Variable labor effort, involuntary unemployment, and effective demand

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Irreconcilable concepts?

A large and growing literature has developed that attempts to utilize the variable labor effort (VLE) hypothesis as an explanation of involuntary unemployment. The VLE hypothesis allegedly recognizes Marx's contention that the purchase of labor services has a unique and defining characteristic: capital does not purchase a specific amount of labor activity (LD); rather, it purchases control over labor services for a specific (and finite) period of time (LP). Since sales depend on LD while costs depend on LP, profit maximizing firms must account for worker effort, $e = LD/LP$, in their maximand.

Effort is a function of the wage rate, $e = e(w)$, in both neo-Keynesian (Akerloff and Yellen, 1986; Katz, 1986; Stiglitz, 1987) and neo-Marxian (Bowles and Gintis, 1990; Bowles, 1985; Gordon, 1990) models and firms select the wage-employment combination that maximizes profit. The labor extraction function then is a constraint on the profit maximizing behavior of neoclassically competitive firms; thereby, an equilibrium is reached where the VLE wage rate may exceed the Walrasian wage rate[1] and thus involuntary unemployment may occur.

The exact relationship between the VLE hypothesis, effective demand, and resource mobility is less clear. The reason for this lack of clarity may be found in the conceptualization of the labor market, especially the role of the wage rate. Wages as a source of effective demand have been ignored. Yet the common intellectual heritage of both Keynesian and Marxian traditions suggest that wages are a major component of effective demand. When one considers the relationship between the

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[1]The "Walrasian wage rate" is that wage rate that occurs in the absence of the VLE hypothesis.

wage bill and the level of effective demand, it is not immediately obvious that "high wages" are the source of involuntary unemployment, nor is it immediately obvious that if involuntary unemployment does exist, it is caused, primarily, by the variability of worker effort. Accordingly, one task of this paper is to explore the character of neo-Keynesian and neo-Marxian equilibria when sources of income (wages and profit) are explicitly related to types of spending (consumption and investment).

The integration of wages as a source of effective demand into models incorporating the VLE hypothesis is of very recent vintage. Drago (1990) explores this relationship; but this model takes changes in effective demand as exogenous, not induced by changes in the wage bill. Bowles and Boyer (1988, 1991) provide an ambitious attempt to model the wage rate as a cost of production, a labor extraction mechanism, and a determinant of aggregate demand. Clearly, this neo-Marxian conceptualization of the wage rate goes far beyond the standard notion that the price of labor services is synonymous with the price of any other good or service sold on the market. Interestingly, involuntary unemployment in the Bowles and Boyer model is not, primarily, a result of insufficient effective demand. The unemployment results from a supply-side wage-squeeze mechanism.

In a wage-squeeze model of involuntary unemployment, rising real wages eventually reduce profitability. Specifically, as the employment rate increases, there are contradictory effects on the total profits of the representative firm. On the one hand, for a given real wage rate, a rise in the employment rate will increase total profits. On the other hand, a rise in the employment rate will tend to reduce worker effort as the cost of job loss declines. At a high employment rate, profits are thus squeezed and no new job offers are forthcoming.

Effective demand does not play a role in determining the wage squeeze. Effective demand considerations may lead to a greater or lesser amount of unemployment, but the supply-side wage squeeze occurs whether or not investment is totally exogenous or adjusts to savings out of profits (Bowles and Boyer, 1988, 1991).

Finally, a second task of this paper is to explore the stability of VLE equilibria when there are no constraints on resource mobility. Specifically, if VLE contractual arrangements are nonbinding on entering firms which hire directly from the pool of involuntarily unemployed, and if a spell of unemployment induces workers to supply greater effort for any given wage rate, then VLE equilibria may also be degenerative equilibria.

