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**Conference Paper**

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39th Congress of the European Regional Science Association: "Regional Cohesion and Competitiveness in 21st Century Europe", August 23 - 27, 1999, Dublin, Ireland

**Provided in Cooperation with:**

European Regional Science Association (ERSA)

*Suggested Citation:* Ostbye, Stein (1999) : Should Norway give up regional employment subsidies?, 39th Congress of the European Regional Science Association: "Regional Cohesion and Competitiveness in 21st Century Europe", August 23 - 27, 1999, Dublin, Ireland, European Regional Science Association (ERSA), Louvain-la-Neuve

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# Should Norway give up regional employment subsidies?

## An economic analysis of Case E-6/98, Norway versus ESA

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Date: June 25, 1999

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### Abstract

There has been disagreement between Norway and the EFTA Surveillance Authority (ESA) concerning the continued use of regional employment subsidies. ESA considers subsidies to firms in the economic base sector of assisted areas to be incompatible with the state aid rules of the European Economic Area (EEA). The principal view of the Norwegian Government is that implicit regional employment subsidies in the form of differentiated payroll taxes is part of the overall tax system and central to labour market policy. Since the State retain the power of exercising both taxation and labour policy under the EEA Agreement, the payroll tax system is outside the competence of ESA. In this paper, the case is discussed from an economic point of view. Likely consequences of changing the system are discussed within a conceptual model in the new economic geography tradition where the centre-periphery structure is partly endogeneous.

*Key words:* International law; Economic geography; Regional labour subsidies

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### 1. Introduction

The EFTA Surveillance Authority (ESA) decided July 2 1998 (Decision No. 165/98/COL) that the Norwegian system of regionally differentiated social security contributions involves state aid incompatible with the Agreement on the European Economic Area (the EEA Agreement). The decision is fully supported by the European Commission (Commission's observations in Case E-6/98 and Dec. No. 165/98/COL p. 3). The Norwegian Government has contested the decision and applied for annulment to the EFTA Court. At time of writing, on May 20 1999, the Court dismissed the application (for details on the judgement, see **Error! Bookmark not defined.**).

The system of regionally differentiated social security contributions paid by employers is an implementation of implicit regional labour subsidies. To appreciate the substantial importance of the case, it is necessary to understand that labour subsidies represent the main instrument of Norwegian regional policy. According to estimates from a study commissioned by ESA, total benefits in 1994 were 4473 million 1994-NOK (Hervik, 1996). Admittedly, this estimate

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<sup>\*</sup> E-mail: **Error! Bookmark not defined.**

exaggerates the cost savings to the firm for two reasons: all firms are assumed to pay the highest rate instead of the more relevant revenue neutral flat rate. It is difficult to understand why the widely accepted conventional methodology of comparative studies on tax systems has not been followed here (see, e.g., Hamilton, 1999). Second, it is assumed that the subsidy is not shifted on to the employees at all. This question is discussed further below.

Maybe even more important than the estimated magnitude of the benefit, is the symbolic political importance attached to the issue. Recommending the ratification of the EEA Agreement, the Government wrote to the Parliament (Proposition No. 100, 1991-92, p. 376): “The Government’s opinion is that the regional differentiation of employers’ social security contributions can and shall be continued.”

The purpose of this paper is to present an economic analysis of the case. Although, by now, the court has ruled in favour of ESA and dismissed the Norwegian application for annulment, we may still ask how reasonable the judgement is from an economic point of view and suggest some answers to the likely consequences.

In the next section (Section 2) a brief outline of the Norwegian system, the modifications of the system requested by ESA, and the economic arguments of the two sides are presented. In Section 3 a simplifying model in the new economic geography tradition, suitable for a formal discussion of the effects of modifying regional policy, is suggested. Section 4 to 8 present the model in more detail. Partial and general equilibrium solutions under alternative assumptions are presented in Section 9 to 11. Section 12 concludes.

## **2. Description**

Compulsory social security contributions levied on employers were introduced in 1966 (Act of 17 June 1966 no. 12), but it was not until 1975 that the rate paid was regionally differentiated (Ot. Prp. No. 12, 1974-75). When the system was first implemented in January 1976, there were 3 tax zones with tax rates ranging from 14 to 17 per cent, replacing the previous flat rate of 16.7 per cent. For practical reasons, differentiation was linked to place of residence of the employee, not the location of work place. The tax base was the gross salary or the payroll. In principle, the system remains unchanged, but today there are 5 zones with tax rates ranging from zero to 14.1 per cent. It is estimated that a flat rate of 12.6 per cent would generate the same revenues (Application for annulment to the EFTA Court, the Government of Norway, September 2 1998, p. 3).

Already at this point there are several remarks that need to be made. Since this is in effect a differentiation of payroll tax rates, there will be carry over effects. As is well known from the economic literature on tax incidence, a tax formally levied on the employer may de facto serve as a tax on the employee (Hamermesh, 1993). If we for the moment ignore carry over effects, there will be cost advantages for firms hiring labour from assisted areas compared to the previous flat rate system. Insofar as these firms compete internationally, they will get a competitive advantage in relation to foreign rivals. However, equally important from an international point of view, the firms hiring labour from central areas will get a competitive disadvantage. In sum, it may therefore very well be that foreign firms competing in the same markets will be better off with a tax neutral system of differentiation than no differentiation although there may be losers as well as winners.

