e\int_{-\infty}^{\underline{\gamma}} x(i)\, dH(\widetilde{\gamma}) + e\int_{\underline{\gamma}}^{\infty} \left[x(i) + \widetilde{\gamma}\right]\, dH(\widetilde{\gamma}) - ei \quad \Leftrightarrow \\ &\max_{i,\underline{\gamma}} \quad x(i) - i + \int_{\underline{\gamma}}^{\infty} \widetilde{\gamma}\, dH(\widetilde{\gamma}). \end{aligned} \tag{2.33}$$

The optimality conditions are

$$-\,q(\underline{\gamma}) \cdot \underline{\gamma} = 0 \quad \Rightarrow \quad \underline{\gamma} = 0, \tag{2.34}$$

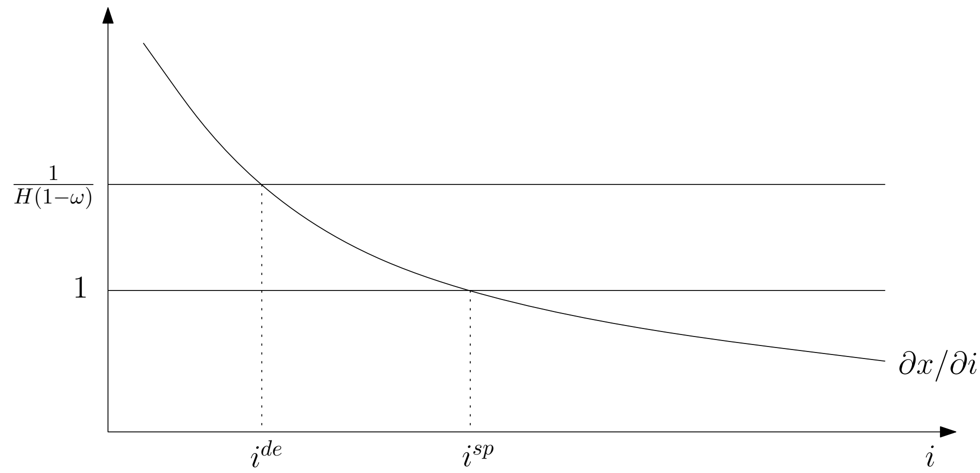
$$1 = \frac{\partial x}{\partial i} \qquad \Rightarrow i^*_{sp}. \tag{2.35}$$

Clearly, when comparing the decentralized investment decision it is revealed that investment is suboptimal and it is so for two distinct reasons. First, it is not optimal as $H < 1$ and underinvestment, i.e. $i^*_{sp} - i^*_{de}$ decreases in H (or increases in Q). Figure 2.1 illustrates the underinvestment.

The second reason for underinvestment stems from the wage bargaining and the fact that investment costs are sunk at the time of bargaining.[10] This underinvestment is repre-

[10]Observe that this form of underinvestment would vanish if investment costs i would be part of the

Figure 2.1: Investment in human capital - the decentralized outcome versus the social planner's solution



sented by the term $(1-\omega)$, i.e. it vanishes when $\omega \to 0$. For our purpose the interesting form of underinvestment is the former one connected to quitting. Observe that the best policy for optimizing human capital investment would therefore be sufficiently high classical severance pay that would completely discourage quitting, hence $H = 1$.

We now turn to the other optimality condition, the one for the optimal quitting behavior in order to reap productivity gains from reallocation (2.34). Optimal reallocation demands that $\underline{\gamma} = 0$ which leads to a positive quitting rate $Q > 0$. Comparing (2.26) with (2.34) reveals that classical severance pay S should optimally be zero. In this case there is no distortion in the quitting decision. Hence, from the perspective of reaping welfare gains from reallocation the quitting rate should optimally be positive.[11]

Proposition 2.5. *The* ***new regime*** *implements the optimal reallocation but leads to underinvestment in human capital. Further, changing the severance pay coverage does not affect the quitting nor the human capital investment decision.*

Proof. This follows from setting $S = 0$ and $\Sigma > 0$ and comparing (2.26) with (2.34) and (2.30) with (2.35). ∎

Proposition 2.6. *The* ***old regime*** *fails to implement optimal reallocation and optimal investment in human capital but can compromise between both inefficiencies. Further, an increase in severance pay coverage leads to an improvement of welfare because of higher human capital investment but to a decrease in welfare because of lower productivity gains from job reallocation.*

joint surplus during the wage bargaining.

[11] As long as $H(\cdot)$ has support above zero, i.e. by excluding that a worker would always be worse of if she accepted a new job.

