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The European unemployment problem in a globalized world: Wage rigidities, welfare and involuntary low-skilled labour unemployment

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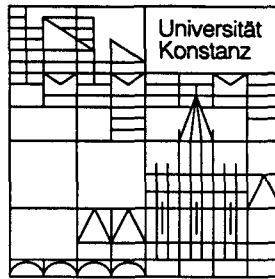
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Diskussionsbeiträge

**The European Unemployment Problem in a Globalized World –
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Unemployment**

Bodo Hilgers and Ulrich Wacker

Serie I – Nr. 300

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The European Unemployment Problem in a Globalized World - Wage Rigidities, Welfare and Involuntary Low-Skilled Labour Unemployment

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Abstract

In a general equilibrium model of a small open economy with a nontraded goods sector involuntary low-skilled labour unemployment is introduced by an exogenously given wage rate, orientating ourselves by what has been called in the literature the 'European scenario'. By the concept of constrained and unconstrained transfer and profit functions we analyse the impact of a change both in an exogenously given low-skilled labour wage rate and in terms-of-trade on employment and welfare. As a striking result we will show that an increase in the exogenously given wage does not necessarily imply the expected decrease in employment and welfare. Thus, it will become obvious that not the distortion as such is decisive but its general equilibrium effects. We will derive necessary and sufficient conditions for an increase in employment and welfare due to an increase in the exogenously given wage. For improvements in employment and welfare the direction of change in the nontraded goods price and, thus, the output effect shows to be the driving force in our model. A terms of trade improvement leads to an employment effect that can either be positive or negative. In consequence, a decrease in employment can go hand in hand with an increase in welfare. In the case of a terms-of-trade deterioration, welfare only increases if employment increases.

*For inspiring discussions and helpful comments we thank Max Albert, Friedrich Breyer, Udo Broll, Oliver Fabel, Claus Knoth, Nikolaus Läufer, Erik Lehmann, Jürgen Meckel, Albert Schweinberger and Norbert Wunner. However, the usual caveats apply.

1 Introduction

In the last three decades, unemployment has become a severe and persisting problem especially in the leading continental European economies. In the same period the economic opening of economies has accelerated. Two important processes can be distinguished: first, regional economic integration inside the European Union has been deepened and a free trade area, the Common Market, has been created. Second, economic globalization has become more and more important. That means that the European unemployment problem has occurred in the context of economic internationalization both in a regional and a global sense. Whereas a huge empirical literature discusses the impact of economic internationalization on U.S. labour markets¹ mainly assuming full employment, this assumption does not seem to be conclusive for the European case. However, there yet does not exist an extensive literature that tries to give a theoretical framework for the case of rationed labour markets, exceptions being Krugman (1995) and Davis (1997, 1998). If one seeks to analyse the impact of economic internationalization on European labour markets this case is essential. Finally, from a theoretical point of view, a further shortcoming of the 'trade and wages' literature is that the debate on the effects of economic internationalization on welfare is neglected.

In our contribution we develop an appropriate framework to analyse involuntary unemployment in an open economy. If the analysis is concentrated on the labour markets of the two leading continental European economies France and Germany, above all low-skilled and unskilled labour is affected by involuntary unemployment. Due to this stylized fact we will concentrate our analysis on the market for this kind of labour under the assumption of an exogenously given wage rate for low-skilled labour. An obvious shortcoming of our analysis we are not intending to hide lies in the missing explanation of involuntary low-skilled labour unemployment by an endogenous wage determination mechanism. However, there are many possibilities to

¹For a survey see Haveman (1994), Levy and Murnane (1992) and Slaughter (1998).

integrate endogenous wage determination mechanisms within our model framework. One of these possibilities is the efficiency wage hypothesis. As can be shown, this works for certain groups of effort functions.

Another reason would be minimum wages due to institutional settings, that could be modelled within a political economy framework. From an empirical point of view, there are good reasons for assuming rigid wages when modelling European labour markets for low-skilled and unskilled workers. In Germany, for example, minimum wages for low-skilled and unskilled workers are negotiated by trade unions and employers' associations. In order to further approximate our model to stylized facts, a nontraded goods sector will be introduced. This seems to be important because in spite of accelerating economic internationalization a huge part of goods produced is still traded nationally.

Our model corresponds to those in the rationing literature of open economies describing an orthodox Keynesian regime.² Some authors have pointed to this underemployment regime where only the labour market is price distorted and the goods market is perfectly competitive, coming closest to what was analysed by Keynes (1936) in his *General Theory*. Neary (1990) has reminded of only a quantity constraint on goods market being, together with involuntary unemployment, a necessary condition for typical Keynesian results like multiplier effects and determination of output by effective demand. According to Neary, not only the existence of two quantity constraints but also both quantity constraints that affect different actors is sufficient for Keynesian results. We will examine this hypothesis.

Second-best welfare economics teaches that in the case of only one distortion, i.e. in our model the exogenously given wage, a reinforcement of this distortion leads to a decrease in welfare. Thus an increase in the exogenously given wage would lead to a decrease in employment. Schweinberger (1978) has shown in a general equilibrium model of a small open economy with n fully employed factors, n internationally

²See Cuddington, Johansson and Löfgren (1984).

traded goods and m involuntary unemployed factors due to exogenously given factor prices that an exogenous increase in real wages cannot lead to an increase in employment. We will examine whether this general conclusion still holds in case of an economy with a nontraded goods sector, i.e. in an economy where not all goods prices are determined on world markets.

The remainder is organized as follows. In the first section we expose the structure of our analysis. Then we will derive the theoretical framework of our model. Finally the impact of changes in the exogenously given wage and in terms-of-trade on both welfare and low-skilled labour employment will be examined by comparative static analysis. The final section contains some concluding comments.