According to ESA, several amendments have to be made in order to make the system compatible with the EEA Agreement. Most notably, subsidies are in principle not to be granted to firms with no alternative location (Dec. No. 165/98/COL, p.21). No alternative location is identified as natural resource based sectors like extractive industries and hydroelectric power stations. Specifically ESA lists the following sectors (ibid., p.29):

- “- enterprises engaged in Production and distribution of electricity (NACE 40.1)
- enterprises engaged in Extraction of crude petroleum and gas (NACE 11.10)
- enterprises engaged in Service activities incidental to oil and gas extraction excluding surveying (NACE 11.20)
- enterprises engaged in Mining of metal ores (NACE 13)
- enterprises engaged in relation to the extraction of the industrial minerals Nefeline syenite (HS 2529.3000) and Olivine (HS 2517.49100)”

In the regional science literature, we find the idea that economic activities in a region can be divided into an economic base sector exporting its output to the world outside, and a non-basic sector serving the region (see, e.g. Armstrong and Taylor, 1985, ch. 1.2).<sup>1</sup> For peripheral regions the world outside is often far away in a literal sense. In the standard Weber-Lösch model of location, firms choose location in order to economise on transport costs. Hence, the location of an economic base sector in a peripheral region far from the output market, reveals that transport costs of a locally available input are so high that commercial firms have no alternative but to locate at the source.

Now, there may be exceptions. For some firms located in peripheral regions, distance to the market may be of minor importance. Examples are firms within the telecommunication industry as well as service firms relying on modern telecommunications for market access and perhaps even firms in the transport industry. When transport costs do not matter much, cheap labour may be sufficient to choose a remote location. The ESA decision is in effect covering this possibility as well, since apart from the industry groups referred to above, the following groups are also requested to pay the highest rate (Ibid, pp.29-30):

- “- enterprises with more than 50 employees engaged in Freight transport by road (NACE 60.24)
- enterprises engaged in the Telecommunication sector (NACE 64.20)
- enterprises having branch offices established abroad or otherwise being engaged in cross-border activities related to the following sectors, namely, Financial intermediation (NACE 65), Insurance and pension funding (NACE 66), and services auxiliary to financial intermediation (NACE 67), with the exception of branch offices only providing local services.”

On basis of this, I think that the analytical distinction between an economic base and a non-basic sector may serve as a useful taxonomy. Although there are some economic base industries allowed to benefit from a lower rate, it is reasonable to argue that by and large the

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<sup>1</sup> The idea of an economic base has recently been revisited by Anthony Venables, interestingly within the same tradition as the model to be presented here (Venables, 1993). Venables suggests that the original idea, entirely pragmatic, can be based upon economic theory.

ESA decision amounts to request that economic base sectors covered by the EEA Agreement pay the full rate, whereas non-basic sectors may continue to pay the reduced rate.<sup>2</sup>

The principal view of the Norwegian Government is that the differentiated payroll tax system is part of the overall tax system and central to labour market policy. Since the State retain the power of exercising both taxation and labour policy under the EEA Agreement, the payroll tax system is outside the competence of both ESA and the Commission.

Although the Government emphasises the significance of the scheme for reducing unemployment in assisted areas, the reason why this is of particular importance in the Norwegian case is not explained. It is an interesting point here of considerable importance to the issue. The Norwegian labour market is exceptional at least in one respect: The highly centralised bargaining institution is well alive and even strengthened in opposition to the more general trend that national industrial relations systems appear to be moving towards greater decentralisation (Marginson and Sisson, 1998, pp. 509-512). This peculiarity is recognised as one of the most important factors explaining the relative success of Norwegian economic policy as measured by unemployment rates compared to many member states of the European Union. The importance attached to centralised bargaining is shown by the fact that the Government has until recently been very reluctant to give up the fixed exchange rate policy in spite of considerable pressure towards an exchange rate regime targeted at price stability. The decisive argument seems to have been that a fixed exchange rate regime imposes discipline on the bargaining parties by making them responsible for the consequences of the outcome. In our context, the most interesting point about the centralised bargaining system is that, if unchecked, the producer wage rate in peripheral areas is higher than the market clearing rate. Demand for labour falls short of supply and there is unemployment that would not have arisen in a more decentralised system. The other side of regional convergence in income for the employed (the insiders) is regional divergence in employment opportunities for the unemployed (the outsiders). The regionally differentiated payroll tax system may be essential in compensating for this inefficiency.

### 3. Conceptual model

Let us partition the European Economic Area into three regions: Northern Norway ( $n$ ), southern Norway ( $s$ ), and the European Union ( $u$ ). To a first approximation we may consider  $n$  to be the assisted area benefiting from a lower payroll tax rate than  $s$ . According to ESA, close to 70 percent of total benefits accrue to  $n$  (Dec. No. 165/98/COL, p.6). To a first order of approximation we may also ignore the small economies of Liechtenstein and Iceland, and consider the EEA to consist of Norway and the EU, as noted by Baldwin et al. (1995). We may say more than merely stating that we have three regions and impose some structure on the classification along at least two dimensions. Home markets increase as we move from  $n$  by  $s$  to  $u$ . Population is 0.51 mill., 3.85 mill., and 372.26 mill. We also know that transport costs between  $n$  and  $u$  is higher than either between  $n$  and  $s$  or  $s$  and  $u$ . In the formal model to be used, I will abstract from differences in marked size, but retain distance as an explanatory factor.

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<sup>2</sup> In addition to the industry groups listed, ESA also mentions production of ECSC steel and shipbuilding which have a particular status.