Proof. This follows from setting $S > 0$ and $\Sigma = 0$ and comparing (2.26) with (2.34) and (2.30) with (2.35). ■

Hence, no policy can implement a first best solution. While changing coverage in the new system is neutral for welfare we can look for an optimal coverage of severance pay in the old system that optimally compromises between encouraging human capital investment and job reallocation. We therefore look for a **second best solution** within the old regime where welfare is optimized w.r.t. S subject to the decentralized equilibrium conditions. S itself has no first order effect on welfare and therefore does not show up in the objective function. The optimization problem is

$$\max_S \; x(i) - i + \int_{\underline{\gamma}}^{\infty} \widetilde{\gamma}\, dH(\widetilde{\gamma}) \tag{2.36}$$

$$\text{s.t. (2.26), (2.27) and (2.30).} \tag{2.37}$$

The first order condition implies that

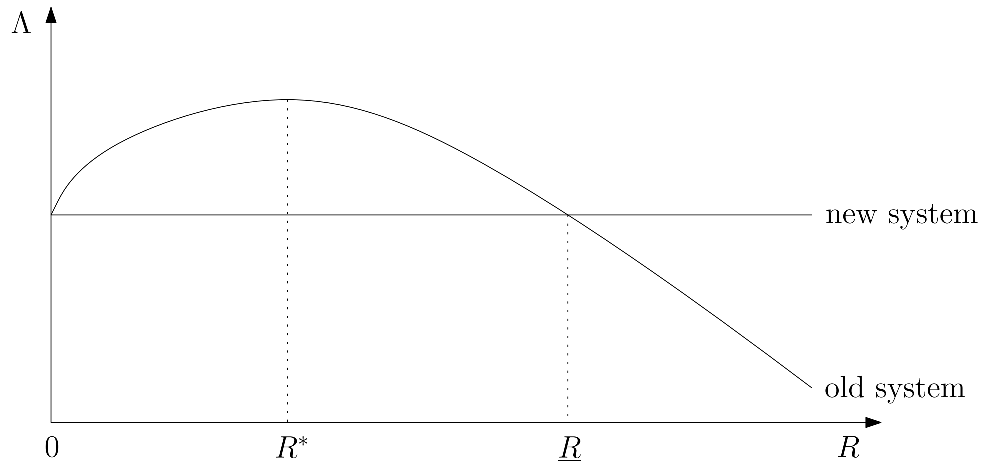
$$\left[\frac{\partial x}{\partial i} - 1\right] \frac{di}{dH}\frac{dH}{dS} - \left[h(\underline{\gamma}) \cdot \underline{\gamma}\right] \frac{d\underline{\gamma}}{dS} = 0. \tag{2.38}$$

Insert (2.26), (2.28) and (2.30) and rearrange to get an implicit relation for optimal classical severance payment S^*

$$S^* = \omega \left[\frac{1 - H(1-\omega)}{H(1-\omega)}\right] \frac{di}{dH} > 0. \tag{2.39}$$

The relation is implicit because the staying rate H is also a function of S^*. Using the fact that $di/dH > 0$ established in equation (2.31) proves that $S^* > 0$. Further observe that $S = 0$ would give the same welfare $\Lambda \equiv x(i) - i + \int_{\underline{\gamma}}^{\infty} \widetilde{\gamma}\, dH(\widetilde{\gamma})$ as the any severance pay coverage in the new system $\Sigma \geq 0$. As S^* this implies that there exists a positive value of classical severance pay that strictly dominates all possible severance coverage options in the new system in welfare/output terms. This is illustrated in figure 2.2 that plots the welfare dependent on severance pay coverage R. In case of the old system this is simply $R = S$, in the new system we define $R = \Sigma$. The figure is drawn under the assumption that the variance of $H(\cdot)$ is sufficiently large such that at a high enough coverage $R > \underline{R}$ the new system outperforms the old regime. As the new system does not hinder to job reallocation the cut-off coverage level $\underline{R}$ obviously decreases in the variance of the new productivity shocks as higher variance implies more possibilities to gain from job reallocation. For $R < \underline{R}$ the old system is preferable and for some $R^* < \underline{R}$ welfare in the decentralized economy is globally maximized. As a disclaimer we have to emphasize that the statement of maximized welfare is obviously reduced to the aspect of human capital

Figure 2.2: Welfare in the new and old system for different levels of severance pay coverage



investment versus job reallocation for a given mass of employment and leaves out other aspects, e.g. the effects on employment as discussed in section 2.1. The next proposition summarizes the main result of this section.

Proposition 2.7. *The exists a positive coverage level of classical severance pay* $R^* > 0$ *where output is maximized in the decentralized economy such that the old severance pay system at that point strictly outperforms the new system independent of the chosen coverage level in the new system. For all coverage levels* $R > R^*$ *the following is true. The higher the coverage level the smaller the output advantage of the old system over the new. If the variance of the distribution of new productivity shocks is sufficiently large the new system will eventually at some coverage level* $\underline{R} > R^* > 0$ *dominate the old system in terms of output.*

Proof. This follows directly from the derivations and the discussion above. ■

3 Conclusions

The paper is analyzing some of the fundamental aspects of the Austria severance pay reform from a theoretical perspective. First, we use a static Diamond-Mortensen-Pissarides model wit job creation and job destruction. If firms are not-finance constrained the classical severance payment system is relatively more employment-friendly. However, if firms are finance constrained the employment effect of the new severance pay insurance system is ambiguous as on one hand job destruction but also job creation are increased. Second, using a static model to capture labor market reallocation through ob-to-job quits for a given employment size we find that output is on one hand increase in the new system through gains from labor reallocation. On the other hand the new system dampens firm investments into human capital which reduces overall production again. Non of the systems can implement a first-best solution in which output is maximized. The second-best solution is described by a positive classical severance payment. However, the larger the generosity of the severance pay provision the lower the relative output advantage of the old system, which can eventually lead to a relative disadvantage versus the new system.

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