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WHY DO COUNTRIES SUBSIDIZE INVESTMENT AND NOT EMPLOYMENT?

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ABSTRACT

The governments of nearly all industrialised countries use subsidies to support the economic development of specific sectors or regions with high rates of unemployment. Conventional economic wisdom would suggest that the most efficient way to support these regions or sectors is to pay employment subsidies. We present evidence showing that capital subsidies are empirically much more important than employment subsidies. We then discuss possible explanations for the dominance of investment subsidies and develop a simple model with unemployment to explain this phenomenon. In our model, unemployment arises due to bargaining between unions and heterogenous firms that differ with respect to their productivity. Union bargaining power raises wage costs and leads to a socially inefficient collapse of low productivity firms and a corresponding job loss. Union-firm bargaining also gives rise to underinvestment. In this framework, it turns out that an investment subsidy dominates an employment subsidy in terms of welfare. The reason is that investment subsidies are a more efficient instrument to alleviate the underinvestment problem and to raise the number of operating firms.

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The governments of nearly all industrialised countries use subsidies to support the economic development of specific sectors or regions with high rates of unemployment. Conventional economic wisdom suggests that the most efficient policy would be to reduce the cost of labour, that is to pay employment subsidies. Empirically, however, governments usually rely on investment rather than employment subsidies. In the debate on these subsidy policies, economists have repeatedly argued that the concentration of public support on investment schemes is inefficient. One example is the case of Eastern Germany, where, in spite of very high rates of unemployment, subsidy programmes almost exclusively support investment. Sinn and Sinn (1993) argue that the public support schemes for Eastern Germany distort the relative price between capital and labour and thus give rise to excessively capital intensive production.[1] They conclude that this policy is suboptimal and that it contributes to the unemployment problem. Begg and Portes (1993) make the same type of argument and conclude that it would be desirable to switch to labour subsidies.[2]

However, while it may well be that investment subsidies are inefficiently high in certain cases, the fact that these subsidies are much more important empirically than employment subsidies seems to be a very general phenomenon. It is therefore unsatisfactory to argue that it simply reflects irrational economic policy decisions. It is the purpose of the present paper to provide an economic explanation for the dominance of investment relative to employment subsidies. We analyse the issue of investment versus employment subsidies in a simple model where unemployment arises due to bargaining between unions and heterogenous firms, which differ with respect to their productivity. Union bargaining power raises wage costs and leads to a socially inefficient liquidation of firms with low productivity and a corresponding loss of jobs. As in Grout (1984), however, union-firm bargaining also leads to underinvestment. In this framework, it turns out that investment subsidies dominate employment subsidies in terms of welfare. The reason is that investment subsidies are a more efficient instrument to alleviate the underinvestment problem and to raise the number of operating firms.

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[1]See also Sinn (1995).

[2]Labour subsidies have also been advocated by Akerlof et al. (1991).

In the following, we proceed as follows. Section 2 provides empirical evidence on the role of employment and investment subsidies in industrialised countries. In section 3, possible explanations for the dominance of investment incentives are discussed. In section 4, we develop the model sketched above. In section five, we compare the effects of investment and employment subsidies. Section 6 concludes.

2. Investment and Employment Subsidies: Empirical Evidence

In this section, we present some empirical evidence about the role of investment and employment subsidies in industrialized countries. Somewhat surprisingly, there are few empirical studies trying to assess quantitatively the relative importance of these two types of subsidies. In the following, we discuss the results of three different studies. Firstly, on the basis of data collected by the OECD (1996), we consider the structure of aggregate general public support to industry in the OECD countries. Secondly, we use a report on regional incentive programmes in Europe (Yuill (1994)) to illustrate the role of capital and employment subsidies in individual European countries. Thirdly, we briefly consider the case of East Germany. In all cases, regional or sectoral subsidies are analysed. Subsidisation of employment and investment is measured relative to the general tax and social security system in the various countries under consideration. Our approach thus identifies how policies for specific sectors or regions are designed.

The most comprehensive study of public support policies is provided by the OECD (1996). This study covers 1552 public support programmes, all aiming at the manufacturing sector, in 24 OECD member countries, the Slovak republic and at the EU level. The study classifies the subsidy programmes, among other things, according to “policy objectives pursued” and “economic activities supported”. In this classification, 40% of all subsidies can be assigned to the groups of employment or investment promoting policies. The remaining 60% mainly comprise research and development and export promotion subsidies, which cannot unambiguously be considered as supporting specifically either employment or investment. The absolute and relative shares of investment and employment subsidies of the remaining 40% of overall subsidies are reported in table 1.