In each of the three regions there is an economic base sector, the  $B$  sector, and a non-basic sector, the  $A$  sector. To simplify, I assume that the  $B$  sector produces only final goods, while the  $A$  sector only produces intermediates. This means that we abstract from interregional trade in intermediates. Technology is assumed identical in the three regions. The  $B$  sector produces by means of  $B$  skilled labour and intermediates from the  $A$  sector. The consumers distinguish the products from the  $B$  sectors of the three regions by origin only. Hence, output from different firms of the same region is homogeneous. The firms are price takers in the output market and use a constant to scale technology. The  $A$  sector produces differentiated intermediates by means of a single input called  $A$  skilled labour. Due to fixed set up costs there are internal increasing returns to scale. The market structure is monopolistic competition.

$B$  skilled labour is immobile, whereas  $A$  skilled labour is mobile between  $n$  and  $s$ , except from in the very short run. We do not allow retraining. Following the new economic geography tradition, regional equilibrium is obtained when perceived real wage of mobile labour is the same in all feasible locations. We are going to consider two alternative institutional arrangements in the labour market. First we will consider a competitive outcome in all labour markets where supply equals demand. Next, we will look at a situation believed to be more in line with the stylised facts of wage determination in Norway. A sector specific common wage rate for  $s$  and  $n$  in the economic base sector is determined through central bargaining. In case the bargaining wage is below the market clearing wage, wage drift sufficient to clear the market is allowed at the firm level. The centrally bargained wage rate is a mark up over the average competitive wage rate and constitute a floor so that wages are rigid downwards. In this way, involuntary regional unemployment may arise in the peripheral region. The  $A$  sector labour market is assumed to always clear.

Using this conceptual set up we are going to consider what happens when we introduce a tax neutral regionally differentiated payroll tax/subsidy in Norway. We consider two alternatives: an equal tax/subsidy across industries in accordance with the present scheme and a subsidy on  $A$  skilled labour in  $n$  only in accordance with the ESA decision. The performance of the alternatives are judged by reference to indicators, representing different economic aspects: market shares of  $n$ ,  $s$  and  $u$  representing the competitive aspect, presumably of foremost concern to the ESA and the EU Commission, and unemployment, income and diversity in  $n$  representing regional policy aspects of concern to regional policymakers in Norway and elsewhere.

#### 4. Consumers

Consumers have identical preferences regardless of occupation and location of residence. This is of course not very realistic, but convenient. Let us assume that the corresponding aggregate expenditure system can be written

$$s_{ij} = \frac{p_{ij} y_{ij}}{\sum_i p_{ij} y_{ij}} \quad (1)$$

Greek letters are parameters,  $s_{ij}$  is aggregate expenditure share in region  $j$  of the good produced in region  $i$ ,  $p_{ij}$  is delivered price and  $y_{ij}$  is quantity of the good. For the expenditure shares to add to unity,  $\sum_i s_{ij} = 1$ . Everybody supplies one unit of labour inelastically, receiving  $v_j/t_{jA}$  and  $w_j/t_{jB}$  depending on skills. The producer wage rate in sector  $A$  is  $v_j$  and in the  $B$  sector  $w_j$ , whereas  $t_{jA}$  and  $t_{jB}$  are the payroll tax factors (see Holmlund, 1989, p.98). Individual expenditure systems for  $A$  skilled and  $B$  skilled consistent with (1) are

$$\begin{aligned}
p_{ij} y_{ij}^{hA} &= \mathbf{a}_i v_j / t_{jA}, \\
p_{ij} y_{ij}^{hB} &= \mathbf{a}_i w_j / t_{jB}, \quad i, j = n, s, u.
\end{aligned} \tag{2}$$

Hence, preferences are homothetic.

The present scheme of differentiated payroll tax rates may be imposed by setting

$$t_{nA} = t_{nB} \equiv t_n, t_{sA} = t_{sB} \equiv t_s, t_{uA} = t_{uB} \equiv 1. \tag{3}$$

The amendments requested by ESA mean

$$t_{nB} \neq t_{nA} \equiv t_n, t_{sA} = t_{sB} = t_{nB} \equiv t_s, t_{uA} = t_{uB} \equiv 1. \tag{4}$$

Here, no pay roll tax rates have been used as reference by setting the payroll tax factor equal to unity in region u. In the remaining part of the paper I restrict generality of the payroll tax system to the two schemes (3) and (4). If tax neutrality is to hold, we must have

$$r_{An}(1 - t_{An}) + r_{Bn}(1 - t_{Bn}) = r_s(t_s - 1). \tag{5}$$

Aggregate income in the A sector in region n is given by  $r_{An} = m_n v_n / t_{An}$ , and aggregate income in the B sector,  $r_{Bn} = l_n w_n / t_{Bn}$ . Here,  $m_j$  and  $l_j$  denote the number of A skilled and B skilled in region j. Subsidies mean that the payroll tax factor is below unity in the assisted region and/or sector, and above unity in the non-assisted area and/or sector.

Delivered prices are in general different from mill prices because of transport costs. Following von Thünen (1826) and Samuelson (1952), I assume only  $y_{ij}$  units arrive when  $t_{ij} y_{ij}$  units are shipped. Hence,  $t_{ij}$  represent transport costs. The relationship between delivered prices and mill prices are

$$p_{ij} = t_{ij} p_i, \quad i, j = n, s, u. \tag{6}$$

I assume symmetry,  $t_{ij} = t_{ji}$ , that  $t_L \equiv t_{nu} > t_{su} = t_{ns} \equiv t_s$ , and ignore domestic distribution costs,  $t_{ii} = 1$ .<sup>3</sup>

Realistically, market shares should depend on income and relative prices. The model suggested implies that market shares in value are constant, independent of both income and relative prices. This is not a desirable property *per se*, but a simplifying assumption. We are working on a more general model with quasi homothetic preferences (Muelbauer, 1975), but the results are not yet available.