2 A General Equilibrium Framework for the European Unemployment Problem

Our model starts with k factor markets for fully employed factors $\mathbf{v} = [v_i]$ with $\mathbf{z} = [z_i]$ as factor prices where $i = 1, \dots, k$ and s goods markets for internationally traded goods $\mathbf{x} = [x_j]$ with $\mathbf{p} = [p_j]$ as goods prices where $j = 1, \dots, s$. Let the good denoted x_n be the nontraded good with goods price p_n . Like all factors, this good is traded only nationally. The k factors can be imagined as different labour skills and different kinds of physical capital. Let the factor denoted l be low-skilled labour. On the market for low-skilled labour a binding exogenously given wage \bar{w} yields excess supply. This means that desired labour supply cannot be realized at the prevailing wage rate. Involuntary unemployment results. As the short side of the market, labour demand determines effective employment. Throughout, we will assume $k \geq s + 1$.

Under the assumption of a small open economy world market prices for the tradeable goods are treated parametrically, i.e. the small open economy can import and export as much as the country wishes without any impact on world market prices.

Internationally traded goods are both imported and exported so that all goods are produced domestically. By contrast, the nontraded goods price p_n is determined endogenously. Integrating a nontraded good within the model of a small open economy not only implies that at least one goods price is determined nationally but also that world market prices do not solely determine factor prices any longer. However, the last point concerns distribution topics which are not given priority in this paper.

We should emphasize that we abstract from money. In the rationing literature dealing with open economies often a net import good is introduced being paid with money. A severe problem with these models is that not all functions of money can be explained. Two further problems arise: these models remain atemporal although they try to describe intertemporal phenomena. Besides, at least implicitly the existence of all relevant markets has to be assumed. However, this is also incompatible with money functions as being observed in reality.

In our model, money only takes over the task of an accounting unit which can also be taken over by one of the goods. All markets do exist. Although there exists more than one price on the market for low-skilled labour, the market wage rate is known to each actor. For these reasons the structure of our basic model is in the tradition of the so-called classical trade theory with a long-term perspective. In what follows, we will first describe the behaviour of the representative household facing a quantity constraint on the market for low-skilled labour. Then we will model the behaviour of the representative firm. The method applied is duality theory.³ Finally, we will—examine the impact of a change in the exogenously given factor price of low-skilled labour and of a change in the parametric world goods prices on employment and welfare by comparative static analysis.

³For an excellent exposition of duality theory see Cornes (1992).

3 The Representative Household

The behaviour of the representative household can be modelled by a so-called transfer function. First, a transfer function can be defined by describing household behaviour in the case of perfect competitive goods and labour markets. All prices are treated parametrically.

$$T(\mathbf{p}, p_n, w, \mathbf{z}, u) \equiv \min_{\mathbf{x}, x_n, l, \mathbf{z}} \{ \mathbf{p}\mathbf{x} + p_n x_n - \mathbf{z}\mathbf{v} - wl \mid U(\mathbf{x}, x_n, l, \mathbf{v}) \geq u \}. \quad (1)$$

While U stands for a concave utility function satisfying standard assumptions, u represents a certain utility level. Like expenditure functions, the transfer function is an optimal value function. In contrast to expenditure functions, the concept of transfer functions allows variable factor supplies to be integrated. This is an important property because variable low-skilled labour supply is a necessary assumption for the work with the virtual wage concept.

Definition 1 *The transfer function gives the minimal transfer income necessary for the household to finance the utility level u at given goods and factor prices. The transfer function can either be negative or positive.*

In Walrasian general equilibrium models with constant returns to scale technologies, the value of the transfer function just equals zero.

Second, we are able to define a further transfer function now describing the household behaviour in the case of a quantity constraint on the market for low-skilled labour because of an exogenously given wage rate \bar{w} . Consequently, the desired labour supply cannot be realized at the prevailing wage rate and the representative household suffers from involuntary unemployment on the market for low-skilled labour:

$$\tilde{T}(\bar{l}, \mathbf{p}, p_n, \mathbf{z}, \bar{w}, u) \equiv \min_{\mathbf{x}, x_n, l, \mathbf{v}} \{ \mathbf{p}\mathbf{x} + p_n x_n - \mathbf{z}\mathbf{v} - \bar{w}l \mid U(\mathbf{x}, x_n, l, \mathbf{v}) \geq u, l \leq \bar{l} \}. \quad (2)$$

Definition 2 *The constrained transfer function gives the minimal transfer income necessary for the household to finance the utility level u when treating prices on goods and factor markets as well as the quantity constraint on the market for low-skilled labour parametrically.*

In what follows we assume an additive separability of utility in goods and factor quantities. Hence, a change in the quantity constraint faced by the household on the market for low-skilled labour will only lead to an income effect, and as an implication the household's consumption decision is neither influenced by substitution effects nor by the labour-leisure trade-off.

Because of assuming inelastic fully employed factor supply, utility does not depend on supplied factor quantities which are no longer arguments of the utility function.⁴ As factor prices \mathbf{z} are perfectly flexible, desired factor supplies are actually employed. Factor inputs equal factor supplies, i.e. $\mathbf{v} = \mathbf{v}^s$. Due to goods and factor prices being treated parametrically by the representative household, income from fully employed factors can be defined as follows:

$$V \equiv \mathbf{z}\mathbf{v}. \quad (3)$$

In our analysis we merely consider the labour supply curve within the range where the substitution effect of a change in the wage dominates its income effect, i.e. where the labour supply curve exhibits a positive slope.