Table 1: Subsidies to Industry in the OECD, Net Cost to Government, Million US-$

Subsidy Type	1989	1990	1991	1992	1993
Investment	13468,1	16376,6	18945,1	19103,5	17754,7
(%)	**86,6**	**87,1**	**87,2**	**88,5**	**88,9**
Employ-ment	2084,1	2422	2783,4	2482,3	2208,4
(%)	**13,4**	**12,9**	**12,8**	**11,5**	**11,1**
Total	15552,2	18798,6	21728,5	21585,8	19963,1
(%)	100	100	100	100	100

Source: OECD (1996), Own Calculations

It turns out that, between 1989 and 1993, around 87% of these subsidies were directed towards the support of investment, whereas only about 13% were devoted to supporting employment. In absolute terms, expenditure on investment-promoting measures in the OECD was thus roughly six times as high as expenditure on programmes promoting employment.[3] Even in relation to all subsidies (including the 60% which cannot be classified), programmes promoting investment thus absorbed 36% of overall public support. The authors of the study therefore conclude: "...this (the large share of investment subsidies, C.F./B.H.) shows the extent to which manufacturing investment is an engine of economic development and job creation." (OECD(1996), p. 9.).

Another study which sheds some light on the relative empirical importance of employment and investment subsidies is Yuill et al. (1994). This study is more limited by the fact that it only covers regional policies in a sample of EU countries and only the three or four most important programmes for each country. The study has the advantage, however, that the data is country

[3]The absolute level of subsidies reprted in table 1 seems fairly low. This reflects that the OECD calculates subsidies according to its "net cost to government" (NGC) concept. "NGC calculates the difference between the cost of funding a programme in any given year and the revenue generated for the public budget by the same programme in any given year." (OECD(1996), p. 12). Of course, such an approach raises various methodological problems that cannot be discussed here.

specific.

Table 2: Regional Incentives in Europe

Country[1]	Capital Subs.	Labour Subs.	No Classif.
Belgium	X		
France			X [2]
Germany	X		X [3]
Greece	X		
Ireland	X		X
Italy	X	X[4]	
Luxemburg	X		
Netherlands	X		
Portugal	X		X
Spain	X		
Sweden	X	X	
United Kingdom	X	X	

Source: Yuill et al. (1994)
(1) Among the EU member states, the table excludes Denmark, which has abolished its regional incentive programs in 1991. Austria and Finland are not covered by the report.
(2) These are a) the Regional Policy Grant, which is a per job subsidy combined with a ceiling for grants as a percentage of investment and b) the Local Business Tax Concession; the base of the Local Business tax includes both the firm`s assets and the payroll.
(3) As part of a general investment grant program which is a capital subsidy, there is a "special investment grant available for the creation of "high-grade-jobs".
(4) Yuill et al. (1994) report no labour subsidies for Italy. The Social Security Concessions, however, have to be considered in our view as an incentive reducing the cost of labour.

Table 2 shows that, while in nearly all countries under consideration, investment promotion plays an important role, significant programmes directly subsidising labour are reported for three countries only. Table 3 shows the expenditure shares of investment and employment subsidies. Here, it turns out that, even in those countries which do have employment subsidies, expenditure on investment promotion is much more important, with the exception of Italy.

Table 3: Regional Subsidies (Millions, nat. Currencies)

Subsidy Type:[1)]	Capital Share (%)	Capital	Labour	No Class.	OverallValue
Belgium	100	8362	-		8362
France	n.a.[2)]	-	-	1278	1278
Germany	55,5	2876	-	2308	5184
Greece	100	77161	-	-	77161
Ireland	80,4	140	-	34	174
Italy	33,5	3251750	6455333	-	9707083
Luxemburg	100	1281	-	-	1281
Netherlands	100	222	-	-	222
Portugal	n.a.[2)]	10140	-	n.a.[2)]	10140
Spain	100	84547	-	-	84547
Sweden	78,5	803	220	-	1023
United Kingdom	94,2	251	15	-	266

Source: Yuill (1994), Own Calculations
1) Average per Year 1988-1991
2) Not applicable or no data on expenditures available.

European Regional Policies thus also place emphasis on investment rather than employment subsidies.

An important case of a substantial government subsidy programme, which has received considerable attention among economists, is the transformation of Eastern Germany after reunification. Table 4 gives an overview over the budgetary cost of the most important subsidy programmes for Eastern Germany.[4] Here, it turns out that over 90% of the expenditure takes the form of investment subsidies whereas programmes directly promoting employment are almost negligible. The figures given above mainly include subsidies for on-the job training and support for the employment of special groups, such as immigrants of German origin from Eastern

[4]Only the three quanitatively most important measure are covered. For a more detailed account of the investment support policies in Eastern Germany see Sinn (1995).

Europe. Explicit and general wage subsidy programmes aiming at reducing the cost of labour in Eastern Germany do not exist.

Table 4: Subsidies in Eastern Germany 1991-1994, Million DM

Subsidy Type	1991	1992	1993	1994
Investment[1)]	9920	12080	15430	15500
(%)	**95,6**	**92,4**	**91,7**	**91,0**
Employ-ment[2)]	451,6	990,6	1392,5	1541,3
(%)	**4,4**	**7,6**	**8,3**	**9,0**
Total	10371,6	13070,6	16822,5	17041,3
(%)	100	100	100	100

Source: Sachverständigenrat/German Council of Economic Advisers (1995/96), Own Calculations.
1) Includes: Investment Allowances according to the Laws on Corporate and Personal Income Taxation, Investment Grants on the basis of the program "Common Task: Improvement of Regional Economic Structure" (Gemeinschaftsaufgabe: Verbesserung der regionalen Wirtschaftsstruktur) and Special Depreciation Provisions according to the "Regional Support Law" (Fördergebietsgesetz).
2) Includes: Promotion of "Starting to Work", Subsidies for On-the Job Training, Diverse Labour Market Integration Programmes.