The current model differs from Bowles and Boyer in that it examines

the effect of efficiency wages on effective demand without the contrivance of a wage-squeeze mechanism. Moreover, the current model explicitly connects the comparative statics of VLE, resource mobility, and effective demand to various types of macroeconomic equilibria that have been hypothesized in the literature.[2]

Formal macro-model and its micro-foundations

Generally, VLE models assume "something like perfect competition"[3] in the operation of labor markets. Firms maximize the following objective function, with respect to the wage rate and the volume of employment:

$$\max_{(w,\, n)} p\theta f(e(w)n) - wn\,, \tag{1}$$

where p = the price of the firm's output, w = the wage rate, n = the volume of employment, e = is the effort extraction function, θ = the rate of technological progress. Therefore, in addition to the traditional role of the wage rate as a measure of allocative efficiency, the wage rate also serves as a effort extraction mechanism.

The model's first-order conditions imply:

$$[w_*/e(w_*)]/e'(w_*) = 1, \tag{2}$$

and

$$w_* = p\theta f'(e(w_*),n_*)e(w_*). \tag{3}$$

Equation (2) states that at the equilibrium wage rate firms will hire workers up to the point where the wage elasticity of effort is equal to unity. Equation (3) states that the efficiency adjusted wage rate is equal to the value of the marginal product of labor.

[2] This paper does not attempt an empirical evaluation of either the efficiency wage or contested exchange versions of VLE. The focus here is solely on the internal consistency of alternative theorectical perspectives. Bowles, Gordon, and Weisskopf (1989) present an empirical macro-model that incorporates the VLE hypothesis. Levine (1991) provides a favorable summary of the empirical literature. Heckman and Sedlacek (1990) present strong evidence against the VLE hypothesis.

[3] Admittedly, this is rather vague phrasing. But the vagueness derives from the nature of the assumptions underlying VLE models. These models assume that each firm produces a single homogeneous output whose price is given—indicating the absence of market power in the output market. But the existence of the effort extraction function implies that firms have the ability to set wage rates and thus operate with imperfections in the labor market.

The equilibrium conditions imply that it is possible that $w_* \geq w_c$ (the perfectly competitive wage); hence, involuntary unemployment may result when the level of effort is a function of the wage rate. Although this is a necessary condition for proof of involuntary unemployment in a model where the wage rate is a measure of allocative efficiency, it is neither a necessary nor a sufficient proof of involuntary unemployment in structural models of effective demand that link sources of income and types of spending.

In a model of effective demand with Sraffian or Marxian micro-foundations, the wage rate is a reflection of the class struggle between labor and capital over the allocation of an economic surplus. If aggregate demand tends to rise with an increase in the wage bill, then it is not immediately obvious that $w_* \geq w_c$ should lead to involuntary unemployment.

Consider Nell's (1979) model of effective demand, modified to include the VLE hypothesis.

$$Y = F(L, e), \tag{4}$$

$$Y = I + C, \tag{5}$$

$$Y = ED, \tag{6}$$

$$ED = W + P = \Sigma w_i n_i + P, \tag{7}$$

$$W = C, \tag{8}$$

$$P = I. \tag{9}$$

Equation (4) is a utilization function. Technology and capacity are fixed in the short period, allowing output (Y) to rise with the level of employment (L) and the level of worker effort (e). Equation (5) states that output is divided between investment goods (I) and consumption goods (C). Equation (6) establishes that output adjusts to the level of effective demand (ED), while equation (7) relates that total income equals the wage bill (W) plus realized profits (P). Equation (8) is a very simple consumption function, while equation (9) expresses that realized profits equal the level of investment spending initiated by capitalists. The latter equations embody the Kaleckian insights that "workers spend what they get and capitalists get what they spend." Equations (4) through (9) define an approach to the analysis of effective demand that also allows one to analyze the effects of simultaneous changes in the wage rate and the level of worker effort.

Figure 1 represents the comparative statics of alternative wage bills. The low wage equilibrium is at L_0. The high wage equilibrium, which sustains a greater volume of consumption spending for any given level of employment, occurs at L_1. *Ceteris paribus*, a higher wage bill is associated with a higher volume of effective demand, thereby generating a higher volume of employment.