Taking price inelastic factor supplies \mathbf{v} into consideration yields the definition of the modified constrained transfer function:

$$\tilde{T}(\bar{l}, \mathbf{p}, p_n, \bar{w}, V, u) \equiv \min_{\mathbf{x}, x_n, l} \{ \mathbf{p}\mathbf{x} + p_n x_n - \bar{w}l \mid U(\mathbf{x}, x_n, l) \geq u, l \leq \bar{l} \} - V. \quad (4)$$

In the following, we will apply this constrained transfer function. However, the function's properties are not known because of the quantity constraint \bar{l} . Therefore we

⁴For a more detailed treatment of fixed and variable factor supplies in duality theory see Dixit and Norman (1980).

try to replace the constrained transfer function by an unconstrained or virtual transfer function that solely depends on price signals and whose properties are known. In order to establish a link between unconstrained and constrained transfer functions we use an important characteristic of all price-distorted market coordination mechanisms: if quantity constraints are binding there exists more than one price system. Market and shadow prices are falling apart. This is the reason for the existence of unexploited arbitrage possibilities. Neary and Roberts (1980) have utilized the concept of virtual prices to examine household behaviour in case of quantity constraints. Hence, their contribution offers the reference and starting point of our analysis.

3.1 Virtual Wage Rate

By means of the concept of virtual prices we are able to establish a link between constrained and unconstrained transfer functions.

Definition 3 *The virtual factor price \hat{w} is the wage which lets the quantity-constrained household just voluntarily supply the rationing quantity.*⁵

Graphically, the virtual wage rate \hat{w} for low-skilled labour is illustrated in figure 1. There, both the case of elastic labour supply and the case of inelastic labour supply is considered. The virtual wage cannot be observed on markets because it is a shadow price. We start with the constrained transfer function:

$$\tilde{T}(\bar{l}, \mathbf{p}, p_n, \bar{w}, V, u) \equiv \mathbf{p}\mathbf{x}^d(\bar{l}, \mathbf{p}, p_n, \bar{w}, u) + p_n x_n^d(\bar{l}, \mathbf{p}, p_n, \bar{w}, u) - \bar{w}\bar{l} - V. \quad (5)$$

The right-hand side is extended by $\hat{w}\bar{l} - \bar{w}\bar{l}$. Considering (5) and writing down the virtual wage rate implicitly, i.e.

$$l^s(\mathbf{p}, p_n, \hat{w}, u) = \bar{l}, \quad (6)$$

⁵For a detailed discussion of the concept of virtual prices see Hilgers and Wacker (1999).

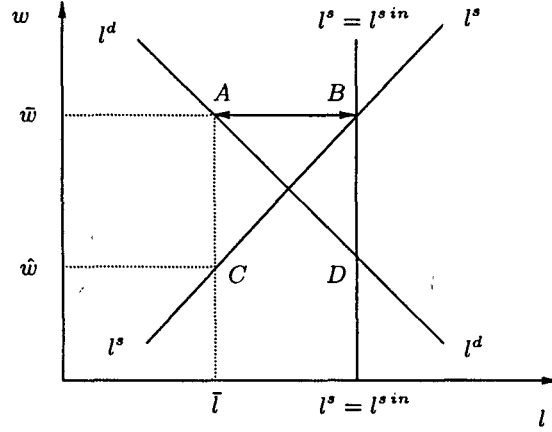
yields

$$\begin{aligned}\tilde{T}(\bar{l}, \mathbf{p}, p_n, \bar{w}, V, u) &\equiv \mathbf{p}\mathbf{x}^d(\bar{l}, \mathbf{p}, p_n, \bar{w}, u) \\ &+ p_n x_n^d(\bar{l}, \mathbf{p}, p_n, \bar{w}, u) - \hat{w}\bar{l} - V + \hat{w}\bar{l} - \bar{w}\bar{l}.\end{aligned}\quad (7)$$

Finally, with (6) the link between the constrained and unconstrained transfer func-

Figure 1

Virtual Wage Rate



tion results as

$$\tilde{T}(\bar{l}, \mathbf{p}, p_n, \bar{w}, V, u) \equiv \hat{T}(\mathbf{p}, p_n, \hat{w}, V, u) + (\hat{w} - \bar{w})\bar{l}.\quad (8)$$

Definition 4 The transfer function $\hat{T}(\mathbf{p}, p_n, \hat{w}, V, u)$ is called *virtual price transfer function*.

Apart from utility level u and given factor income V the virtual price transfer function depends on world market prices, the nontraded goods price and the virtual wage. The virtual price transfer function can be defined as a minimization problem:

$$\hat{T}(\mathbf{p}, p_n, \hat{w}, V, u) \equiv \min_{\mathbf{x}, x_n, l} \{ \mathbf{p}\mathbf{x} + p_n x_n - \hat{w}l \mid U(\mathbf{x}, x_n, l) \geq u \} - V.\quad (9)$$

So we can state as a first proposition:

Proposition 1 *The behaviour of the household treating goods and factor prices as well as the quantity constraint on the market for low-skilled labour parametrically can be described either by the constrained transfer function or by the unconstrained or virtual price transfer function and the linear term $(\hat{w} - \bar{w})\bar{l}$. This follows from identity (8).*

3.2 Virtual Labour Supply

The disadvantage of the virtual wage concept lies in the unobservable virtual wage rate. A remedy is offered by the concept of virtual quantities which does not look for a virtual price generating a given quantity but a quantity being voluntarily demanded or supplied at a given price.

Definition 5 *The virtual factor quantity \check{l} is the quantity which is just voluntarily supplied by the household at the exogenously given wage \bar{w} .*

We extend (5) by $\bar{w}\check{l} - \bar{w}\bar{l}$ with

$$l^s(\mathbf{p}, p_n, \bar{w}, u) = \check{l}. \quad (10)$$

Thus, we get

$$\begin{aligned} \tilde{T}(\bar{l}, \mathbf{p}, p_n, \bar{w}, V, u) &\equiv \mathbf{p}\mathbf{x}^d(\bar{l}, \mathbf{p}, p_n, \bar{w}, u) \\ &+ p_n x_n^d(\bar{l}, \mathbf{p}, p_n, \bar{w}, u) - \bar{w}\check{l} - V + \bar{w}\check{l} - \bar{w}\bar{l} \end{aligned} \quad (11)$$

and as a result:

$$\tilde{T}(\bar{l}, \mathbf{p}, p_n, \bar{w}, V, u) \equiv \check{T}(\mathbf{p}, p_n, \bar{w}, V, u) + (\check{l} - \bar{l})\bar{w}. \quad (12)$$