Eastern Germany is thus a striking example for the dominance of investment subsidies relative to measures directly promoting employment.[5]

In summary, the empirical evidence given in this paragraph suggests that the preference for investment over employment subsidies is a reasonably general phenomenon. This raises the question of how the dominance of investment subsidies can be explained. Possible answers to this question will be discussed in the following paragraph.

3. The Investment Subsidy Puzzle

[5]Finally, it is interesting to note that a similar picture emerges for Canada where, in the Atlantic Provinces, investment is subsidized while no direct measures for supporting employment are undertaken (see the Report of the Technical Committee on Business Taxation (1998)).

One reason for the higher level of investment subsidies may simply be that employment and investment subsidies have different underlying policy objectives. While employment subsidies clearly have the function to raise employment, investment may be subsidised for reasons not directly related to labor markets. Most importantly, investment subsidies are also an instrument to raise economic growth. The endogenous growth literature has identified various externalities arising from private investment in physical capital. These externalities may justify investment subsidies.[6] Investment grants may also be a result of tax competition, where national governments offer fiscal incentives to attract internationally mobile capital.[7]

It is a shortcoming of these explanations, however, that they call for broadly-based investment incentives. Most existing programmes, in contrast, are highly selctive and are typically designed to favour investment in certain sectors or regions. Moreover, the preferred regions are often those suffering from high rates of unemployment. One prominent example is, of course, Eastern Germany; another one is the Atlantic Provinces in Canada. The officially declared objective of subsidy programmes also typically includes job creation. This raises the question of why governments prefer investment to employment subsidies, given that unemployment is almost always a key problem of the supported regions. In fact, in a standard labour market model with rigid wages, it is a straightforward exercise in welfare analysis to show that employment subsidies strictly dominate investment subsidies (Begg and Portes (1993), Sinn (1995)). The policy implications of this theoretical benchmark case stand in marked contrast to the policy actually pursued by most governments. In the following, we will try to resolve this investment subsidy puzzle.

Before turning to our own model, we should briefly discuss two other possible explanations. First, many practitioners argue that, while there may be a theoretical case for wage subsidies, they are much more difficult to administer than investment subsidies. A second possible

[6]See, e.g. Barro and Sala-i-Martin (1995).

[7]One might also argue that investment subsidies are a result of rent seeking. Goolsbee (1997) argues that a large part of the benefits of investment tax incentives in the U.S. have gone to suppliers of capital goods through higher prices rather than investing firms. The producers of capital goods are certainly in the position to form a pressure groups that may influence tax policy.

explanation has been given by Torsvik (1993). In the model of his paper, employment subsidies represent a first-best policy. The first-best, however, cannot be implemented because there is a time inconsistency problem. In his model, the government cannot commit to future payments of employment subsidies promised to firms in the present. Investment subsidies, in contrast, are paid immediately and therefore serve as a substitute for employment subsidies. This argument, however, has the weakness that it does not explain why the government should not pay out labour subsidies immediately as well, based on future employment as announced by the firms, and raise taxes later in case the firm does not fulfill its employment obligations.

In what follows, we develop a model which gives a different explanation. In this model, union-firm bargaining distorts both employment and investment decisions and leads to an inefficiently low number of active firms. To correct these distortions, the government may use investment and employment subsidies. Our key result is that investment subsidies strictly dominate employment subsidies in this framework.

4. A Model to Explain the Investment Subsidy Puzzle

In this section, we develop a model which will be used to provide an explanation for the investment subsidy puzzle. We proceed as follows. In 4.1., the basic structure of the model is presented. In 4.2., we discuss the benchmark case of a competitive labour market. In 4.3., we derive the equilibrium with union-firm bargaining.

4.1. The Basic Structure of the Model

There are two groups of agents in the economy: entrepreneurs and workers. Each entrepreneur owns a firm which produces a homogenous numeraire good. The output of firm i is

$$Y(K_i;L_i)+zmy_i \qquad \textbf{(1)}$$

where K_i and L_i are capital and labour employed by firm i. Y is a strictly concave production

function satisfying the standard neoclassical properties. Y(K;L) is common to all firms whereas μ_i denotes a firm-specific random output shock; z is a positive parameter. For the economy as a whole, μ is assumed to be uniformly distributed with support [0;1]. For analytical convenience, we normalize the number of entrepreneurs and firms to unity.

Each entrepreneur is endowed with K_0 units of capital. This endowment may be used either for investment in the firm or for investment in a foreign capital market where it yields the riskless exogenous interest rate r. The entrepreneurs are assumed to be risk-neutral to rule out potential effects of risk-aversion on investment behaviour. In addition, we asssume that K_0 is always large enough to finance investment in the firm. While this assumption is not critical for our results, it simplifies the analysis by ruling out problems arising from the potential bankruptcy of firms.