Figure 2 represents the comparative statics of alternative productivity levels. L_0 is the employment level associated with low productivity. A *ceteris paribus* increase in the average level of worker effort will cause the utilization function to rotate upward—more output can be produced for a given level of employment if worker effort increases. The high productivity equilibrium occurs at L_2.

Conceptually, the movement from L_0 to L_2 takes place because of a "pure productivity effect" and an "induced aggregate demand" effect. Y_0 is the level of output associated with L_0. With an increase in productivity, Y_0 can be produced with employment at L_2'; hence, the reduction in employment from L_0 to L_2' is the pure productivity effect. But, with a constant real wage rate, the decline in employment will lead to a reduction in the wage bill. Therefore, at L_2' the volume of output exceeds the level of effective demand. Firms will be induced to restrict output and employment until L_2 is reached. The reduction in employment from L_2' to L_2 is the induced aggregate demand effect.

The comparative statics of VLE models imply an increase in the market wage over the perfectly competitive wage and an increase in productivity, while the level of output should be at least as large under a VLE regime as it in a Walrasian equilibrium. Thus, whether or not VLE will lead to involuntary unemployment depends upon the complex interaction of effective demand, resource mobility, and the relative differences in the average wage rate and the level of productivity resulting from the VLE hypothesis.

Comparative statics of neo-Keynesian equilibrium

If worker effort is variable, then macroeconomic equilibrium cannot be defined independently of the level of effort. Moreover, since a greater or lesser amount of effort is relative to a given standard, there must be some way of normalizing worker effort. In the analysis below, $(e = e_c; Y_c, L_c)$ is a Walrasian equilibrium, defined as the full capacity utilization, full employment combination when the level of effort is consistent with managerial and engineering expectations.

Figure 1 Effect of increase in the wage rate

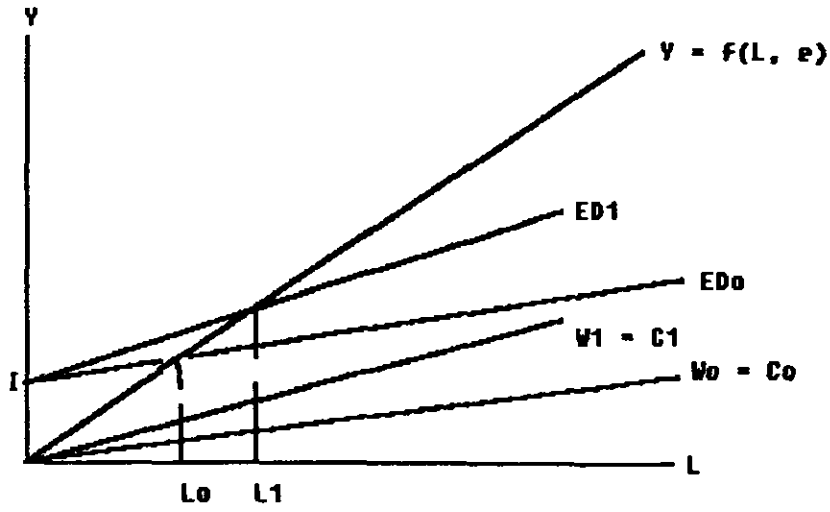
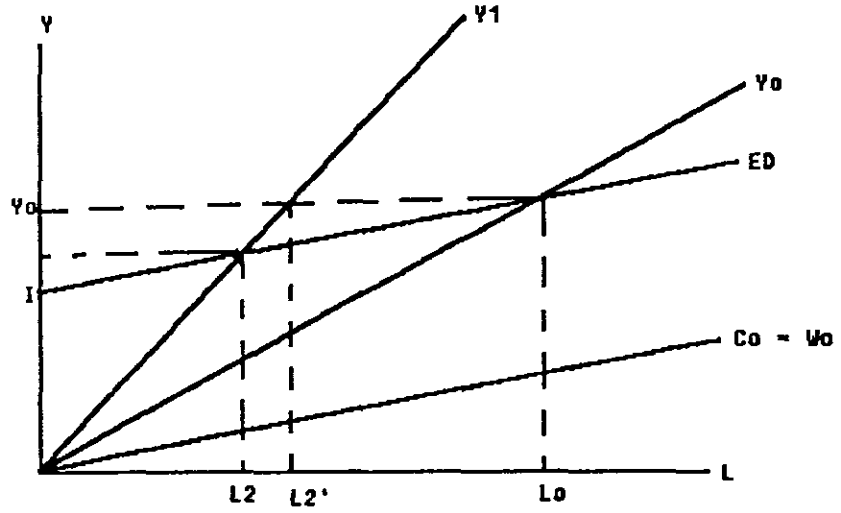