Definition 6 *The transfer function $\check{T}(\mathbf{p}, p_n, \bar{w}, V, u)$ is called virtual quantity transfer function.*

Apart from utility level u and the given factor income V the virtual quantity transfer function depends on world market prices, the nontraded goods price and on the exogenously given wage. The virtual quantity transfer function can be defined as a minimization problem:

$$\check{T}(\mathbf{p}, p_n, \bar{w}, V, u) \equiv \min_{\mathbf{x}, x_n, l} \{ \mathbf{p}\mathbf{x} + p_n x_n - \bar{w}l \mid U(\mathbf{x}, x_n, l) \geq u \} - V. \quad (13)$$

The term $(\check{l} - \bar{l})\bar{w}$ gives the extent to which the household is rationed on the market for low-skilled labour evaluated at the actual wage rate. Identity (12) differs from (5) by the conclusion that the value of the virtual quantity transfer function is not larger but smaller than the value of the constrained transfer function. This is because the unrealized virtual labour supply $l^s(\mathbf{p}, p_n, \bar{w}, u)$ exceeds actual employment in the case of involuntary unemployment. Due to higher labour income the household *ceteris paribus* needs a lower transfer income in order to reach utility level u . The difference between labour income at the exogenously given wage rate \bar{w} and desired labour income $\bar{w}\check{l}$ is covered by the second term on the right-hand side of identity (12).

Proposition 2 *The behaviour of the representative household treating goods and factor prices as well as the quantity constraint on the low-skilled labour market parametrically can be described either by the constrained transfer function or by the unconstrained or virtual quantity transfer function and the linear term $(\check{l} - \bar{l})\bar{w}$. This follows from identity (12).*

The virtual quantity transfer function has the following properties: $\check{T}(\mathbf{p}, p_n, \bar{w}, V, u)$ is non-decreasing in goods prices, non-increasing in factor prices, linear homogeneous in goods and factor prices, quasi concave in goods and factor prices, non-increasing in factor supplies and non-decreasing in utility. Under the assumption of the existence of the first- and second-order derivatives with respect to all goods and factor prices

we can derive goods demand and factor supply functions by SHEPHARD'S LEMMA:

$$\frac{\partial \check{T}}{\partial p_j} = \check{x}_j^d(\mathbf{p}, p_n, \bar{w}, u) \quad \text{and} \quad \frac{\partial \check{T}}{\partial p_n} = \check{x}_n^d(\mathbf{p}, p_n, \bar{w}, u). \quad (14)$$

The unconstrained or virtual goods demand functions are homogeneous of degree zero in goods and factor prices. All goods are normal goods and are considered as substitutes by the household. Unconstrained or virtual factor supply functions are

$$\frac{\partial \check{T}}{\partial \bar{w}} = -\check{l}^s(\mathbf{p}, p_n, \bar{w}, u) \quad \text{and} \quad \frac{\partial \check{T}}{\partial V} \frac{\partial V}{\partial z_i} = -v_i^s. \quad (15)$$

Apart from identity (12) there exists the following link between the constrained and unconstrained transfer function:⁶

$$\check{T}(\mathbf{p}, p_n, \bar{w}, V, u) = \min_{\bar{l}} \tilde{T}(\bar{l}, \mathbf{p}, p_n, \bar{w}, V, u). \quad (16)$$

Proposition 3 *The virtual quantity transfer function is the envelope of the constrained transfer function. This follows from equation (16).*

According to definition (12) the constrained and unconstrained transfer function solely differ by a linear term. So the properties of the virtual quantity transfer function can easily be applied to the constrained transfer function. We do not derive effective goods demand and factor supply functions from the virtual but from the constrained transfer function. On this occasion the effective demand and supply functions can either be derived directly from the constrained transfer function or, with the help of identity (12), be expressed by the unconstrained transfer function. In what follows both alternatives will be considered.

From identity (12) effective goods demand functions for internationally traded goods \mathbf{x} and for the nontraded good x_n can be derived by SHEPARD'S LEMMA:

$$\frac{\partial \tilde{T}}{\partial p_j} \equiv \frac{\partial \check{T}}{\partial p_j} + \bar{w} \frac{\partial \check{l}}{\partial p_j}$$

⁶For a more detailed discussion see Deaton and Muellbauer (1980).

and as a result

$$\tilde{x}_j^d(\bar{l}, \mathbf{p}, p_n, \bar{w}, u) \equiv \check{x}_j^d(\mathbf{p}, p_n, \bar{w}, u) + \bar{w} \frac{\partial \check{l}}{\partial p_j}. \quad (17)$$

Furthermore, for the nontraded good x_n we obtain

$$\frac{\partial \tilde{T}}{\partial p_n} \equiv \frac{\partial \check{T}}{\partial p_n} + \bar{w} \frac{\partial \check{l}}{\partial p_n}$$

and as a result

$$\tilde{x}_n^d(\bar{l}, \mathbf{p}, p_n, \bar{w}, u) \equiv \check{x}_n^d(\mathbf{p}, p_n, \bar{w}, u) + \bar{w} \frac{\partial \check{l}}{\partial p_n}. \quad (18)$$

In the same way we obtain effective factor supply functions:

$$\frac{\partial \tilde{T}}{\partial \bar{w}} \equiv \frac{\partial \check{T}}{\partial \bar{w}} + (\check{l} - \bar{l}) + \bar{w} \frac{\partial \check{l}}{\partial \bar{w}}$$

and as a result

$$-\bar{l} \equiv -\check{l} + (\check{l} - \bar{l}) = -\check{l}. \quad (19)$$

For the fully employed factors:

$$\frac{\partial \tilde{T}}{\partial V} \frac{\partial V}{\partial z_i} \equiv \frac{\partial \check{T}}{\partial V} \frac{\partial V}{\partial z_i}$$

and as a result

$$-v_i^s \equiv -v_i^s. \quad (20)$$

In what follows we assume price inelastic labour supply for reasons of simplification. According to (17) and (18) constrained demand for traded and nontraded goods is identical with virtual demand.