## 5. The economic base sector

The economic base sector in a specific region consists of a large number of firms with identical constant returns to scale technology. Skipping indices for region in this and the following Section, the unit cost function for a firm is written

$$\ln(c/y) = \mathbf{b}_0 + \mathbf{b}_w \ln w + \mathbf{b}_q \ln q, \quad \mathbf{b}_w + \mathbf{b}_q = 1. \tag{7}$$

Here,  $w$  is the wage rate paid by producers,  $q$  is a price index of inputs from the non-basic sector,  $c/y$  is unit cost, and the Greek letters again parameters. The price index,  $q$ , is defined by

$$q = \left( \sum_k q_k^{1-s} \right)^{\frac{1}{1-s}}, \quad s > 1, \tag{8}$$

<sup>3</sup> Martin and Rogers (1995a and 1995b) discuss trade effects of regional aid with distribution costs.

where  $q_k$  is the price paid for input  $k$ , and  $\mathbf{s}$  is the elasticity of substitution between any pair of inputs. The primal of (7) is Cobb-Douglas,  $\ln y = \mathbf{b} + \mathbf{b}_w \ln l + \mathbf{b}_q \ln z$ , with

$\mathbf{b} \equiv -(\mathbf{b}_0 + \mathbf{b}_q \ln \mathbf{b}_q + \mathbf{b}_w \ln \mathbf{b}_w)$ , whereas the primal of (8) is CES,

$$z = \left( \sum_k z_k^{\frac{s-1}{s}} \right)^{\frac{s}{s-1}}. \text{ Here } z \text{ is a quantity index of intermediates and } z_k \text{ is the quantity of input } k.$$

This technology has several attractive properties: a) The cost function is separable in  $w$  and  $q$ , b) costs decrease since productivity increases by the number of inputs from the non-basic sector, and c) no input from the non-basic sector is essential. Property a) implies that the cost minimising firm may proceed in two steps: first, it may choose how much labour,  $l$ , and aggregate input,  $z$ , to use conditional on any output level,  $y$ . Second, conditional on the optimal level of  $z$ , it may choose how much to use of the different inputs from the non-basic sector,  $z_k$ . Property b) means that increased specialisation in the non-basic sector rather than subdivision of labour within a single firm, raises productivity. Property c) implies that the degree of specialisation within any region is endogenous.

Applying Shephard's lemma to the two steps, from (7) we obtain the cost shares for  $l$  and  $z$ ,

$$\begin{aligned} wl / c &= \mathbf{b}_w \\ qz / c &= \mathbf{b}_q \end{aligned} \quad (9)$$

and from (8) we obtain sub cost shares

$$q_k z_k / q = (q_k / q)^{1-s} \quad \forall k. \quad (10)$$

We may write (10) as  $-\ln z_k = \mathbf{s}(\ln q_k - \ln q)$  for any  $k$ , including  $k=s$ . Differentiating logarithmically w.r.t.  $q_s$ , we obtain the demand elasticity,

$$\mathbf{e} \equiv \frac{d(-\ln z_s)}{d \ln q_s} = \mathbf{s} \left( 1 - \frac{q_s z_s}{q} \right) \quad (11)$$

When specialisation increases, the sub cost share for input  $s$  goes to zero and the demand elasticity is simply equal to the elasticity of substitution.

The level of output is determined by assuming that profits are zero due to free entry and exit.

## 6. The non-basic sector

The non-basic sector, the  $A$  sector, is also assumed to consist of firms with identical technology, but this time increasing returns to scale internal to the firms because of set up costs. The cost function for firm  $k$  is written,

$$b_k = (z_k V_1 + V_0) v \quad (12)$$

Here,  $b_k$  is total costs and  $v$  is the producer wage rate prevailing in the non-basic sector. The primal to (12) is  $z_k = (m_k - V_0) / V_1$ , where  $m_k$  is labour input. Marginal cost is  $V_1 v$  and the set up cost is  $V_0 v$ . With internal economies of scale, there must be some kind of imperfect competition to obtain market equilibrium. Following most of the literature in the new economic geography tradition, let us assume that market structure is monopolistic competition. The first order condition for profit maximising is



$$q_k \left( 1 - \frac{1}{e_k} \right) = V_1 v. \quad (13)$$

Assuming specialisation is sufficient to substitute  $\mathbf{s}$  for  $\mathbf{e}_k$  (cfr. eq. (11)), the profit maximising price for each differentiated product is equal to a constant mark up over marginal cost,

$$q_k = \frac{\mathbf{s}}{\mathbf{s} - 1} V_1 v. \quad (14)$$

Monopolistic competition implies that profits vanish in equilibrium,

$$q_k z_k - b_k = 0. \quad (15)$$

Substituting for  $q_k$  from (14) and  $b_k$  from (12), we obtain the equilibrium output,

$$z_k = \frac{V_0 (\mathbf{s} - 1)}{V_1}. \quad (16)$$

If we set  $V_0$  and  $V_1$  in such a way that  $V_1 \equiv 1/V_0 - 1 \equiv \mathbf{s} - 1$ , we may write

$$q_k = \mathbf{s}v, \quad z_k = 1/\mathbf{s}, \quad m_k = 1. \quad (17)$$

In order to fully characterise the sector, what remains is the degree of specialisation or the diversity as measured by the number of available products and the equilibrium wage rate. This is also the number of firms since it is not profitable for two firms to produce the same product, and by the normalisation, (17), it is also the number of labour units employed in the sector. We turn to these issues next, as we look at the labour markets in the economy.