Figure 2 Effect of increase in the level of effort



Think of managers and engineers designing a production facility. They know ahead of time the desired range of output and they try to design a facility such that when a given volume of workers put forth some expected amount of effort per hour, where the expected work effort is

feasible but not necessarily maximal, the planned production facility can reach optimal output. For purposes of normalization, the planned level of effort is $e = e_c$.

Consider figure 3. The Walrasian model implies that $e = e_c$ at all times, thereby the economy will reach equilibrium at full employment and full capacity utilization (Y_c, L_c), with the effective demand function $ED(e = e_c)$. But with VLE considerations the effective demand and utilization functions are $ED(e = e_1'' > e_c)$ and $f(L, e = e_1'' > e_c)$, respectively, and the economy will try to reach equilibrium at E_1'' with employment at L_1''.

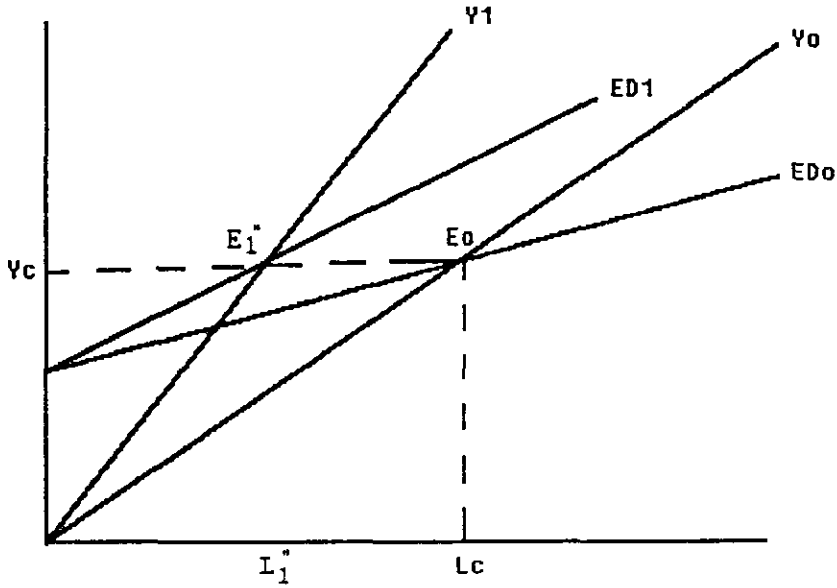
If the wage rate and productivity increase[4] by exactly the same percentage, that is, if the aggregate wage elasticity of effort equals one, then it appears that one will have the expected Neo-Keynesian equilibrium at E_1''. Namely, the wage rate and the level of productivity will rise (relative to the Walrasian equilibrium), firms will operate at full capacity, and there will exist involuntary unemployment since $L_1'' < L_c$. This equilibrium is a mathematical illusion.