Investment, employment and production decisions in this model are not taken simultaneously but in a sequence of three stages. At the first stage, the firms choose the optimal level of investment. At the time of this decision, μ_i is unknown. As firms are ex ante identical, all firms choose the same capital stock, which will be denoted by (K). At the second stage, the labour market transactions take place. At this time, μ_i is still unknown. The number of workers (L) and the wage rate (w) will therefore also be the same for all firms. Note that this particular timing of decisions, where labour market contracts are made after investment decisions have been taken, follows the sequence in the seminal paper of Grout (1984).

At the third stage, μ_i is finally revealed. Given μ_i, each firm has to decide whether to take up production or to close down. If the firm produces, the entrepreneur earns $Y(L;K)+z\,\mu_i-wL$. If the firm is closed down, the workers become unemployed and the capital goods are sold. The liquidation of the firm yields $(1+r_0)K$. We assume $r>r_0>-1$, such that, while the liquidation value of the firm is strictly positive, the return from selling the firm`s assets is less than the market rate of interest. A firm i therefore chooses to produce if and only if

$$Y(K_i;L_i)+zmy_i-wL\geq(1+r_0)K_i \qquad \textbf{(2)}$$

Given that firms may be liquidated, it is natural to ask whether labour contracts chosen before the revelation of μ_i can be renegotiated at this final stage. To keep the analysis simple, we rule

out this possibility here. In section 4.4., however, we will show that none of our results is affected if renegotiation is allowed for.

While the entrepreneurs in our economy take investment decisions and manage the firms, there is a second group of agents, the workers. The overall number of workers is N and each worker inelastically supplies one unit of labour such that L denotes the number of workers employed in each firm. Workers have no initial endowment with capital. A worker of a firm which is not liquidated earns the wage rate w while a worker who finds no job or is employed by a firm which is closed down has an income c, which may also be interpreted as the value of leisure. The workers are assumed to be risk neutral, i.e. they only care about their expected income.

In the following section, we first analyse the benchmark case where no trade union exists, i.e. the case of a competitive labour market. In section 4.3., we then assume that the workers form trade unions, such that labour contracts are subject to bargaining between unions and firms.

4.2. Equilibrium with Competitive Labour Markets

We determine the competitive equilibrium by solving the model recursively, beginning with the third stage. We first note that, for given values of K, w, and L, (2) determines the critical shock level μ^c. All firms where the productivity shock turns out to be lower than the critical level μ^c are liquidated because the operating profits (the l.h.s. of (2)) is lower than the liquidation value (the r.h.s. of (2)). As all firms in the economy are assumed to be distributed in the interval $\mu \in [0;1]$, a corner solution where no firms are liquidated with $\mu^c=0$ may arise. Note that μ^c is also the ex ante probability that a firm will be closed down at the third stage. Finally, as we have normalised the overall number of firms in the economy to unity, μ^c may also be interpreted as the number of firms which will be liquidated at stage three; hence, the number of producing firms will be $1-\mu^c$.

Consider now the second stage. In a competitive labour market, each firm chooses labour input to maximize net revenue $Y+z\mu_i-wL$ if production is taken up. This simply yields the marginal productivity condition $Y_L=w$. The equilibrium wage rate obviously satisfies $w \geq c$. The wage rate may exceed c if L=N in the equilibrium, i.e. no voluntary unemployment exists. For the following

analysis, it is useful to concentrate on the case of an interior solution, where the labour market clears with L<N and w=c. The labour market equilibrium can then be described by

$$Y_L = c \qquad \textbf{(3)}$$

We finally turn to the first stage where the firms choose K. For the analysis of investment behaviour, suppose for the sake of the argument that all firms decide to take up production, that is $\mu^c=0$. We show below that this conjecture is indeed correct. Expected profits of a firm i are thus given by

$$Y(K_i;L_i) + zE(my_i) - wL - (1+r)K_i$$

where $E(\mu_i)=1/2$ is the expected value of μ_i. The first-order condition for K is

$$Y_K = 1 + r \qquad \textbf{(4)}$$

It remains to be shown that $\mu^c=0$ holds in the equilibrium. To demonstrate this, one can use (3) and (4) to write (2) as

$$Y(K;L) - Y_K K - Y_L L + (r - r_0)K + zmy_i > 0$$

which implies that all firms will take up production. We thus have

$$my^c = 0 \qquad \textbf{(5)}$$

Equations (3)-(5) and the condition w=c completely describe the competitive equilbibrium, i.e. the equilibrium values of L,K,w and the liquidation probability μ^c. The competitive equilibrium also represents a first-best outcome in this economy and will serve as a benchmark for the following analysis.

4.3. The Equilibrium with Union-Firm Bargaining

We now introduce a trade union which represents the interests of the workers. As the number of firms is normalised to unity, we also consider one representative trade union. In line with the assumption of risk-neutral workers, it is the objective of the union to maximize expected labour income of workers (U) which is given by

$$U = cN + (1 - my^*)(w - c)L \qquad \textbf{(6)}$$

where μ^* now denotes the probability that a firm is closed. Of course, the union essentially has the function to raise the wage rate above the competitive wage c.

