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ABSTRACT

In this article it is shown that when the effects of an increase in unemployment subsidies are studied in a general equilibrium framework, unemployment increases far less than in a "partial-partial" model, or may even decrease.

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I INTRODUCTION

A substantial literature exists regarding the effect of a change in the unemployment compensation level on the rate of unemployment. This literature consists of both theoretical and empirical contributions. The results from the theoretical analysis, founded primarily on search theory, show that an increase in unemployment compensation will increase the rate of unemployment in an economy. This result rests, however, on an analysis of the behavior of a single agent in an otherwise fixed economy, or in Michael Rotschild's terminology, it is just partial-partial analysis.

The question of the influence of unemployment benefits on unemployment, in particular the unemployment spell, has been the focus of many studies. In Narendranathan, Nickell and Stern (1985) a sample of 2300 men who registered as unemployed in the autumn of 1978 is analyzed. From interviews 6, 16 and 52 weeks after Cohort entry, the spell of unemployment, together with other characteristics, was noted. The result of the analysis was that the elasticity of expected registered unemployment duration for men with respect to unemployment benefits was 0.28-0.36. The result is claimed to be very well defined and highly robust.

This elasticity varies with age, ranging from 0.65 for teenage men, 0.47 for 20-24-year-old men, 0.26 for 25-44-year-old men and 0.08 for men older than 44.

This result, however, rests on a cross-sectional study. The question to what extent, or even whether the unemployment rate would increase if the un-

employment benefit was increased cannot be answered with the help of such an analysis. The claim by Lindbeck that "The theory of job search suggests that subsidized benefits of a general unemployment system ... create substitution effects in favor of greater frequency and longer duration periods of unemployment ... Indeed, empirical studies do indicate a statistically significant effect of this type", (Lindbeck (1981, p. 38)), implies that the result of cross-sectional and time-series studies have been confused.

The problem is similar to the one that confused so many for a long time some decades ago about consumption and saving. It was shown from cross-sectional data that the marginal propensity to consume was well below one. The conclusion was then drawn that as real income in general increased, the rate of consumption would decrease. But time series observations did not confirm this; average consumption increased at the same rate as income. The solution to this apparent paradox has now been awarded two Nobel-prizes. The lesson is that observations made in cross-section studies cannot nessessarily be applied to economic question, requiring knowledge about time-series conditions.

The same confusion occurs here. The fact that a cross-section study such as Narendranathan et al (1985) and studies preceding that show with significance that job-searching individuals with higher unemployment benefits (holding all other characteristics constant) will have a longer unemployment duration <u>is not</u> a legitimate foundation for propositions like the one Lindbeck ventilates in the quotation above; "... subsidized benefits of a general unemployment system ... create ... longer

duration periods of unemployment ...". Indeed, an increase in subsidized benefits to the unemployed - general or of a specific nature - could have the effect that periods of unemployment spells decrease over time while still being perfectly compatible with the observation from cross-section data that the unemployment duration increases with an increased unemployment benefit

This is illustrated in Albrecht, Axell (1984), where a model economy with a search labor market and an auctioneer product market is employed. Individuals differ with respect to the "utility" they gain from being unemployed, which can be interpreted as if they receive different unemployment benefits. Firms differ with respect to their labor productivity. It is then shown that a wage dispersion equilibrium exists with endogenously determined search unemployment. In that equilibrium situation those with high unemployment benefits will have a longer unemployment duration. However, an examination of the impact of an increase in subsidized unemployment benefits gives the following result. If the increase in unemployment insurance (UI) benefits is general, then the unemployment duration will increase. If, however, the increase in benefits is designed according to a "solidaric" profile, i.e., the benefit is increased for only those who have relatively small UI-benefits, then the over-all unemployment duration will decrease, conditional upon a specified shape of the firms' labor-productivity distribution.

The intuition behind this result is the following: In equilibrium individuals with high UI-benefits will have high reservation wages, while those with

low UI-benefits will have low reservation wages. Firms can exploit this condition. The choice is to set a low wage and attract only low-reservation-wage individuals or set a high wage and attract all searchers. The two strategies yield different firm sizes, resulting in an identical total profil for the large and small firms. If now UI-benefits are increased for those who have low benefits these persons will increase their reservation wages. For this reason, the low-wage firms must increase their wage offers. Then the profit of the low-wage strategy will decrease. The most productive of the low-wage firms will then change to the high-wage strategy, and the least productive will go out of business. The net effect is that the relative frequency of high-wage firms will increase. But the high-wage firms are exactly what the search-unemployed are searching for. With a larger frequency of these firms, it will on average take fewer search steps to find a high-wage firm. Therefore, the duration of unemployment decreases.