Within the context of a choice theoretic model where arbitragers are constantly ready to seize excess profits, involuntary unemployment represents an outcome that cannot be made consistent with the assumption of perfect mobility of nonlabor resources. Involuntary unemployment exists if and only if joblessness is not "effort extraction neutral." Effort extraction neutral joblessness means that $V_J(\delta, e_h) = V_E(w_1'', e_1'')$, where "$V$" represents workers' indirect utility functions and the subscripts "J" and "E" represent jobless and employed workers, respectively, while "δ" represents the marginal value of nonmarket time and e_h represents the amount of effort workers must expend in household production and other nonmarket activity. In order for involuntary unemployment to exist, the self-employment contract δ, e_h must be regarded as inferior to the market contract w_1'', e_1'', that is, $V_J(\delta, e_h) < V_E(w_1'', e_1'')$.

If involuntary unemployment exists, then it must be the case that such unemployment restructures the labor extraction function. When $V_E(w_1'', e_1'') - V_J(\delta, e_h) > 0$, unemployed workers have an incentive to underbid

[4]Here and throughout the text, the phrase "wage (productivity) increase" is used in a comparative static sense. In VLE models, wage and productivity rates are endogenous with respect to firm decision making. Hence, it is purely for purposes of pedagogical simplification that I employ the phrase "wage (productivity) increase" rather than the more accurate, but also more cumbersome, phrase "the relatively higher, *ceteris paribus*, endogenously determined efficiency wage (productivity) rate."

Figure 3 Productivity effect equals wage effect



employed workers, that is, for a given wage rate (effort level), involuntarily unemployed workers are willing to put forth more effort (accept a lower wage rate) than currently employed workers. Consequently, unemployed workers are a source of "cheap" labor. Arbitragers will smell out this opportunity to earn excess profit.

Unemployed workers cannot underbid their employed brothers and sisters at currently existing firms. The wage-effort contracts at those firms are optimal; therefore, *ceteris paribus*, any attempt to alter contracts will reduce profitability. However, entering firms that hire directly from the pool of unemployed workers are not constrained by contemporary wage-effort contracts. Because involuntary unemployment increases the amount of effort workers are willing to expend for a given wage rate, new firms will also become the least-cost firms.

A perverse iterative adjustment process begins. New workers accept a contract at a lower alternative wage w_a, at the current level of effort e_1''. Old firms attempt to adjust by slashing wages and maintaining effort. It does not work. Without an intervening spell of unemployment, the lower wage induces lower effort and, therefore, unit costs at older firms remain high. Older firms are driven out of the market as new firms expand their market share.

As previously employed workers become unemployed, their effort extraction functions are restructured. In turn, they will become reemployed at even newer firms at some alternative wage $w_{aa} < w_a < w_1''$ and effort level e_1''. Older firms are again driven out of the market as the newest firms expand their market share. Each round of this iteration leads to even greater wage reductions than the previous round because each reduction in the average wage rate is also associated with a reduction in effective demand, which further reduces the equilibrium level of employment. In the end, effective demand crashes as wages are reduced to the bare minimum.

Clearly, this is a nonsensible result. But it is a logically consistent result as long as joblessness is not effort extraction neutral, there are no barriers to the mobility of nonlabor resources, effort is a function of the wage rate, and aggregate consumption is closely related to the aggregate wage bill.

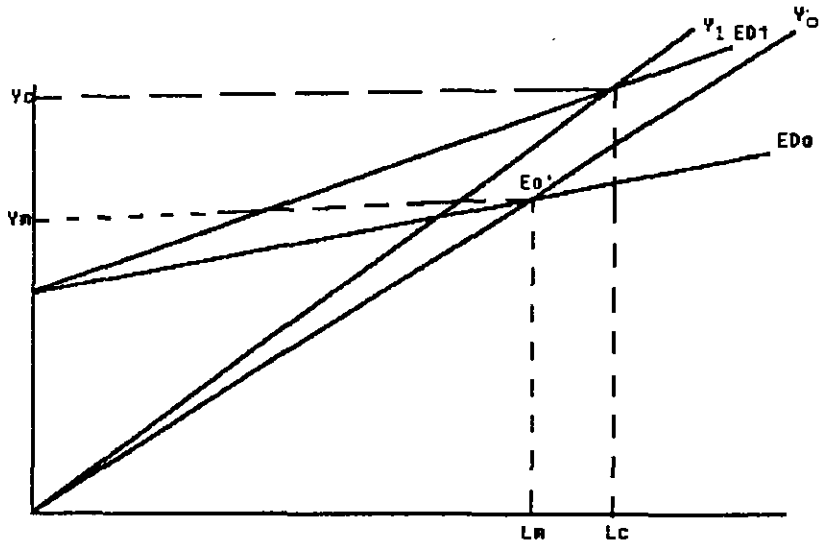
Comparative statics of neo-Marxian equilibrium