The labour market is now characterized by union-firm bargaining, which takes place at stage two in the sequence of decisions. As in Grout (1984), the union is assumed to know the capital stock (K). The (representative) union and the (representative) firm bargain over wages (w) and employment per firm (L). The outcome of this bargaining process specifies a wage-employment contract which determines w and L.[8]

The expected profit (P) of the representative firm in stage 2, where the capital stock is given, can be written as

$$P = \int_{my^*}^{1} (Y(K;L) + zmy - wL)dmy + \int_{0}^{my^*} (1 + r_0)Kdmy \qquad \textbf{(7)}$$

The first term in (7) captures the profit of a firm which takes up production. The latter occurs with probability $(1-\mu^*)$. The second term is the revenue from a liquidation, which occurs with probability μ^*.

As in much of the literature on unionised labour markets, we derive the outcome of union-firm bargaining using the Nash-Bargaining solution (Nash, 1950). The Nash maximand is

$$\Omega = \beta \log(U - U_0) + (1 - \beta)\log(P - P_0) \qquad \textbf{(8)}$$

[8]Recall that neither the firm nor the union knows μ_i at this stage. This means that differentiated wage-employment contracts are ruled out at this point in time. We shall return to this issue in section 4.4. below.

where ($0 \leq \beta \leq 1$) is the relative bargaining power of the trade union. With $\beta=1$, we have the polar case of a monopoly union; $\beta=0$ is the opposite case, where the employers hold all bargaining power. U_0 is the union`s outside option, that is the income level which would be attained if negotiations fail, that is $U_0=cN$.[9] Accordingly, the outside option of the firm (or, more precisely, the entrepreneur) is simply the liquidation value: $P_0=(1+r_0)K$.

As in the preceding section, the equilibrium in this economy is derived recursively. At the third stage (where w,L and K are given), (2) allows to determine the ex ante probability μ^* that a firm will be closed down. More formally, μ^* is given by

$$Y(K;L)+zmy^*-wL \geq (1+r_0)K \qquad \textbf{(9)}$$

where (9) holds as a strict equality if $\mu^*>0$.

Consider now the second stage, where the bargaining between the union and the firm determines w and L (for a given K). The bargaining parties rationally anticipate that their wage/employment decisions will affect the liquidation probability as in equation (9). The bargaining problem is thus to maximize (8) subject to the constraint (9):

$$\max_{(w;L;my^*;\lambda)} \Lambda=\Omega+\lambda(Y(K;L)+zmy^*-wL-(1+r_0)K)$$

where λ is the multiplier for constraint (9) in the Lagrangean Λ. The first-order conditions can be written as:

$$L: \quad \beta+\frac{(1-\beta)}{(P-P_0)}(1-my^*)(Y_L-w)L+\lambda(Y_L-w)L=0 \qquad \textbf{(10a)}$$

[9] Another possible approach would be to consider a dynamic framework along the lines of Layard, Nickell and Jackman (1991, chapter 2), where the outside option of the union is a weighted average of unemployment benefits and wages in other firms. In the standard efficient bargaining model, this assumption avoids the outcome that employment is as high as or even higher than in the case of competitive labour markets. In our model, however, this is avoided by the introduction of firm heterogeneity.

We focus on an interior solution for μ^* with $\mu^*>0$ such that (9) is binding with $\lambda>0$ at the optimum. Below, we will derive a sufficient condition for $\mu^*>0$. As a first result, one can see

$$w: \quad \beta-\frac{(1-\beta)}{(P-P_0)}(1-my^*)(w-c)L-\lambda(w-c)L=0 \qquad \textbf{(10b)}$$

$$my^*: \quad \beta+\frac{(1-\beta)}{(P-P_0)}(1-my^*)(Y+zmy^*-wL-(1+r_0)K)-\lambda z(1-my^*)=0 \qquad \textbf{(10c)}$$

from (10a) and (10b) that

$$Y_L=c \qquad \textbf{(11)}$$

The bargaining solution implies that employment in the producing firms is efficient. Using (10b), (10c) and the (binding) constaint (9), one can now derive

$$L(w-c)=\frac{\beta}{2}(Y+z-cL-(1+r_0)K) \qquad \textbf{(12)}$$

The term L(w-c) can be interpreted as the rent the union achieves in the bargaining process. This rent simply turns out to be the fraction $\beta/2$ of the surplus generated by the most productive firm in the economy (the term on the right-hand side of (12)). A monopoly union ($\beta=1$) would capture half of this surplus. If the union has no bargaining power ($\beta=0$), its rent is zero.

