



Model Distraction: A Comment on Daveri and Tabellini

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In 2000, Francesco Daveri and Guido Tabellini published an article in *Economic Policy*, a prominent European journal published by the London-based Centre for Economic Policy Research. The article has been quite influential: by August 2012 it had accumulated 184 citations in the Thomson Reuters Web of Science.

Daveri and Tabellini's article is titled "Unemployment, Growth and Taxation in Industrial Countries." It argues that the increase in labor taxation seen in most industrialized countries, from the second half of the 1960s, has had varying effects depending on the prevalent characteristics in the respective labor markets. In countries with competitive markets, that increase did not produce substantial effects on labor costs, but in continental Europe, the authors say, trade unions shifted a large part of the burden of the taxation increase onto businesses. The resulting increase in labor costs, according to the authors, had two effects: (1) it reduced the labor demanded, leading to an increase in unemployment; (2) it resulted in an increase in the capital-labor ratio and a reduction in the rate of return on capital as well as the GDP growth rate. According to the authors, therefore, the increase in labor taxation contributed in a significant manner to the increased unemployment and slower growth in European countries.

The layman's impressions about the connection between heightened levels of unemployment and reduced levels of economic growth are fundamentally right, say Daveri and Tabellini. They attempt to offer an explanation for the connection.

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They say that their goal “is to make this argument more precise,” and thus they develop a model. The model’s “results serve as a basis for [their] empirical investigation” (2000, 51-52).

Daveri and Tabellini say that labor taxation was increased chiefly in order to pay for increases in the public social security systems. They then suggest that, by reducing public pensions, states can reduce labor taxation levels and thereby reduce the cost of labor, increase employment, and spur economic growth. In their words:

The first and most important implication concerns the cost of the generous European welfare states. The spectacular rise in labor taxes in Europe is mainly due to rising pension expenditures. The cost entailed by these tax distortions has probably been underestimated by European policymakers and public opinion at large. Our estimates on the effects of labor taxes suggest that the long-run benefits of pension reforms could be very large, in terms of unemployment, investment and growth. (87)

In what follows, I present the main features of the Daveri and Tabellini model. I demonstrate that in the model the existence of unemployment benefits is a necessary, although not sufficient, condition for the existence of unemployment. In light of that result, I question the purpose, usefulness, and framing of Daveri and Tabellini’s article.

The main features of the Daveri and Tabellini model

The model proposed by Daveri and Tabellini describes the functioning of an economic system closed to the rest of the world. Four types of agents are at work: individuals, businesses, a trade union, and the government. The model is one of general equilibrium with overlapping generations. The population of individuals is constant, and individuals live for only two periods: working age and old age. Therefore, in every period there are two generations: young individuals (of which the labor force is made up) and old individuals (the owners of capital). The entire labor force belongs to a trade union that acts as a monopolist in the labor market and is therefore able to impose real wage rates on businesses. The businesses are perfectly competitive; they produce a single commodity, using the labor offered by the young along with capital, which is a physical quantity of the sole commodity produced. If a young individual is employed, he receives real net wages equal to $w(1-\tau)$, where w is the gross wage rate set by the trade union and τ is the wage taxation rate. If an individual is unemployed he receives unemployment benefits, s , which are not subject to taxation.

At the end of the productive process the old individuals consume a physical quantity of the commodity equal to the stock used in the production, capitalized at interest rate $r(1-\tau^k)$, where r is the rate of return on capital before taxes and τ^k is the tax rate on capital income. The young individuals, both employed and unemployed, only partially consume their income. Savings are an increasing function of income and of the interest rate after taxes $r(1-\tau^k)$. Savings are entirely invested and constitute the stock of physical capital which will be used, along with the labor of the new generation of young individuals, in production in the period immediately afterwards.