Neo-Marxians argue that if the economy is at $(Y_c, L_c; e = e_c)$ there is no cost to workers for shirking or simply quitting jobs on a whim. At the Walrasian equilibrium, new jobs are found instantaneously; hence, there is no reason for the actual level of effort to equal the expected level of effort. Consequently, *absent some combination of higher wages and more monitors of labor effort* (Gordon, 1990), *the economy may be characterized by a suboptimal equilibrium* such as E_0' in figure 4 where $(L_m < L_c, Y_m < Y_c; e = e_{\min} < e_c)$.

Y_0 is the utilization function associated with "workers freely chosen effort level" (Bowles and Gintis, 1990, p. 25), that is, $e = e_{\min}$, the so-called "whistle-while-you-work" (WWYW) level of effort. Similarly, the wage rate associated with employment level L_m is such that there are no employment rents, "the job is no more desirable to the worker than a spell of unemployment followed by a job search and another job." Joblessness is effort extraction neutral, that is, involuntary unemployment does not exist.

If the economy is characterized by a WWYW equilibrium, then there is preexisting joblessness that is disassociated with VLE concerns. But from the WWYW equilibrium the microeconomic explanation of the increase in effort and the wage rate is problematic. If for some reason managers do resort to a high wage strategy, an increase in the level of effort will not be forthcoming. As the wage rate and effective demand

Figure 4 Neo-Marxian equilibrium

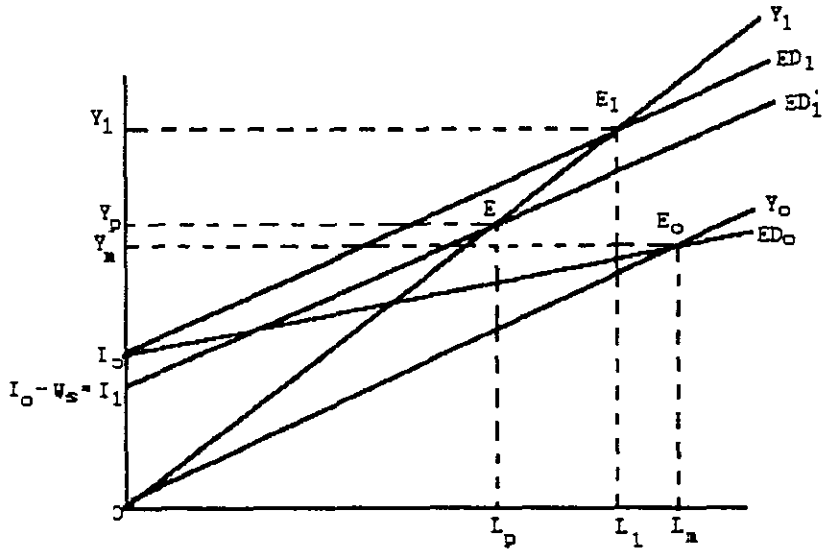


increase and therefore the amount of joblessness declines, workers have every incentive to put forth even less effort. In order to increase productivity, capital must hire more supervisors (so as to extract greater effort from workers when they are granted higher wages) and (1) accept lower profits or (2) have supervisors extract a greater productivity increase out of production workers than the wage increase of production workers.