## 7. Labour markets

I have assumed that people inelastically supplies one unit of labour each, that they are either  $A$  skilled or  $B$  skilled and that they cannot be retrained. The number of  $B$  skilled people in each region is fixed,  $\bar{l}_n, \bar{l}_s, \bar{l}_u$ . So is the number of  $A$  skilled in region  $u$ ,  $\bar{m}_u$ , whereas region  $n$  and  $s$  share a common pool of mobile  $A$  skilled workers,  $\bar{m}$ . We must have

$$m_u \leq \bar{m}_u, \quad l_u \leq \bar{l}_u, \quad m_n + m_s \leq \bar{m}, \quad l_n \leq \bar{l}_n, \quad \text{and} \quad l_s \leq \bar{l}_s. \quad (18)$$

Mobile workers do not consider amenities and locate wherever perceived real wages are highest. In spatial equilibrium perceived real wages in the  $A$  sector in region  $n$  and  $s$  must be equal. Workers observe their nominal wage rates in alternative locations and calculate real wages on basis of information on regional consumer price indices,  $cpi_j$ ,  $j = n, s$ . In equilibrium we must then have

$$\ln(v_n / t_{nA}) = \ln(v_s / t_{sA}) + \ln(cpi_n / cpi_s), \quad (19)$$

The consumer price index of region  $j$  is assumed to take the multiplicative form

$$cpi_j = \prod_i (t_{ij} p_i)^{s_{ij}}. \quad (20)$$

In the very short run I assume that even  $A$  skilled labour cannot move, in which case I replace (18) and (19) by

$$m_u \leq \bar{m}_u, \quad l_u \leq \bar{l}_u, \quad m_n \leq \bar{m}_n, \quad m_s \leq \bar{m}_s, \quad \bar{m}_n + \bar{m}_s = \bar{m}, \quad l_n \leq \bar{l}_n, \quad l_s \leq \bar{l}_s. \quad (21)$$

By (17), we know that the number of firms in the  $A$  sector is equal to the number of labour units. Hence,

$$\ln(k_u) = \ln(m_u), \quad \ln(k_s) = \ln(m_s), \quad \ln(k_n) = \ln(m_n) \quad (22)$$

We also know by (17) that  $q_k$  is equal for all  $k$  in one region. Using (8) and (22), we may write

$$\ln(q_i) = \frac{1}{1-s} \ln(m_i) + \log(s) + \log(v_i), \quad i = n, s, u. \quad (23)$$

Turning to the  $B$  sector, by (9) we have

$$\ln(l_i) = \mathbf{b}_0 + \ln(\mathbf{b}_w) - \mathbf{b}_q \ln(w_i) + \mathbf{b}_q \ln(q_i) + \ln(y_i), \quad i = n, s, u. \quad (24)$$

Let us start out by looking at the very short run under labour market clearing so that we have full employment, i.e., all the restrictions given by (21) are binding. We may use (23) and (24) to solve for equilibrium wage rates in both sectors in all regions,  $v_n^*$ ,  $v_s^*$ ,  $v_u^*$ ,  $w_n^*$ ,  $w_s^*$ , and  $w_u^*$ , conditional on  $A$  sector product price indices,  $q_n$ ,  $q_s$ , and  $q_u$ , and  $B$  sector output,  $y_n$ ,  $y_s$ , and  $y_u$ .

When we allow mobility, (19) is valid, along with (23) and (24). When (18) is binding, we may use the three equations to solve for equilibrium wage rates conditional on the same set of variables as before and the consumer price indices of region  $n$  and  $s$ .

Under the alternative wage determination regime with centralised bargaining in the  $B$  sector, universal market clearing in the labour markets do not hold in general. Let us use the monopoly union model, where the union maximises utility as a function of the consumer wage and employment, subject to labour demand (see, e.g., Oswald, 1985). Assuming a utilitarian union, the bargaining consumer wage rate,  $\underline{w}$ , is obtained from  $\text{Max}_w \{U(w)(l_n + l_s)\}$ . The utility function will be fully specified later on. When wage drift eliminates upward pressure, the consumer wage rates in sector  $B$  in region  $n$  and  $s$  are  $\max[w_j^*/t_{jB}, \underline{w}]$ . In order to find the solution to this problem, as well as the unconditional solutions under universal market clearing, we need the full general equilibrium solution of the model. Let us therefore move on to the product markets.

## 8. Product markets

Since  $z_k$  according to (17) is equal to  $1/s$  and  $k_i$  is equal to  $m_i$ , aggregate supply from the  $A$  sector in region  $i$  is

$$z_i = m_i \frac{s}{s-1} / s \quad (25)$$

whereas demand is obtained from (9). Equating supply and demand, the market clearing condition is therefore

$$\frac{s}{s-1} \ln(m_i) = \mathbf{b}_0 + \ln(\mathbf{b}_q) + \ln(s) + \mathbf{b}_w \ln(w_i) - \mathbf{b}_w \ln(q_i) + \ln(y_i), \quad i = n, s, u. \quad (26)$$

In the  $B$  sector, we know that profits vanish in equilibrium,

$$\log(p_i) = \mathbf{b}_0 + \mathbf{b}_w \log(w_i) + \mathbf{b}_q \log(q_i), \quad i = n, s, u. \quad (27)$$

With free trade for  $B$  sector goods we must have balance-of-payments equilibrium,

$$\sum_{i, i \neq j} s_{ij} r_j = \sum_{j, i \neq j} s_{ij} r_j, \quad i, j = n, s, u. \quad (28)$$

Adding up implies that only two of the three equations of (28) are independent. Hence, we have one degree of freedom and may choose one of the variables as numéraire, say  $B$  sector wage rate in region  $u$ ,  $w_u \equiv 1$ , and arbitrarily drop one of the restrictions that is redundant, say the balance-of-payment restriction for region  $u$ .