Consequently, for a given capital stock, and if the union has some bargaining power ($\beta>0$), the wage rate under union-firm bargaining will always exceed the wage rate in a competitive labour market. This affects the probability of a firm to be liquidated. To see this, consider the least productive firm in the economy, that is the firm j with $\mu_j=0$. This firm will be closed if

$$Y(K;L)-cL-(1+r_0)K-(w-c)L<0$$

The sum of the first three terms is strictly positive.[10] If w=c, firm j will never be closed, which confirms our result for the competitive labour market, where we have shown that $\mu^c=0$. If w>c, however, the entrepreneur may prefer to close firm j. Using (12) and making some rearrangements shows that firm j is liquidated if and only if

$$\frac{2-\beta}{\beta}(Y(K;L)-cL-(1+r_0)K) < z \qquad \textbf{(13)}$$

We assume that (13) is satisfied, which also ensures that we have an interior solution, i.e. that $\mu^*>0$ holds in the equilibrium.[11] It is now also straightforward to derive the probability that a firm will take up production $(1-\mu^*)$:

$$1-my^* = \frac{2-\beta}{2}+\frac{2-\beta}{2}\frac{1}{z}(Y(K;L)-cL-(1+r_0)K) < 1 \qquad \textbf{(14)}$$

Notice that $(1-\mu^*)$ is also the number of firms which will take up production in the equilibrium with union-firm bargaining. For a given K, it thus turns out that union-firm bargaining leads to a decline in the number of operating firms relative to the equilibrium with a competitive labour market. This undersupply of firms constitutes the key source of inefficiencies associated with non-competitive labour markets in this model: a firm i will take up production if $Y(K;L)+z\mu_i-wL-(1+r_0)K\geq 0$. From a welfare point of view, however, it is desirable to produce as long as $Y(K;L)+z\mu_i-cL-(1+r_0)K\geq 0$. The undersupply of operating firms also induces an inefficiently low level of employment in the economy because, for a given K, less workers are employed than would be socially optimal. Notice also that the reason for this unemployment is the inefficiently low number of firms while the level of employment withing each individual producing firm is efficient since $Y_L=c$. These results can be summarised as

Proposition 1:

If there is union-firm bargaining, and if the union has some bargaining power ($0<\beta\leq 1$),

1. employment in the operating firms is efficient but

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[10]This follows from the fact that $Y-cL=Y-Y_LL>Y_KK$ and, as will be shown in the following analysis, $Y_K\geq 1+r>1+r_0$

[11]Of course, this also implies that we have to assume $\beta>0$ in what follows.

2. the number of operating firms and, hence, employment for the economy as a whole is inefficiently low.

Proof: See above.

So far, we have discussed stages two and three, where we have derived the equilibrium values of L, w and μ^* for a given K. For further use, we rewrite these variables as functions of K. Straightforward comparative statics reveal:

$$\frac{\partial L}{\partial K} = -\frac{Y_{KL}}{Y_{LL}} \tag{15}$$

$$\frac{\partial w}{\partial K} = \frac{\beta}{2}\frac{(Y_K - (1+r_0))}{L} + \frac{Y_{KL}}{Y_{LL}}\frac{(w-c)}{L} \tag{16}$$

and

$$\frac{\partial my^*}{\partial K} = -\frac{1}{z}\frac{2-\beta}{2}(Y_K - (1+r_0)) \tag{17}$$

On the basis of the results for stages two and three, we may now discuss investment behaviour at stage one. The firm anticipates the effect of the capital stock on the bargaining outcome, i.e. L, w and μ^*, and maximizes expected profits (I) over K:

$$\max_K \qquad I = \int_{my^*}^{1} (Y(K;L) + zmy - wL)dmy + \int_{0}^{my^*} (1+r_0)Kdmy - (1+r)K \tag{18}$$

We can now immediately state

Proposition 2:

If there is union-firm bargaining, and if the union has some bargaining power ($0<\beta\leq 1$) the capital stock is inefficiently low.

Proof:

The first-order condition of the investor`s problem can be written as[12]

$$(1-my^*)\frac{2-\beta}{2}(Y_K-(1+r_0))+(1+r_0)-(1+r)=0 \qquad \textbf{(19)}$$

which directly implies that we have

$$Y_K-(1+r_0)=(r-r_0)\frac{2}{(2-\beta)}\frac{1}{(1-my^*)}>0$$

in the equilibrium. Rewriting (19) yields

$$Y_K=1+r+(\frac{\beta}{2}+my^*)(Y_K-(1+r_0)) \qquad \textbf{(20)}$$

which shows that the marginal productivity of capital now exceeds (1+r) for $\beta>0$. Relative to the first-best, investment is thus inefficiently low. Q.E.D.

Underinvestment occurs because the firms take into account that the benefit of an increase in the capital stock is partly captured by the unions via the bargaining process.[13] To summarize, the equilibrium which emerges under union-firm bargaining is thus characterised as follows. While employment in the operating firms is efficient, there is underemployment for the economy as a whole, because the number of operating firms is inefficiently low. There is also a suboptimal level of investment. The magnitude of these distortions depends on the relative bargaining power of the trade union.

4.4. An Extension: Renegotiation of Labour Contracts

[12]For the second-order condition see the appendix.

[13]It is straightforward to show that the union`s rent, L(w-c), increases in response to higher investment. This effect is at the heart of the analysis in Grout (1984). The effect of unionisation on investment is also studied in Van der Ploeg (1987), Anderson and Devereux (1988), and Devereux and Lockwood (1991).