4 The Firm

The production side is characterized by a representative firm which behaves on both goods and factor markets as price taker. The representative firm maximizes profit by choosing profit maximizing goods supplies and factor demands. In addition, the representative firm is quantity constrained neither on goods nor on factor markets. So the firm behaviour can be expressed by the unconstrained profit function

$$\pi(\mathbf{p}, p_n, \bar{w}, \mathbf{z}) \equiv \max_{\mathbf{x}, x_n, l, \mathbf{v}} \{ \mathbf{p}\mathbf{x} + p_n x_n - \bar{w}l - \mathbf{z}\mathbf{v} \mid g(\mathbf{x}, x_n) \leq 0 \} \quad (21)$$

where restriction $g(\mathbf{x}, x_n) \leq 0$ describes a convex production possibility set.

In order to simplify our analysis we are now going to integrate perfect competitive factor markets for factors \mathbf{v} into the definition of the profit function. We assume that the firm already knows the market solution. Hence, the firm not only knows market clearing factor prices \mathbf{z} but also corresponding factor inputs \mathbf{v} . At this point one has to be careful: we are still in an atemporal simultaneous equilibrium system. Therefore actors' behaviour cannot be interpreted in a temporal sense. Market solutions on competitive markets are not given exogenously. We only decompose our model for reasons of simplification and because we are not interested in distribution topics in the first place.

Integrating market equilibria on perfect competitive factor markets leads us to the following definition of the profit function:

$$\pi(\mathbf{p}, p_n, \bar{w}, V) \equiv \max_{\mathbf{x}, x_n, l} \{ \mathbf{p}\mathbf{x} + p_n x_n - \bar{w}l \mid g(\mathbf{x}, x_n) \leq 0 \} - V. \quad (22)$$

Integration of competitive factor market equilibria becomes intelligible by the profit function no longer depending on factor prices \mathbf{z} but on income as defined in (3). So inputs \mathbf{v} can be understood as exogenously given factor endowments. Like all other prices, factor prices are treated parametrically. Hence, for the firm, income

earned by fully employed factors is given. Due to constant returns to scale the zero profit conditions hold. From (22) follows that instead of maximizing the value of production the firm maximizes the value of income earned by fully employed factors, so that the quintessence of a distortion caused by exogenously given factor prices is revealed.⁷

The profit function exhibits the following properties: $\pi(\mathbf{p}, p_n, \bar{w}, V)$ is non-decreasing in goods prices, non-increasing in factor prices, linear homogeneous in goods and factor prices and convex in goods and factor prices. Under the assumption of the existence of the first- and second-order derivatives with respect to all goods and factor prices HOTELLING's LEMMA yields the following goods supply functions:

$$\frac{\partial \pi}{\partial p_j} = x_j^s(\mathbf{p}, p_n, \bar{w}) \quad \text{and} \quad \frac{\partial \pi}{\partial p_n} = x_n^s(\mathbf{p}, p_n, \bar{w}). \quad (23)$$

The factor demand functions are

$$\frac{\partial \pi}{\partial \bar{w}} = -l^d(\mathbf{p}, p_n, \bar{w}) \quad \text{and} \quad \frac{\partial \pi}{\partial V} \frac{\partial V}{\partial z_i} = -v_i. \quad (24)$$

Furthermore, the goods supply functions obviously are non-decreasing and all factors are substitutes.

5 General Equilibrium

In free trade equilibrium, the value of exports has to equal the value of imports, i.e. the balance of trade is always adjusted:

$$\sum_{j=1}^s p_j [x_j^s(\mathbf{p}, p_n, \bar{w}) - \check{x}_j^d(\mathbf{p}, p_n, \bar{w}, u)] = 0. \quad (25)$$

⁷Schweinberger (1978) comes up with a proof in a general equilibrium model with n goods, n fully employed factors and m underemployed factors due to exogenously given factor prices.

The equilibrium condition on the market for the nontraded good is $\pi_{p_n} = \tilde{T}_{p_n} = \check{T}_{p_n}$ and as a result

$$x_n^s(\mathbf{p}, p_n, \bar{w}) = \check{x}_n^d(\mathbf{p}, p_n, \bar{w}, u). \quad (26)$$

Now excess supply on the market for low-skilled labour due to an exogenously given wage is taken into consideration. Therefore

$$l^d(\mathbf{p}, p_n, \bar{w}) = \bar{l}. \quad (27)$$

The quantity constraint \bar{l} is treated parametrically by the representative household. This is the reason why from the household's point of view at first \bar{l} does not change if low-skilled labour reward changes. In general equilibrium \bar{l} is determined by the short side of the market, i.e. labour demand determines \bar{l} and thus the labour input necessary for goods production. In other words, labour demand determines effective employment. This is the HAHN-NEGISHI or short-side rule.

The factor market clearing conditions for fully employed factors,

$$v_i^d(\mathbf{p}, p_n, \mathbf{z}, \bar{w}) = v_i^s = v_i, \quad (28)$$

are integrated within the profit function. This means that flexible factor prices ensure that zero profit conditions are satisfied without explicit treatment. If a parameter changes, fully employed factor prices inevitably change. This process is happening in the background.⁸

Apart from the fully employed factors' aggregated income V the economy's income I consists of labour income $\bar{w}\bar{l}$ and the profit income π of the representative firm:

$$I = \mathbf{z}\mathbf{v} + \bar{w}\bar{l} + \pi = V + \bar{w}\bar{l} + \mathbf{p}\mathbf{x} + p_n x_n - \bar{w}\bar{l} - V = \mathbf{p}\mathbf{x} + p_n x_n. \quad (29)$$

⁸An explicit treatment would imply the extension of the model by k further equations and k further variables. In order to avoid further complication we drop the explicit determination of factor prices \mathbf{z} .