Adding (26) and (28) to (23) and (24), when (21) is binding, we can find equilibrium wage rates in the case of labour market clearing in the very short run, conditional on the numéraire. Adding (27), we can solve for  $B$  sector product prices and obtain the complete partial equilibrium solution.

Adding (26), (27) and (28) to (19), (23) and (24), when (18) is binding, we can find the full general equilibrium solution when  $A$  sector labour is mobile.

## 9. Partial equilibrium

Let us start out ignoring migration and look at the short run equilibrium. Subtracting (26) from (24), and taking into account that  $m_i = \bar{m}_i$  and  $l_i = \bar{l}_i$ , I obtain

$$\ln q_i = \ln(\mathbf{b}_q / \mathbf{b}_w) + \ln \mathbf{s} + \ln \bar{l}_i + \frac{\mathbf{s}}{1-\mathbf{s}} \ln \bar{m}_i + \ln w_i. \quad (29)$$

Substituting for  $\ln q_i$  from (29) in (23), we get

$$\ln v_i = \ln(\mathbf{b}_q / \mathbf{b}_w) + \ln \bar{l}_i - \ln \bar{m}_i + \ln w_i. \quad (30)$$

Substituting for  $\ln q_i$  in (27) as well, we obtain the output price for the  $B$  sector,

$$\ln p_i = -\mathbf{b} - \ln \mathbf{b}_w + \mathbf{b}_q \ln \mathbf{s} + \mathbf{b}_q \ln \bar{l}_i + \mathbf{b}_q \frac{\mathbf{s}}{1-\mathbf{s}} \ln \bar{m}_i + \ln w_i. \quad (31)$$

Output from the  $B$  sector is most easily obtained using the primal,

$$\ln y_i = \mathbf{b} - \mathbf{b}_q \ln \mathbf{s} + \mathbf{b}_w \ln \bar{l}_i + \mathbf{b}_q \frac{\mathbf{s}}{\mathbf{s}-1} \ln \bar{m}_i. \quad (32)$$

As far as aggregate income is concerned, we need to take into account that the payroll tax factor is allowed to be different between region  $n$ ,  $s$  and  $u$ , and between the  $A$  sector and  $B$  sector in region  $n$ . Aggregate income in region  $n$  is

$$r_n = \frac{w_n \bar{l}_n}{\mathbf{b}_w} (\mathbf{b}_q / t_{An} + \mathbf{b}_w / t_{Bn}). \quad (33)$$

And in region  $s$  and  $u$ ,

$$r_s = \frac{w_s \bar{l}_s}{t_s \mathbf{b}_w}, \quad (34)$$

$$r_u = \frac{\bar{l}_u}{\mathbf{b}_w}. \quad (35)$$

Substituting from (31) – (35) and (1) in (28), we obtain

$$\begin{aligned} w_n l_n (\mathbf{a}_n + \mathbf{a}_u) \left( \frac{\mathbf{b}_q}{t_{An}} + \frac{\mathbf{b}_w}{t_{Bn}} \right) - w_s \frac{l_s \mathbf{a}_n}{t_s} &= \mathbf{a}_n l_u, \\ - w_n l_n \mathbf{a}_s \left( \frac{\mathbf{b}_q}{t_{An}} + \frac{\mathbf{b}_w}{t_{Bn}} \right) + w_s \frac{l_s (\mathbf{a}_n + \mathbf{a}_u)}{t_s} &= \mathbf{a}_s l_u. \end{aligned} \quad (36)$$

Let us abstract from differences in marked size and assume that all Engel curves have the same slope, i.e. all  $l_i$  and all  $\mathbf{a}_i$  are equal. Let us also simplify by setting  $\mathbf{b}_w = \mathbf{b}_q$  and  $m_i = l_i$  for all  $i$ . By (30) this also means  $w_i = v_i$ . Then, (36) is reduced to

$$\begin{aligned}
w_n \left( \frac{1}{t_{An}} + \frac{1}{t_{Bn}} \right) - w_s \frac{1}{t_s} &= 1, \\
- w_n \frac{1}{2} \left( \frac{1}{t_{An}} + \frac{1}{t_{Bn}} \right) + w_s \frac{2}{t_s} &= 1.
\end{aligned} \tag{37}$$

Adding (5) to (37), we may solve for equilibrium producer wage rates under tax neutrality. I have illustrated the solution graphically in Figure 1, setting the payroll tax factor in the assisted area or region equal to 9/10. There are two sets of solutions corresponding to the two payroll tax regimes. In the Norwegian regime, the payroll tax factor is equal for both sectors in region  $n$ , i.e.,  $t_{An} = t_{Bn} = 9/10$ , and the tax neutral payroll tax factor in region  $s$  using (5), is  $t_s = 11/10$ . The solid lines represent the balance-of-payment restrictions for region  $s$  (steepest slope) and  $n$ . The intersection represents the solution,  $w_n / w_u = 0.90$  and  $w_s / w_u = 1.10$ . In the ESA regime, only  $t_{An} = 9/10$ . Tax neutrality gives  $t_{Bn} = t_s = 1.04$ . The dashed lines in Figure 1 represent the balance-of-payment restrictions under this regime, intersecting at  $w_n / w_u = 0.96$  and  $w_s / w_u = 1.04$ .

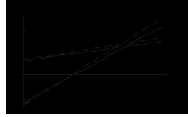


Figure 1. Equilibrium producer wage rates.

Balance of payment restrictions in region  $n$  and  $s$  under the Norwegian regime (solid lines) and the ESA regime (dashed lines).