So far, we have excluded that wage-employment contracts may be renegotiated at stage three. Allowing for renegotiation would imply that wage-employment contracts are now effectively chosen at the third stage, after the productivity shock μ_i is revealed. We assume that the realization of μ_i is private information of firms. Consider now how wage-employment contracts are determined in this situation. To keep things simple, we focus on the case of a monopoly union, with $\beta=1$. As before, the union seeks to maximize expected income of its members in (6). It also has to take into account constraint (9), which may now be seen as a participation constraint. Since the firm knows the realization of μ_i, it is natural to think that the union would now use differentiated wage employment contracts inducing the firm to reveal its type. To understand the nature of this problem, assume that the union offers two wage-employment contracts which we denote by $(w_j;L_j)$ and $(w_k;L_k)$. As long as a firm operates, it will choose, e.g., contract j if

$$Y(K;L_j)-w_jL_j>Y(K;L_k)-w_kL_k$$

and vice versa. This choice, however, is independent of the firm`s productivity shock $\mu_i$. The firm always chooses the contract where the cash flow term Y(K;L)-wL is highest. Note that this is a consequence of the assumption that the productivity shock is additive. Differentiated wage-employment contracts therefore do not allow the union to infer the firm`s true productivity. The optimal policy of the union is thus to offer a uniform wage-employment contract, such that a pooling equilibrium always emerges.[14] Formally, the union maximizes (6) subject to (9). Of course, the solution to this problem is (12) with $\beta=1$. This also implies that the results derived in section 4.3. do not change if we allow for renegotiation. In what follows, we therefore return to the original model.

5. Employment versus Investment Subsidies

The preceding analysis has shown that trade union power gives rise to employment and investment distortions and welfare losses. There is thus a potential role for welfare-enhancing

[14]In the terminology of agency theory, the union`s problem is a case where the firm`s iso-profit curves in the w-L-space do not satisfy the single-crossing property, such that a pooling equilibrium emerges.

government interventions. Since all agents are risk-neutral, we use aggregate surplus as a welfare criterion. This surplus (R) can be written as

$$R = \int_{my^*}^{1} (Y(K;L) + zmy - cL)dmy + \int_{0}^{my^*} (1 + r_0)Kdmy - (1 + r)K \qquad \textbf{(21)}$$

In the present section, we introduce two policy instruments. A capital tax (or, if negative, a subsidy) denoted by t and a payroll tax (or subsidy) which we denote by τ. In the appendix, we integrate these two taxes/subsidies into our model and again derive the equilibrium under union/firm bargaining, as in section 4.3.

It is straightforward to show that, considered separately, and assuming lump sum financing, the introduction of both subsidy types would raise welfare. This is not particularly surprising. It is the purpose of this paper, however, to compare the efficiency of employmnent and investment subsidies. In order to make this comparison, we therefore assume that, if an investment subsidy is to be paid, it has to be financed by a tax on labour, and vice versa. The government budget constraint is thus

$$\int_{my^*}^{1} (tK + \tau wL)dmy = 0 \qquad \textbf{(22)}$$

Analysing the effect of the two subsidies/taxes on investment, employment, the number of firms and welfare leads to the following results:

Proposition 3:
If there is union-firm bargaining, and if the union has some bargaining power ($0<\beta\leq 1$), introducing an investment subsidy financed by a labour tax
1. raises the capital stock in the operating firms,
2. has an ambiguous effect on overall employment
3. raises the number of operating firms and
4. raises welfare.

Proof: See the appendix.

Intuitively, these results may be explained as follows. First of all, it is surprising that there is no unambiguous decline in employment per firm (and overall employment). The reason is that the higher capital stock c.p. raises employment and thus counteracts the negative effect of the higher labour tax. It is theoretically possible that employment in the existing firms increases, in spite of the higher labour tax. This occurs if c approaches zero (see equation (A.15) in the appendix). The reason is that the labour tax is partly a tax on the worker`s rents, which are a consequence of union power.

The reason why welfare increases is best understood by considering the combined effect of the investment subsidy and the labour tax on the number of operating firms. Ceteris paribus, an increase in the labour tax would reduce the number of firms while the capital subsidy has the opposite effect. The key point is now that, on balance, the number of firms increases. This also raises investment and ensures in this model that the overall welfare effect of the labour tax financed capital subsidy is positive.

6. Conclusions

It is the purpose of this paper to find an explanation for the empirical observation that governments prefer investment to employment subsidies in policies aiming at the support of regions or sectors with high rates of unemployment. We have compared investment and employment subsidies in a model where union-firm bargaining gives rise to unemployment by reducing the number of active firms in the economy. It turns out that, while no unambiguous conclusions can be drawn for the relative effectiveness of the two subsidies in promoting employment, investment subsidies dominate employment subsidies in terms of welfare. It may therefore be misleading to argue that the preference for investment incentives reflects suboptimal economic policy decisions.