Finally, the model is completed by the economy's budget constraint

$$\pi(\mathbf{p}, p_n, \bar{w}, V) = \tilde{T}(\mathbf{p}, p_n, \bar{w}, V, u)$$

and as a result

$$\pi(\mathbf{p}, p_n, \bar{w}, V) = \check{T}(\mathbf{p}, p_n, \bar{w}, V, u) + (\check{l} - \bar{l})\bar{w}. \quad (30)$$

The model consists of three equations: the market clearing condition for the non-traded good (26), the employment equation (27) and the economy's budget constraint (30). This equation system simultaneously determines the three endogenous variables p_n , \bar{l} and u . The exogenous variables are \mathbf{p} , \bar{w} and \mathbf{v} .

6 An Increase in the Exogenous Wage - Welfare Loss and Less Employment?

Partial equilibrium models of the labour market in neoclassical tradition draw an unambiguous conclusion: an increase in the exogenously given wage results in higher unemployment, and therefore in a welfare loss. Undoubtedly it is common sense that this result also holds in general equilibrium when there is only one distortion.

Only if there is more than one distortion in the sense of second-best welfare economics it cannot be concluded any longer that a factor price distortion becoming more binding clearly results in a decrease in welfare. Our model is characterized by only one distortion as well, i.e. a non-market clearing price of low-skilled labour. Besides, we have tried to approximate the sectoral structure of economies by introducing a nontraded goods sector. Does the result postulated above still hold in such a regime?

With $d\mathbf{p} = d\mathbf{v} = [0]$ differentiation of (26), (27) and (30) yields

$$\left(\frac{\partial x_n^s}{\partial p_n} - \frac{\partial \check{x}_n^d}{\partial p_n} \right) dp_n - \frac{\partial \check{x}_n^d}{\partial u} du = - \left(\frac{\partial x_n^s}{\partial \bar{w}} - \frac{\partial \check{x}_n^d}{\partial \bar{w}} \right) d\bar{w} \quad (31)$$

$$\frac{\partial l^d}{\partial p_n} dp_n - d\bar{l} = \frac{\partial l^d}{\partial \bar{w}} d\bar{w} \quad (32)$$

$$\left(\frac{\partial \pi}{\partial p_n} - \frac{\partial \check{T}}{\partial p_n} \right) dp_n + \bar{w} d\bar{l} - \frac{\partial \check{T}}{\partial u} du = \left(\frac{\partial \check{T}}{\partial \bar{w}} - \frac{\partial \pi}{\partial \bar{w}} + \check{l} - \bar{l} \right) d\bar{w} \quad (33)$$

The terms in brackets in (31) reflect the Walrasian Tâtonnement process. The difference $\left(\frac{\partial x_n^s}{\partial p_n} - \frac{\partial \check{x}_n^d}{\partial p_n} \right) \equiv \alpha > 0$ shows that excess supply of the nontraded good *ceteris paribus* decreases due to a fall in price. So we have derived stability conditions for a Walrasian market solution depending on the slopes of both supply and demand functions.⁹

Whereas the expression analysed above describes movements both on the demand and supply curve, the difference $\left(\frac{\partial x_n^s}{\partial \bar{w}} - \frac{\partial \check{x}_n^d}{\partial \bar{w}} \right) \equiv \beta < 0$ describes shifts of both curves. An increase in wages yields the supply curve shifting to the left and the demand curve for the nontraded good to the right. In the case of a given nontraded goods price a wage increase *ceteris paribus* leads to a reduction in excess supply. Conversely, this difference implies that the exogenously given wage can increase without violating the zero profit conditions because of an increase in the nontraded goods price when all other variables remain unchanged.

By HOTELLING'S LEMMA and SHEPARD'S LEMMA (33) can be further simplified and, as a result, we see from the equalization of demand and supply in equilibrium, i.e. $x_n^s = \check{x}_n^d$,

$$d\bar{l} = \frac{\partial \check{T}}{\partial u} du > 0 \quad (34)$$

because, without loosing generality, the wage rate can be set to unity. The total

⁹The demand function with a negative slope is more restrictive than required by the stability condition. A demand function with a positive slope not steeper than that of the supply curve suffices.

differential of the economy's budget constraint shows that utility and employment respond the same way in the case of an infinitesimal change in the exogenously given wage. An increase in utility always implies an increase in employment and vice versa. Utility can only increase if the quantity constraint on the labour market is relaxed. The price distortion induced by the exogenously given wage leads to an employment constraint. Nevertheless, an increase in the exogenously given wage does not necessarily imply a decrease in employment and utility. According to equation (34) the distortion in our model is not represented by the exogenously given wage but by its effect on actual employment. I.e., the quantity constraint is the genuine distortion in our model. Equation (34) can be interpreted as a specific result of second-best welfare economics in the sense that as long as there is only one distortion its reinforcement has to lead to a welfare loss.