What are the consequences in terms of real income in the different regions when the ESA regime replaces the Norwegian? In our model, the answer is none. However, with more general preferences (quasi-homotheticity), changing regime would have had an effect: region  $n$  would be worse off and region  $s$  better off, i.e., the ESA regime implies larger regional inequality. Throughout, I have used the software program *Mathematica* to simulate the impact of changing the regime (Wolfram, 1991). The real income in  $s$  is higher than in  $n$  and  $u$  since lower transport costs make delivered prices lower than elsewhere.

Region	Norwegian regime	ESA regime
$n$	100	100
$s$	106	106

Table 1. Real income.

Per cent of real income in region  $u$ .

Please, note that under our assumptions, the figures in Table 1 pertain to aggregate income, as well as individual income.

What are the consequences for the competitive position in terms of market shares? Table 2 provides an answer, using the same set of parameter values as before.

Region of origin	Market $n$	Market $s$	Market $u$
$n$	-5.51 (0.44)	-6.48 (0.34)	-6.43 (0.30)
$s$	7.35 (0.29)	6.24 (0.35)	6.31 (0.29)
$u$	1.16 (0.27)	1.11 (0.31)	0.17 (0.41)

Table 2. Changes in marked shares.

ESA regime replacing Norwegian regime. Percentage change (market shares under Norwegian regime in parenthesis).

The figures in parenthesis are market shares under the Norwegian regime. Market shares are computed using volume, not value. Replacing the Norwegian regime by the ESA regime, the market shares of the product from region  $n$  fall in all markets. Region  $u$  increases their shares, but perhaps less than hoped for by supporters of the ESA decision since tax neutrality implies that the winning region is  $s$ .

## 10. General equilibrium

Let us now look at the situation when  $A$  skilled labour is mobile between region  $n$  and  $s$ . Based on the same set of parameter values as before, the balance-of-payment restrictions, (37), remain valid. Let us set  $m = m_n + m_s \equiv 1 + 1 = 2$ . We need the mobility equilibrium condition, (19), to obtain the number of  $A$  skilled workers in region  $n$ ,  $m_n$ . Using (26), mill prices are

$$p_n = \sqrt{2} \frac{w_n}{m_n}, \quad p_s = \sqrt{2} \frac{w_s}{2 - m_n}, \quad p_u = \sqrt{2}. \quad (38)$$

Using (6) and (38), delivered prices in region  $n$  and  $s$  are

$$\begin{aligned} p_{nn} &= \sqrt{2} \frac{w_n}{m_n}, & p_{sn} &= \frac{5}{4} \sqrt{2} \frac{w_s}{2 - m_n}, & p_{un} &= \frac{3}{2} \sqrt{2}, \\ p_{ns} &= \frac{5}{4} \sqrt{2} \frac{w_n}{m_n}, & p_{ss} &= \sqrt{2} \frac{w_s}{2 - m_n}, & p_{us} &= \frac{5}{4} \sqrt{2}. \end{aligned} \quad (39)$$

All expenditure shares are equal to  $1/3$ . The consumer price indices for region  $n$  and  $s$  are therefore

$$\begin{aligned} cpi_n &= \sqrt[3]{\sqrt{2} \frac{w_n}{m_n}} \sqrt[3]{\frac{5}{4} \sqrt{2} \frac{w_s}{2 - m_n}} \sqrt[3]{\frac{3}{2} \sqrt{2}}, \\ cpi_s &= \sqrt[3]{\frac{5}{4} \sqrt{2} \frac{w_n}{m_n}} \sqrt[3]{\sqrt{2} \frac{w_s}{2 - m_n}} \sqrt[3]{\frac{5}{4} \sqrt{2}}. \end{aligned} \quad (39)$$

By the analogue to (29),  $v_i m_i = w_i \bar{l}_i$  (when  $\mathbf{b}_w = \mathbf{b}_q$ ). The equilibrium condition (19) can then be written,

$$\frac{w_n / t_{An}}{w_s / t_s} = \frac{m_n \bar{l}_s cpi_n}{(2 - m_n) \bar{l}_n cpi_s}. \quad (40)$$

Substituting for  $cpi_n$  and  $cpi_s$  from (39), and  $w_n$  and  $w_s$  from the previous section, I solve for  $m_n$ . Under the Norwegian regime, the solution is 0.9696, under the ESA regime 1.0036. This means that changing regime increases population and the number of differentiated inputs in the north. In this sense, the regional performance of changing regime is improved.

Although mobility makes no difference as far as relative real aggregate regional income is concerned, we get a richer picture when we look at relative real individual income. Since mobility implies that the number of residents is endogeneous, relative real individual income is no longer identical to the aggregate. Let us therefore look at the micro situation.

Region	Sector	Norwegian regime	ESA regime
$n$	$A$	103.13	106.66
	$B$	100.00	92.95
$s$	$A$	103.13	106.66
	$B$	106.27	106.27

Table 3. Real individual income.

Per cent of real individual income in region  $u$ .

Table 3 presents individual income or wage rates. The real wage in the  $A$  sector is equal irrespective of region by the spatial equilibrium condition. The ESA regime means relative real wages fall in the  $B$  sector in the north and rise in the  $A$  sector. The income distribution becomes more unequal. Hence, the Norwegian regime is performing better from an egalitarian regional point of view.

Moving on to the effects of changing regimes for marked shares, the results are presented in Table 4.

Region of origin	Market $n$	Market $s$	Market $u$
$n$	-2.68 (0.43)	-3.16 (0.33)	-3.14 (0.29)
$s$	3.28 (0.30)	2.77 (0.36)	2.79 (0.30)
$u$	0.65 (0.27)	0.15 (0.31)	0.17 (0.41)

Table 4. Changes in marked shares.