Acting autonomously, a government sets all of the variables of fiscal policy (2000, 97). In all periods the revenues from income taxes are entirely used either to pay for unemployment benefits or for government consumption, “the latter being treated as a residual variable that plays no role except to balance the budget” (2000, 57). Pension payments come under government consumption. The government budget constraint in per capita terms is as follows:

$$\tau^k r k + \tau^l w l = \gamma + (1-l)s \quad (1) \text{ [A4]}$$

where τ^k is the tax rate on capital incomes; r is the interest rate before taxes; k is the stock of capital per member of the labor force; τ^l is the wage tax rate; w is the wage rate before taxes; l is the employment rate; γ is government consumption per unit of labor force; and s is unemployment benefits. On the left side of the equation (1) is the government revenue, and on the right is public expenditure. (I provide new numbering to equations that appear in the Daveri and Tabellini article but also, in brackets, their original numbering of corresponding equations, which are sometimes in slightly different yet equivalent form.)

Labor market equilibrium

As stated above, businesses are perfectly competitive. They produce a sole commodity by way of the use of labor and a physical quantity of the commodity itself. Technology is represented by the following production function:

$$y = \varphi(k)l^{1-\alpha} \quad (2) \text{ [A6]}$$

where y is the level of the real product divided by the overall labor force N ; k is the stock of capital per member of the labor force existing at the beginning of the period; φ is a concave and increasing function; l is the employment rate, $l \leq 1$; and α is a parameter, $0 < \alpha < 1$.

Through equation (2) the following labor demand function is obtained:

$$l = \left(\frac{(1 - \alpha)(1 - \tau)^{\lambda} \varphi(k)}{w_n} \right)^{1/\alpha} \quad (3) \text{ [A7]}$$

where w_n is the real wage rate after taxes, $w_n = w(1 - \tau)^{\lambda}$. The function (3) is decreasing and convex; it is asymptotic in relation to both the axes (w_n, l) ; the elasticity is constant and equal to $1/\alpha$:²

$$|\varepsilon| : = \left| \frac{\partial l}{\partial w_n} \right| \frac{w_n}{l} = \frac{1}{\alpha} \quad (4)$$

with $1/\alpha > 1$. All things being equal, an increase in τ^{λ} causes a downward shift in the entire labor demand function towards the left. The reason for such a shift can be intuited. In order that businesses may continue to maximize profits, any increase in the wage tax rate must be followed by a reduction in the wage rate after taxes so that the gross wage rate remains unchanged.

Daveri and Tabellini hypothesize that the trade union acts as a monopolist in the labor market and that it sets real wages at the level at which the expected income of a union member is at its highest (again, every worker belongs to the union). The union's objective function is therefore:

$$lw(1 - \tau)^{\lambda} + (1 - l)s \quad (5) \text{ [A9]}$$

where l and $1 - l$ express the odds that a worker is employed or unemployed, respectively, and w is the real wage rate before taxes. Moreover, as has already been said, τ^{λ} is the wage tax rate and s is unemployment benefits; the size of each is set by the government and is, therefore, given from the union's point of view. I will use an equivalent objective function from an analytical point of view, obtained by multiplying (5) by the labor force N :

$$Nlw(1 - \tau)^{\lambda} + N(1 - l)s \quad (6)$$

The trade union's objective, according to (6), is to maximize the sum of the overall net wages, $Nlw(1 - \tau)^{\lambda}$, and unemployment benefits, $N(1 - l)s$.

All the elements necessary to solve the trade union's optimization problem are now in place. The problem involves determining the level of the real wage rate³ so that (6) is maximized under the constraint represented by equation (3), given the

2. For the demonstration see Appendix A.

3. Since the wage tax rate is a given from the union's point of view, reference can be made either to before-tax or to the after-tax wages without any change.

levels of τ' and s set by the government. From this maximization the equilibrium level of the gross wage rate is derived:⁴

$$w^E = \frac{s}{(1-\alpha)(1-\tau')} \quad (7) \text{ [A10]}$$

to which the following level of wage rate after taxes w_n^E corresponds:

$$w_n^E = \frac{s}{1-\alpha} \quad (8)$$

Substituting (8) in (3) yields the equilibrium level of employment divided by the overall labor force N , i.e., the equilibrium rate of employment:

$$l^E = \left(\frac{(1-\alpha)^2(1-\tau')\varphi(k)}{s} \right)^{1/\alpha} \quad (9) \text{ [A11]}$$

From the presentation given by Daveri and Tabellini, one is led to think that the causes of unemployment in the model are the level of labor taxation (and the corresponding pension expenditure) and the contractual power of the trade union. An increase in the government's pension expenditure would bring about an increase in the wage tax rate. Thanks to the power to impose the real wage level on businesses hypothesized by the authors, the trade union would entirely shift such an increase to the businesses themselves. The gross real wage (equation 7) would increase so as to be sufficient enough to leave the real net wage unchanged (eq. 8), and the wage increase would bring about a reduction in employment (eq. 9). In the following section I shall illustrate why Daveri and Tabellini's interpretation of the causes of unemployment in the model is not convincing.