Proposition 4 *In a small open economy characterized by involuntary low-skilled labour unemployment because of an exogenously given wage and a nontraded goods sector with endogenous price determination, a marginal increase in the low-skilled labour wage leads to an increase in utility if and only if employment increases. This follows from (34).*

In order to answer the question whether this also means incompatibility between an increase in wages and an increase in employment we insert (32) into (34). By few transformations we obtain

$$\frac{dp_n}{d\bar{w}} = \frac{\partial \check{T}/\partial u}{\partial l^d/\partial p_n} \frac{du}{d\bar{w}} - \frac{\partial l^d/\partial \bar{w}}{\partial l^d/\partial p_n} > 0. \quad (35)$$

Already equation (35) reveals that an increase in wages leading to an increase in utility necessarily implies an increase in the price of the nontraded good. However, the opposite does not hold. An increase in the price of the nontraded good is a necessary but not a sufficient condition for an increase in utility. This result makes sense intuitively as well: on the one hand, an increase in the exogenously given wage, being nothing else but a cost effect, results in a straightforward negative

impact on employment. The reader is reminded that the short side of the market, i.e. the demand for low-skilled labour, is determining employment. On the other hand an increase in the exogenously given wage will cause not only a movement on the labour demand curve but also a shift of labour demand due to a structural effect. This structural effect is caused by an increase in the price of the nontraded good and, thus, by an output expansion effect in the nontraded goods sector. If the price increase is sufficiently large, implying a sufficiently large output expansion, employment will rise. In consequence, on the one hand we can state the well-known cost effect resulting in a decrease in employment. Graphically, this effect is represented by a movement to the left on the low-skilled labour demand curve. On the other hand the output expansion effect shifts the labour demand curve to the right possibly outweighing the negative cost effect. In the end, an increase in the exogenously given wage can result in an increase in both employment and utility.

Proposition 5 *In a small open economy characterized by involuntary low-skilled labour unemployment because of an exogenously given wage and a nontraded goods sector with endogenous price determination, a marginal increase in the low-skilled labour wage leads to an increase in employment and utility only if the price of the nontraded good increases. This follows from (34) and (35).*

Finally, we obtain the following equation system:

$$\begin{bmatrix} \alpha & 0 & -\frac{\partial \check{x}_n^d}{\partial u} \\ \frac{\partial l^d}{\partial p_n} & -1 & 0 \\ 0 & 1 & -\frac{\partial \check{T}}{\partial u} \end{bmatrix} \begin{bmatrix} dp_n \\ d\bar{l} \\ du \end{bmatrix} = \begin{bmatrix} -\beta d\bar{w} \\ -\frac{\partial l^d}{\partial \bar{w}} d\bar{w} \\ 0 \end{bmatrix}. \quad (36)$$

The sign of the determinant of the matrix in (36) is indeterminate:

$$\det = \alpha \frac{\partial \check{T}}{\partial u} - \frac{\partial l^d}{\partial p_n} \frac{\partial \check{x}_n^d}{\partial u}. \quad (37)$$

In order to derive the change in utility as a result of a change in the exogenously

given wage we make use of the following determinant:

$$\begin{vmatrix} \alpha & 0 & -\beta \\ \frac{\partial l^d}{\partial p_n} & -1 & -\frac{\partial l^d}{\partial \bar{w}} \\ 0 & 1 & 0 \end{vmatrix} = \alpha \frac{\partial l^d}{\partial \bar{w}} - \beta \frac{\partial l^d}{\partial p_n} . \quad (38)$$

It follows:

$$\frac{du}{d\bar{w}} = \frac{\alpha \frac{\partial l^d}{\partial \bar{w}} - \beta \frac{\partial l^d}{\partial p_n}}{\alpha \frac{\partial \check{T}}{\partial u} - \frac{\partial l^d}{\partial p_n} \frac{\partial \check{x}_n^d}{\partial u}} . \quad (39)$$

To show that the indirect effect of a labour demand shift to the right, i.e. the structural effect, can overcompensate the direct effect of a movement on the labour demand curve, i.e. the cost effect, is one of the essential objectives of our analysis. Equation (39) shows in detail which effects determine the increase in utility. An increase in the exogenously given wage leads to an increase in welfare and, according to (34), to an increase in employment as well if numerator and denominator reveal the same signs. Whether the numerator becomes positive or negative depends on α and β and on the size of the cost effect due to the increase in the exogenously given wage resulting in a reduction of low-skilled labour demand compared to the structural effect of an increase in the price of the nontraded good resulting in an increase in low-skilled labour demand: the cost effect's size compared to the output expansion effect is decisive. A priori, there is no reason to exclude the possibility of an increase in welfare when the exogenously given wage is increasing.

What remains to examine is how a change in the exogenously given wage changes employment. Again we make use of Cramer's Rule. Thus, we get:

$$\frac{d\bar{l}}{d\bar{w}} = \frac{\alpha \frac{\partial l^d}{\partial \bar{w}} \frac{\partial \check{T}}{\partial u} - \beta \frac{\partial l^d}{\partial p_n} \frac{\partial \check{T}}{\partial u}}{\alpha \frac{\partial \check{T}}{\partial u} - \frac{\partial l^d}{\partial p_n} \frac{\partial \check{x}_n^d}{\partial u}} = \frac{du}{d\bar{w}} \frac{\partial \check{T}}{\partial u} . \quad (40)$$

This expression can be interpreted in the same way as (39).

Proposition 6 *In a small open economy characterized by involuntary low-skilled*

labour unemployment because of an exogenously given wage and a nontraded goods sector with endogenous price determination, a marginal increase in the wage for low-skilled labour leads to an increase in employment and utility if and only if the structural effect dominates the cost effect. This follows from (40).

As an important result we are able to state: if there are spillover effects on the market for the nontraded good in a world with only one distortion, the distortion becoming more binding does not necessarily result in a welfare loss implying an increase in involuntary low-skilled labour unemployment. This more plausible approximation of what has been called the 'European scenario'¹⁰ is contrary to the standard scenario of a rationing economy characterized by only one distortion with all goods being traded internationally.

Furthermore it contradicts the reasoning of second-best welfare economics. The key to this miracle is the distortion itself. If we do not interpret the exogenously given wage but its consequence the quantity constraint distortion, we get again into accordance with second-best welfare economics. Welfare can only increase if employment increases. This is the major result of our analysis. But as could be shown, this does not imply that employment increases if and only if the exogenously given low-skilled labour wage decreases. So our analysis points out that one has to be careful when interpreting distortions. Not the cause but the consequence of a distortion proves to be the crucial point.

It is of special interest that the typical Keynesian feature of an increase in wages leading to an increase in employment is brought about by the integration of a perfectly competitive nontraded goods market, i.e. a clearly neoclassical feature, into a, except for the constraint on the low-skilled labour market, completely neoclassical general equilibrium model.