Appendix:

In this appendix, we derive the equilibrium under union-firm bargaining with the subsidies/taxes t and τ. For $\mu^{*}>0$, the marginal firm is now characterized by the condition:

$$Y(K;L)+zmy^{*}-tK-(1+\tau)wL-(1+r_0)K=0 \qquad \textbf{(A.1)}$$

Expected profits of the representative firm (P) are now

$$P = \int_{my^{*}}^{1}(Y(K;L)+zmy-tK-(1+\tau)wL)dmy+\int_{0}^{my^{*}}(1+r_0)Kdmy \qquad \textbf{(A.2)}$$

The objective function of the union does not change. The bargaining solution now yields the following equations:

$$Y_L=(1+\tau)c \qquad \textbf{(A.3)}$$

and

$$L(w-c)(1+\tau)=\frac{\beta}{2}(Y(K;L)+z-cL(1+\tau)-(1+r_0+t)K) \qquad \textbf{(A.4)}$$

The investor`s objective function is

$$I = \int_{my^{*}}^{1}(Y(K;L)+zmy-tK-(1+\tau)wL)dmy+\int_{0}^{my^{*}}(1+r_0)Kdmy-(1+r)K \qquad \textbf{(A.5)}$$

The first-order condition of the investor`s problem becomes

$$\frac{\partial I}{\partial K}=(1-my^{*})\frac{(2-\beta)}{2}(Y_K-(1+r_0+t))+1+r_0-(1+r)=0 \qquad \textbf{(A.6)}$$

where we have used

$$\frac{\partial L}{\partial K}=-\frac{Y_{KL}}{Y_{LL}}>0 \qquad \textbf{(A.7)}$$

and

$$\frac{\partial my^*}{\partial K} = -\frac{1}{z}\frac{2-\beta}{2}(Y_K-(1+r_0+t))<0 \qquad \textbf{(A.8)}$$

For later use, we note that the second-order condition requires

$$\frac{\partial^2 I}{\partial K^2} = \frac{1}{z}\frac{(2-\beta)^2}{4}(Y_K-(1+r_0+t))^2+(1-my^*)\frac{(2-\beta)}{2}(Y_{KK}-\frac{Y_{KL}^{\ 2}}{Y_{LL}})<0 \qquad \textbf{(A.9)}$$

which we assume to hold. The equilibrium is thus characterized by equations (A.1), (A.3), (A.4) and (A.6). We now derive the effect of a simultaneous change in t and τ, departing from an equilibrium with t = τ=0. A change in t and τ which keeps the budget balanced implies

$$dtK = -d\tau wL \qquad \textbf{(A.10)}$$

Totally differentiating equations (A.3), (A.4), (A.6), and using the total differential of (A.1) and dτ=-dtK/wL yields

$$dL = -\frac{1}{Y_{LL}}(Y_{LK}dK+\frac{K}{L}\frac{c}{w}dt) \qquad \textbf{(A.11)}$$

$$dL(w-c)+dwL = \frac{\beta}{2}(Y_K-(1+r_0+t))dK+\frac{2-\beta}{\beta}(1-\frac{c}{w})Kdt \qquad \textbf{(A.12)}$$

and

$$\frac{\beta-2}{2}[dmy^*(Y_K-(1+r_0+t))+(1-my^*)(dt-(Y_{KK}dK+Y_{KL}dL))]=0 \qquad \textbf{(A.13)}$$

Equations (A.11)-(A.13) determine dL, dK and dμ* as functions of dt. We thus get

$$\frac{dK}{dt} = \frac{2-\beta}{2}[(1-my^*)(1+\frac{Y_{KL}}{Y_{LL}}\frac{K}{L}\frac{c}{w})+\frac{1}{z}\frac{(2-\beta)}{2}(Y_K-(1+r_0+t))(1-\frac{c}{w})K]1/\frac{\partial^2 I}{\partial K^2}<0 \qquad \textbf{(A.14)}$$

where we assume

$$1+\frac{Y_{KL}}{Y_{LL}}\frac{K}{L}\frac{c}{w}>0$$

to hold. For this condition to be satisfied it is sufficient to assume a homogenous production function with decreasing returns to scale. For the effect on employment per firm, we get

$$\frac{dL}{dt}=-\frac{1}{Y_{LL}}(Y_{LK}\frac{dK}{dt}+\frac{K}{L}\frac{c}{w}) \qquad \textbf{(A.15)}$$

which is ambiguous but becomes positive if c is small. For μ^* (remember that the number of operating firms is $(1-\mu^*)$, we have

$$\frac{dmy^*}{dt}=\frac{1}{z}\frac{(\beta-2)}{2}((Y_K-(1+r_0+t))\frac{dK}{dt}-(1-\frac{c}{w})K)>0 \qquad \textbf{(A.16)}$$

Equations (A.14)-(A.16) prove parts 1-3 of proposition 3. The welfare effect is derived by differentiating equation (21). It is easy to check that, in the equilibrium, we have

$$\frac{\partial R}{\partial L}=0;\ \frac{\partial R}{\partial K}>0;\ \frac{\partial R}{\partial my^*}<0$$

This implies

$$\frac{dR}{dt}=\frac{\partial R}{\partial K}\frac{dK}{dt}+\frac{\partial R}{\partial my^*}\frac{dmy^*}{dt}\ <\ 0 \qquad \textbf{(A.17)}$$

which completes the proof of proposition 3.4.Q.E.D.

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