In Lang (1985) it is argued that the general equilibrium effect is non-negligible. Indeed, the usual search theoretic setup gives the equation

$$d\ \ln(D) = \frac{f(w)}{1-F(w)}\,[dw^{*}-dw^{**}],$$

where D is the duration of unemployment, F(w) and f(w) are the distribution and density of wage offers among firms, dw^{*} is the reservation wage differential for an individual with reservation wage w, dw^{**} the wage offer differential for a firm with wage offer w.

We see from this equation that ln(D) is as sensitive to changes in firms' wage offers (w^{**}) as it is to changes in unemployed individuals' reservation wages (w^{*}). This means that in order for an equation for ln(D), estimated from cross-sectional individual data, to be useful for policy considerations, dw^{**} must be small relative to dw^{*}, i.e.,

$|dw^{**}| \leq \epsilon |dw^{*}|$ for some small number ϵ.

However, under certain assumptions the profit maximization behavior of the firm is shown to lead to

$|dw^{**}| \geq \frac{1}{2}|dw^{*}|$.

In this paper we analyze the effects of an increase in unemployment compensation in a general equilibrium framework, without an auctioneer or general equilibrium search. In our model, where general equilibrium effects are taken into account, i.e., the interdependence between markets and of the two sides in the economy - those for firms and individuals, the "traditional" effects of an increase in unemployment compensation will be completely and unambiguously reversed. We show that if unemployment compensation is generally increased this will result in a **decrease** in the unemployment rate in the economy. The result is completely unambiguous.

II OVERVIEW OF THE MODEL

The model employed below is presented in detail in Albrecht, Axell and Lang (1986). The modification made is the introduction of an unemployment compensation, financed by a general profit-tax

In this economy, one homogeneous commodity is produced and consumed. There is one homogeneous factor of production, labor and one good which is produced by firms using labor. All firms have the same constant returns production function.

When individuals are born, they have neither a job nor a ready product market. They start their lives by drawing a wage offer at random (from an urn of wage offers) and a price offer at random from another urn of price offers. The distributions of price and wage offers are known to the individuals.

Each individual faces a death risk of τ per period, and τ is constant through life. The individual compares the expected lifetime real consumption from starting to work at the offered wage and consuming at the offered price with the expected lifetime real consumption from continued search. If the wage he draws is very high and/or the price he draws is very low, he starts to work and becomes employed, otherwise he rejects both offers and continues to search so long as the expected value of accepting the offers falls below the expected value of further search.

If there is price and wage dispersion in the general (Nash) equilibrium there will be endogenous unemployment in this economy. The size of this unemployment is, of course, determined by the endogenous shapes of the wage and price distributions.

The existence of a stable price and wage dispersion equilibrium is proved in Albrecht, Axell and Lang (1986). To see the mechanism, let us briefly explain the situation of the firm.

A firm, facing searching employees as described, has a negatively sloped product demand curve and a positively sloped labor supply curve. A searcher will with greater probability accept a low price than a high price. Likewise a searcher will with greater probability accept a high wage than a low wage.

If a firm sets a low price, the demand is high. But in order to produce a large quantity, it has to attract many workers; i.e., it has to offer a high wage. It will thus produce and sell a large quantity but at a small profit margin per unit. Another strategy that gives the same total profit is to set a high price, giving rise to a low demand. The firm then requires relatively few workers and can offer a relatively low wage. The profit for these latter firms with a low volume and high margin can equal the profit for the high volume/low margin firms because the profit margin per unit is large (high price, low wage) which compensates for the smaller quantity.

We show in Albrecht, Axell and Lang (1986) that such a price-wage dispersion Nash equilibrium ex-

ists. In particular, we show the existence of an equilibrium with just two wages (w_0 and w_1) and two prices (p_0 and p_1). The optimal strategy of a firm is then to charge either (p_0, w_1) or (p_1, w_0), where both combinations yield identical profits.