ESA regime replacing Norwegian regime. Percentage change (market shares under Norwegian regime in parenthesis).

The partial equilibrium results are confirmed. The south is the big winner and the north an even bigger loser, leaving a small net gain to the union.

## 11. Industry wide wage bargaining

The system of wage determination in Norway is highly centralised, as explained in Section 2. It is therefore not reasonable that there should be universal market clearing in all labour markets, as if there were perfect competition. I am now going to investigate what happens when we introduce centralised bargaining in the economic base sector along the lines suggested in Section 7.

The union maximises a utilitarian utility function subject to labour demand in the  $B$  sector. The bargaining wage is given by

$$\underline{w} = \arg \max \{U(w)(l_n + l_s)\}. \quad (41)$$

Recall that  $w$  is the consumer wage rate. The union knows that labour will be adjusted according to (9), leaving the cost share constant. Substituting for  $l_i$  from (9), taking the partial derivative with respect to  $w$ , we obtain the first order condition for the problem,

$$(l_n + l_s)(U'(w) - (1 - b_w)U(w)/w) = 0. \quad (42)$$

In order to have an explicit solution for the bargaining wage, the utility function must be specified. It is convenient to choose

$$U(w) = j_0 + j_1 \ln(w), \quad (43)$$

and to set  $j_0 = 1$  and  $j_1 = 1/2$ . Using  $b_w = 1/2$  as before, the solution is simply  $\underline{w} = 1$ . The producer wage rates under the Norwegian regime is then identical to the situation with market clearing and the results from the previous section apply. Under the ESA regime, the bargaining wage will still clear the market in  $s$ , but not in  $n$ :

$$w_s = t_s w = 1.03 = w_s^*, \quad w_n = t_s w = 1.03 > 0.96 = w_n^*.$$

Hence, there is unemployment among the  $B$  skilled in  $n$  (7 per cent). Compared to the market clearing case, there is a slight decrease in the number of  $A$  skilled locating in  $n$  and an increase in the  $A$  sector wage rate. Real wage rates comparable to the content of Table 3 is presented in Table 5. Real wages under the Norwegian regime with and without bargaining is of course identical by construction, but are repeated here for ease of comparison.

Region	Sector	Norwegian regime	ESA regime
$n$	$A$	103.13	106.66
	$B$	100.00	100.00
$s$	$A$	103.13	106.66
	$B$	106.27	106.27

Table 5. Real wage.

Per cent of real wage in region  $u$ .

The ESA regime benefits the insiders on expense of the outsiders: the relative real wage among the employed is increasing or remain constant, whereas there is an increase in the number of unemployed in the peripheral region. From another perspective, mobile labour is better off while immobile labour is worse off.

As far as market shares are concerned, market shares under the Norwegian regime are again the same as before. The changes in market shares, comparable to the content of Table 4, are presented in Table 6.

Region of origin	Market $n$	Market $s$	Market $u$
$n$	-4.74 (0.43)	-5.54 (0.33)	-5.66 (0.29)
$s$	4.86 (0.30)	3.97 (0.36)	3.84 (0.30)
$u$	2.19 (0.27)	1.32 (0.31)	1.19 (0.41)

Table 6. Changes in marked shares.

ESA regime replacing Norwegian regime. Percentage change (market shares under Norwegian regime in parenthesis).

Although the percentage changes in market shares when the ESA regime is replacing the Norwegian, are larger than when all markets were clearing, the qualitative effects are the same, and qualitative effects are all that matter here. The winning region is  $s$ , but  $n$  is losing even more, giving Norway a net loss.

## **12. Concluding discussion**

According to the model employed, the regional impact of replacing the present regime of differentiated payroll tax rates with the regime proposed by the EFTA Surveillance Authority, is mixed. On the one hand, diversity in the non basic economic sector in the assisted area is increased leading to higher productivity. On the other hand, unemployment in the area will increase in case wages are rigid downwards, and real wages in the base sector will fall in case wages are flexible. From a regional policy point of view, the negative effects would probably be considered more important than the positive effect.

The change in regime leads to an increase in marked shares for products from the European Union in all markets. The assisting area of Norway increases its market shares even more, leaving the assisted area as the big loser since this is a zero-sum game. One may wonder however, how robust this conclusion is when differences in marked size are accounted for. It would be an interesting extension to introduce marked size as an explanatory factor, but then the simple model used would have to be changed in other ways as well, most notably expenditure shares could not be equal for all goods in all regions.

Another interesting issue for more research, is the effect of more general preferences. As already mentioned in the text, work is being done based on quasi-homothetic preferences. If this work succeed, conclusions would no longer be conditional on the presumably restrictive assumption of income independent expenditure shares.

The decision by the EFTA Court leaves the Norwegian Government with no other choice than to find alternative instruments if the regional effects, under the ESA regime, is considered unacceptable. An interesting policy option that could easily be analysed within the present framework is infrastructure investments reducing transport costs. There are already several studies on this subject (Martin and Rogers, 1995a and 1995b, and Kilkenny, 1997), but the work should be extended to non-clearing labour markets. As long as there is no harmonisation of public infrastructure investment criteria in the European Economic Area, state aid rules would not apply to provision of infrastructure.

## **Acknowledgements**

I want to thank Mr. Dajani, the Norwegian Ministry of Finance, for helpful assistance in providing information on the case between ESA and Norway. I also want to thank for comments on previous drafts of the paper from participants at recent conferences in Lillesand and Tromsø. The research has been financed by the SIS program at Agder College.



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