¹⁰See Krugman (1995).

7 Changing Terms-of-Trade in a Globalized World

In the context of the so-called 'trade and wages' debate, trade theorists like Lawrence and Slaughter (1993) have emphasized that from their point of view trade is an endogenous phenomenon and that the change in relative prices is the relevant transmission mechanism of the effects due to the process of economic internationalization. So, for trade economists Stolper-Samuelson effects have been the most prominent ones being analysed in order to elucidate the link between world market prices and factor prices. As a background for the empirical analysis, trade theorists have used the changes in relative goods prices suggested to characterize economic internationalization as a stylized fact. This is what we are starting from.

In addition, this line of reasoning displays that, in contrast to changes in the exogenously given wage, changes in terms-of-trade are a market phenomenon and do not imply any quantity constraint. While a change in wages results from bargaining power or from changes in the institutional settings, changes in terms-of-trade are an endogenous phenomenon. This applies even if the terms-of-trade are treated parametrically by a small open economy. Therefore we suggest that the unambiguous link between an increase in employment and an increase in welfare does not hold any longer for changes in terms-of-trade. This is clearly because parametrically treated terms-of-trade are not a distortion.

Without losing important insights we assume only two tradeable goods in order to simplify our analysis: let x_1 be the export good and x_2 be the import good with goods prices p_1 and p_2 . To guarantee consistency, we further have to assume three fully employed factors \mathbf{z} . As p_2 can be set to unity without further ado we can restrict ourselves to the analysis of a change in p_1 . Again we are making use of Cramer's Rule in order to derive the effect of a change in terms-of-trade on both

employment and utility. With $\left(\frac{\partial x_1^s}{\partial p_1} - \frac{\partial \tilde{x}_1^d}{\partial p_1}\right) \equiv \gamma < 0$ we get:

$$\frac{d\bar{l}}{dp_1} = \frac{\alpha \frac{\partial l^d}{\partial p_1} \frac{\partial \bar{T}}{\partial u} + \gamma \frac{\partial l^d}{\partial p_n} \frac{\partial \bar{T}}{\partial u} - (x_1^s - \tilde{x}_1^d) \frac{\partial l^d}{\partial p_n}}{\alpha \frac{\partial \bar{T}}{\partial u} - \frac{\partial \tilde{x}_1^d}{\partial u} \frac{\partial l^d}{\partial p_n}} \quad (41)$$

and

$$\frac{du}{dp_1} = \frac{\alpha \frac{\partial l^d}{\partial p_1} + \gamma \frac{\partial l^d}{\partial p_n} + \alpha(x_1^s - \tilde{x}_1^d)}{\alpha \frac{\partial \bar{T}}{\partial u} - \frac{\partial \tilde{x}_1^d}{\partial u} \frac{\partial l^d}{\partial p_n}}. \quad (42)$$

The numerator in (42) shows to be positive in the case of a terms-of-trade improvement. By contrast, the numerator in (41) can either be positive or negative. This elucidates the crucial point of a change in terms-of-trade:

Proposition 7 *In a small open economy characterized by involuntary low-skilled labour unemployment because of an exogenously given wage and a nontraded goods sector with endogenous price determination, the employment effect due to a terms-of-trade improvement can either be positive or negative. If the employment effect is positive, utility will increase. If the employment effect is negative, utility only increases if the terms-of-trade effect is dominating the negative employment effect. In the case of a terms-of-trade deterioration, utility increases if and only if the employment effect becomes positive and dominates the negative terms-of-trade effect. This follows from equations (41) and (42).*

8 Conclusions

Duality theory working with constrained and unconstrained transfer functions allows an analysis of economic scenarios characterized by binding quantity constraints. This has the advantage that only very general assumptions are necessary as to preferences and technology. For the case of a small open economy with only one distortion in form of an exogenously given wage in the market for low-skilled labour, comparative static results have shown that an increase in the exogenously given

wage can lead to an increase in both employment and utility. This effect is due to the change in the endogenously determined price of the nontraded good and the resulting output expansion effect. Furthermore, we could show that this change in the price of the nontraded good is a necessary but not a sufficient condition for an increase in employment and utility.

This result teaches that we should be very careful when interpreting distortions. Opposite effects have to be taken into consideration. At first glance one would suppose, according to second-best welfare economics, that in our model an increase in the exogenously given wage should lead to a decrease in employment and welfare. However, not the binding exogenously given wage is decisive, i.e. the kind of distortion, but the link between this distortion on the one hand and quantities and prices on goods and factor markets on the other hand. With reference to the question about the characteristics of typical Keynesian results, our conclusion clearly contradicts Neary (1990): for typical Keynesian results neither the existence of more than one distortion is necessary nor both representative actors have to be affected by market constraints. Finally, the analysis of a change in terms-of-trade has elucidated that the impact of economic internationalization interpreted as a change in terms-of-trade on employment critically depends on the economy's sectoral structure and the extent of price and quantity reactions in the nontraded goods market.

If one seeks to analyse the interaction between economic internationalization and factor prices, employment and welfare, one should sharply distinguish economic scenarios. In contrast to the 'American scenario', the 'European scenario' has to take factor price rigidities into consideration and has to focus on employment effects. Our general equilibrium based attempt to model the 'European scenario' more realistically has shown that an increase in the exogenously given wage for low-skilled labour does not necessarily result in a loss in welfare as well as in a decrease in employment contrary to standard results, renewing the focus on general equilibrium theory. When analysing the link between economic internationalization, factor prices, em-

ployment and welfare, one should not go back to partial equilibrium analysis, being done so often to give the 'trade and wages' debate a theoretical background, and forget the insights of more than a century of general equilibrium theory. The authors have strong beliefs that one should not complicate simple things as long as there are enough other opportunities to prove acuteness.

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