Notations

w_0 : The low wage
w_1 : The high wage
p_0 : The low price
p_1 : The high price
θ : Dividends
γ : Frequency of high wage-low price firms
k : Optimal reservation real income $\frac{w+\theta}{p}$
τ : The death risk (constant)
b : Unemployment compensation
u : Individuals
n : Firms
μ : u/n = individuals per firm
s : Unemployment rate
$\ell(w)$: The supply of labor a firm faces offering the wage w
$g(p)$: The demand for products a firm faces charging the price p

When unemployment compensation is introduced, the model is described by the following equations:

$$\frac{k}{\tau} = (\theta+b)\left(\frac{1-\gamma}{p_1} + \frac{\gamma}{p_0}\right) + \frac{1-\tau}{\tau}\gamma^2\frac{w_1+\theta}{p_0} +$$

$$+ \frac{1-\tau}{\tau}(1-\gamma^2)k \qquad (1)$$

$$(p_1-w_0)\gamma = p_0 - w_1 \qquad (2)$$

$$\theta + b + \frac{1-\tau}{\tau}\gamma(w_1+\theta) = p_1\frac{1-\tau}{\tau}\gamma \qquad (3)$$

$$\theta + b + \frac{1-\tau}{\tau}\left[(1-\gamma)(w_0+\theta) + \gamma(w_1+\theta)\right] = p_0\frac{1-\tau}{\tau} \qquad (4)$$

$$p_0 = \frac{w_0+\theta}{k} \qquad (5)$$

$$p_1 = \frac{w_1+\theta}{k} \qquad (6)$$

There are six equations and seven unknowns (k, θ, p_0, p_1, w_0, w_1 and γ). There must be a unit of account, thus one of the unknowns is used as a numeraire and hence is set equal to one.

Equation (1) is the optimal search equation. A price and wage offer is acceptable if

$$\frac{w+\theta}{p} > \tau V \equiv k$$

where V is the real lifetime consumption, given that the individual follows an optimal search strategy.

Hence,

$$V = (\theta+b)E\left(\frac{1}{p}\right) + \frac{1-\tau}{\tau}E\left(\frac{w+\theta}{p}\middle|\frac{w+\theta}{p}>k\right)\cdot Pr\left(\frac{w+\theta}{p} > k\right) +$$

$$+(1-\tau)V\cdot Pr\left(\frac{w+\theta}{p} < k\right).$$

Substituting $k/\tau = V$ for the case of a two wage-two price equilibrium gives

$$\frac{k}{\tau} = (\theta+b)\left(\frac{1-\gamma}{p_1} + \frac{\gamma}{p_0}\right) + \frac{1-\tau}{\tau}\gamma^2\frac{w_1+\theta}{p_0} + \frac{1-\tau}{\tau}(1-\gamma^2)k \quad (1)$$

The equal profit constraint ensures that firms with a low wage (w_0) and high price (p_1) (small firms), gain the same profit as firms with high wage (w_1) and low price (p_0) (large firms).

Hence,

$$(p_1-w_0) \cdot q(p_1) = (p_0-w_1)q(p_0)$$

(We assume a constant returns production function, where simply $q(p) = \ell(w)$.)

The labor supply functions as functions of the wage offered, as well as product demand functions of offered price are derived in Albrecht-Axell-Lang (1986).

In the present model they become:

$$q(p) = \begin{cases} \frac{\mu s}{p}\left\{\theta + b + \frac{1-\tau}{\tau}\left[(1-\gamma)(w_0+\theta) + \gamma(w_1+\theta)\right]\right\} & p<p_0 \\ \frac{\mu s}{p}\left\{\theta + b + \frac{1-\tau}{\tau}\gamma(w_1+\theta)\right\} & p_0<p<p_1 \\ \frac{\mu s(\theta+b)}{p} & p_1<p \end{cases}$$

$$\ell(w) = \begin{cases} 0 & w<w_0 \\ \mu s \frac{1-\tau}{\tau}\gamma & w_0<w<w_1 \\ \mu s \frac{1-\tau}{\tau} & w_1<w \end{cases}$$

Hence,

$$(p_1-w_0)\cdot q(p_1) = (p_0-w_1)\cdot q(p_0),$$

i.e.,

$$(p_1-w_0)\cdot \ell(w_0) = (p_0-w_1)\cdot \ell(w_1),$$

i.e.,

$$(p_1-w_0)\mu s \frac{1-\tau}{\tau} \gamma = (p_0-w_1)\mu s \frac{1-\tau}{\tau}$$

or

$$(p_1-w_0)\cdot\gamma = p_0 - w_1 \qquad (2)$$

Equations (3) and (4) follow immediately from the production constraint.