The role of unemployment benefits

With reference to the Daveri and Tabellini model I shall now demonstrate the following propositions:

1. The existence of unemployment benefits is a necessary condition for the existence of unemployment.
2. The existence of unemployment benefits is not a sufficient condition for the existence of unemployment.

Let us demonstrate the first proposition. Assume that there are no benefits— $s = 0$ —and that the wage tax rate at any specific level is given to be

4. The demonstration is provided in Appendix B.

$0 < \tau^l < 1$. With $s = 0$, from equation (6) one obtains the following as the trade union's objective function:

$$Nw(1-\tau^l) \tag{10}$$

Therefore, the trade union's objective is to maximize overall wages after taxes.

Consider an infinitesimal reduction in the real wage rate w from any level higher than that of full employment. Since labor demand elasticity is greater than 1, given τ^l , a decrease in w will lead to an increase in total after-tax wages. For the maximization of overall net wages, the trade union will therefore have to set the real wage rate at the level that yields full employment. Since the wage tax rate that we have hypothesized is arbitrary, we can conclude that in the absence of unemployment benefits it is convenient for the monopoly trade union to fix the wage rate at the full employment level, whatever the level of the wage tax rate may be.

So I have demonstrated that in the Daveri and Tabellini model the absence of unemployment benefits implies the absence of unemployment. Consequently, the existence of unemployment implies the existence of unemployment benefits. The existence of unemployment benefits is a necessary condition for unemployment.

The economic explanation is that unemployment benefits represent an incentive for the monopoly trade union to fix the wage rate above the level associated with full employment because they guarantee a transfer to workers who would be laid off. Since labor demand elasticity is greater than 1, an increase in the wage rate would only accentuate the drop in the overall wages. Therefore, in the absence of unemployment benefits, an increase in labor taxation would weigh entirely upon the workers: the trade union would leave the real gross wage rate unchanged and the economy would retain full employment.

Daveri and Tabellini highlight the role of the contract power of the trade union and the level of labor taxation (and that of pension expenditure). But neither would be able to cause unemployment if there were no unemployment benefits in the model. This leads to the question: Why should the government introduce unemployment benefits in an economic system that otherwise would always operate at full employment?

I shall now demonstrate the second proposition, that the existence of unemployment benefits is not a sufficient condition for the existence of unemployment. Let $s > 0$ and $0 < \tau^l < 1$. First, calculate the after-tax wage rate that corresponds to full employment, indicated by the symbol w_n^{FE} . Assuming $l = 1$, from equation (3) one obtains:

$$w_n^{FE} = (1 - \alpha)(1 - \tau^l)\varphi(k) \tag{11}$$

Assume that the following condition holds:

$$s = (1-\alpha)^2(1-\tau^l)\varphi(\kappa) \quad (12)$$

Substituting this expression in equation (8), one finds that even though unemployment benefits have been introduced, there is still full employment:

$$w_n^E = \frac{(1-\alpha)^2(1-\tau^l)\varphi(\kappa)}{1-\alpha} = w_n^{FE} \quad (13)$$

Thus in the Daveri and Tabellini model the existence of unemployment benefits is not a sufficient condition for unemployment. In order to have unemployment, the following condition must hold:

$$s > (1-\alpha)^2(1-\tau^l)\varphi(\kappa) \quad (14)$$

To prove this, substitute (14) in (8). One obtains:

$$w_n^E > (1-\alpha)(1-\tau^l)\varphi(\kappa) = w_n^{FE} \quad (15)$$

As for the economic meaning of condition (14), unemployment benefits are an incentive for the trade union to increase the wage rate as a response to an increase in labor taxation. If this incentive is strong enough (i.e., the unemployment benefits are high enough), the reduction in the total net wages caused by an increase in the real wage rate above the level of full employment will be compensated for by the overall unemployment benefits. In this case the trade union would be well advised to increase wages, and an increase in τ^l will actually cause unemployment.

The above gives rise to a second question, logically subordinate to the first, which is, as has been seen, the economic justification for the existence of unemployment benefits in the Daveri and Tabellini model. Assume that condition (12) holds and, therefore, that there is no unemployment. Suppose the government increases the wage tax rate (and pension expenditure); the negative effect on employment this would bring about could be eliminated by decreasing unemployment benefits. Since in the Daveri and Tabellini model unemployment benefits are a waste of resources, and the authors assume that the government controls all the policy variables (2000, 97), the reduction of unemployment benefits is the best way to maintain a situation of full employment. Daveri and Tabellini make no mention of this possibility. The reader is led to believe that reductions to labor taxation and pension expenditure are the main economic policy indications that derive from the model. Why is this so?

Appendix A: The wage elasticity of the labor demand

$$|\varepsilon| := \left| \frac{\partial l}{\partial w_n} \right| \frac{w_n}{l} \quad (\text{A1})$$

Where:

$$l = [(1 - \alpha)(1 - \tau^k)\varphi(k)]^{1/\alpha} w_n^{-1/\alpha} \quad (\text{A2})$$

Substituting (A2) in (A1), one obtains:

$$\begin{aligned} |\varepsilon| &= [(1 - \alpha)(1 - \tau^k)\varphi(k)]^{1/\alpha} \left| \frac{d}{dw_n} w_n^{-1/\alpha} \right| \frac{w_n}{[(1 - \alpha)(1 - \tau^k)\varphi(k)]^{1/\alpha} w_n^{-1/\alpha}} \\ &= \frac{1}{\alpha} w_n^{-1/\alpha - 1} \frac{w_n}{w_n^{-1/\alpha}} = \frac{1}{\alpha} \end{aligned} \quad (\text{A3})$$

Appendix B: Trade union's problem

$$\max_w \{Nlw(1 - \tau^k) + N(1 - l)s\} \quad (\text{B1})$$

$$s.t. \quad l = [(1 - \alpha)\varphi(k)]^{1/\alpha} w^{-1/\alpha} \quad (\text{B2})$$

Where:

$$w = \frac{w_n}{1 - \tau^l} \quad (\text{B3})$$

First-order condition:

$$N \frac{\partial l}{\partial w} w(1 - \tau^k) + Nl(1 - \tau^k) - Ns \frac{\partial l}{\partial w} = 0 \quad (\text{B4})$$

The economic meaning of the first-order condition is the following. An increase in the wage rate has two contrasting effects on overall wages. First, it decreases employment. This negative effect is caught by the first term of the sum,

$N \frac{\partial l}{\partial w} w(1 - \tau^l)$. Second, workers who are not fired as a consequence of the increase in wage rate get a bigger wage; this positive effect is represented by the second term, $Nl(1 - \tau^l)$. Since labor demand elasticity is bigger than 1, the negative effect prevails, so the sum of the first two terms is negative. This can be described as the trade union's marginal cost. Finally the last term, $-Ns \frac{\partial l}{\partial w}$, catches the increase in unemployment benefits; this can be considered the trade union's marginal benefit. So, an increase in the wage rate has a negative effect on the overall wages and a positive effect on unemployment benefits. The monopoly trade union fixes the wage rate as to balance these two effects.

Let us calculate the following partial derivative:

$$\frac{\partial l}{\partial w} = [(1 - \alpha)\varphi(k)]^{1/\alpha} \frac{d}{dw} w^{-1/\alpha} = -\frac{1}{\alpha} [(1 - \alpha)\varphi(k)]^{1/\alpha} w^{-1/\alpha - 1} = -\frac{l}{\alpha w} \quad (\text{B5})$$

Substituting equation (B5) in equation (B4), one obtains:

$$-\frac{Nl}{\alpha w} w(1 - \tau^l) + Nl(1 - \tau^l) + \frac{Ns}{\alpha w} = 0 \quad (\text{B6})$$

From equation (B6), after some algebraic passages, one obtains the Daveri and Tabellini equation [A10]:

$$w^E = \frac{s}{(1 - \alpha)(1 - \tau^l)} \quad (\text{B7}) \text{ [A10]}$$

References

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