$$q(p_1) = \ell(w_0)$$

$$\frac{\mu s}{p_1}\{\theta + b + \frac{1-\tau}{\tau}\gamma(w_1+\theta)\} = \mu s \frac{1-\tau}{\tau}\gamma$$

or

$$\theta + b + \frac{1-\tau}{\tau}\gamma(w_1+\theta) = p_1 \frac{1-\tau}{\tau}\gamma \qquad (3)$$

and

$$q(p_0) = \ell(w_1)$$

i.e.,

$$\frac{\mu s}{p_0}\left\{\theta + b + \frac{1-\tau}{\tau}\left[(1-\gamma)(w_0+\theta) + \gamma(w_1+\theta)\right]\right\} =$$

$$= \mu s \cdot \frac{1-\tau}{\tau}$$

or

$$\theta + b + \frac{1-\tau}{t}\left[(1-\gamma)(w_0+\theta) + \gamma(w_1+\theta)\right] = p_0\,\frac{1-\tau}{\tau} \qquad (4)$$

In addition we have

$$p_0 = \frac{w_0+\theta}{k} \qquad (5)$$

and

$$p_1 = \frac{w_1+\theta}{k} \qquad (6)$$

which constitutes the entire model.

III THE EFFECT OF A CHANGE IN UNEMPLOYMENT COMPENSATION

Solving for γ we get the following equation:

$$\gamma^3 - 2\gamma^2 + \frac{\tau}{\theta(1-\tau)}(2b+\theta-(b+\theta)\gamma) = 0$$

Setting $\tau^* = \frac{\tau}{1-\tau}$ and $\beta = \frac{b}{\theta}$ we get

$$\gamma^3 - 2\gamma^2 + \tau^*(2\beta+1-(\beta+1)\gamma) = 0$$

We see that this equation has a unique solution for $0 < \gamma < 1$, since the LHS is positive for $\gamma = 0$ and negative for $\gamma = 1$ if $b < \frac{\theta(1-\tau)}{\tau}$. The LHS is also strictly decreasing.

Total differentiation gives:

$$[3\gamma^2-4\gamma-\tau^*(1+\beta)]\, d\gamma = -\tau^*(2-\gamma)d\beta,$$

where both the LHS and RHS are negative. This implies that $d\gamma/d\beta$ is unambiguously positive, or that an increase in unemployment compensation will increase the frequency of firms with a high wage and low price.

Since the unemployment rate is[1]

$$s = \frac{\tau}{1-(1-\tau)(1-\gamma)^2}$$

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[1] For derivation, see Albrecht-Axell-Lang (1986).

an increase in γ will <u>decrease</u> the unemployment rate. (Note that if $b > \frac{\theta(1-\tau)}{\tau}$ we have a single wage-single price equilibrium with the constant and lowest possible unemployment rate $s=\tau$.)

This general equilibrium analysis of unemployment compensation thus <u>reverses</u> the traditional result of labor economics concerning the effects of unemployment compensation.

If the unemployment compensation is increased in an economy like that in Sweden, then the rate of unemployment decreases. This is a paradoxical result in a search unemployment economy when disregarding all "Keynesian" effects via aggregated demand.

The reasoning is as follows. In the two-point equilibrium that is explored in this analysis, the strategy to set a low wage and high price or a high wage and low price yields the same profit. The low-wage firms will yield a higher profit per unit produced, but will be of a relatively small size, while the high wage - low price firms will produce and sell more but with a smaller profit margin.

When an unemployment benefit is introduced (or increased) those who draw the low wage offer and previously found it acceptable will now find it unacceptable and prefer further search. Therefore, in order to get any workers at all, the low-wage firms have to increase their wage offers. But then the profit for low-wage firms will be smaller than that for high-wage firms. There is an incentive for low-wage firms to change strategy and become high-wage firms. Changes will be undertaken by some of the low-wage firms until the profit per firm is evened out. But then the frequency of low wage

offers and high price offers, which are exactly what cause searchers to continue to search, diminishes. The average period of unemployment needed to find acceptable price and wage offers will therefore decrease. The rate of unemployment goes down as a consequence of higher unemployment benefits.

IV SUMMARY AND CONCLUSIONS

In this paper we have analyzed the effects on unemployment when unemployment compensation is increased. Many previous studies that showed a positive correlation between unemployment compensation and unemployment base this result on partial models with cross-sectional data. Thus we question whether or not the increase or decrease in overall unemployment can be determined by such studies, as they give no information about the total general equilibrium outcome. Instead, conclusions about total effects founded on cross-sectional data, make the same mistake as decades ago predictions about consumptions based on cross-sectional consumption data.

In this study it is shown that if general equilibrium effects (i.e. the interdependence between markets in an entire economy) are taken into consideration, the impact on unemployment of an increase in unemployment compensation could give rise to a <u>decrease</u> in the rate of unemployment.

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