In figure 5, the Neo-Marxian equilibrium is at E_1. However, the employment level L_1 consists of L_p production workers and $L_1 - L_p$ supervisory workers. If the productivity of workers increases by exactly the same percentage as the wage rate, then total employment must decline from L_m to L_1. However, since production workers received all of the productivity increase, supervisory labor must be paid out of profit. Accordingly, realized profit (I_0) is reduced by the amount of the wage bill to supervisory workers (W_s). The actual effective demand function then becomes line segment I_1EE_1.

At E_1, the economy will certainly exhibit involuntary unemployment since $L_1 < L_m < L_c$. But capital is worse off than at the WWYW equilibrium, even though output and productivity are higher. Supervisors and higher wages are able to coerce workers to work harder, but when the wage elasticity of effort equals one, supervisory labor is paid

Figure 5 Effect of supervisory labor



out of profit. Rational capitalists will certainly recognize that they are better off at E_0 than at E_1; hence, E_1 represents another mathematical illusion.

An alternative scenario is to accept that when supervisory workers are present, the wage elasticity of productive labor effort is greater than one. Under this scenario, supervisors can be paid out of the additional surplus that they extract from workers. Hence, E_1 once again becomes a possible equilibrium point with involuntary unemployment.

Once again it is also an illusory equilibrium. The Neo-Marxian model hails from the same choice-theoretic world as the neo-Keynesian model; therefore as long as joblessness is not effort extraction neutral a perverse iterative dynamic will quickly eliminate E_1 as an equilibrium position. Each round of unemployed workers will have an incentive to offer their labor power to new firms at a lower wage but constant level of effort; hence, new firms will produce the same output but with fewer supervisors—unit costs will decline and profits will rise. In the end, no supervisors will be employed and effective demand will also have collapsed.

Perhaps the results are less problematic for other neo-Marxian applications of the VLE hypothesis. Devine and Reich (1981) utilize a model where worker effort is a function of the division of labor (D) and the amount of wage inequality among the firm's workforce (σ_w); hence, the

effort function is characterized as $e = e(D, \sigma_W)$. Similarly, Reich (1981) utilizes a variable labor effort function where the level of worker effort is a function of relative racial wage and relative racial employment ratios, R_W and R_Q, respectively; therefore, the effort function is characterized as $e = e(R_W, R_Q)$. Neither of these models is primarily interested in explaining involuntary unemployment. They are, however, models interested in exploring the consequences of labor–capital conflict on efficiency, the division of labor, and discrimination. Moreover, neither of these models utilizes the average wage rate as a labor extraction mechanism; instead, these models focus on the production consequences of wage (and employment) inequality across occupations and worker groups.[5]

Both neo-Keynesians and neo-Marxians may object that the effort extraction function in equation (1) is misspecified. Summers (1988) and Bowles and Gintis (1990) use labor extraction functions where effort is a function of the wage rent, not the wage rate. That is to say, the authors utilize a model where $e = e(w-w_r)$, where w_r represents the best available wage in alternative employment opportunities. Of course, neo-Marxians and neo-Keynesians may differ greatly on the determinants of w_r. However, to the extent that variable labor effort models are concerned primarily with the explanation of involuntary unemployment, it is not permissible to utilize a given unemployment rate as a determining variable of w_r.

Moreover, if the unemployment rate is a determining variable of w_r and it is not given, then variable labor effort models are faced with an

[5] The comments in this paragraph are not applicable to Bowles and Gintis (1990). Despite this model's Marxian sociology it is quite neo-Keynesian in its economic logic: effort is a function of the wage rate, worker effort is variable because of asymmetric information, neoclassical competition is the operative environment of firms, and Walrasian equilibrium provides the basis of comparison. Also, my references to Reich's model of discrimination and the Devine and Reich model of conflict and hierarchy should not be taken to mean that I view variable labor effort models as appropriate vehicles for explaining these phenomena. I do not. This paper focuses on the use of VLE models as an explanation of involuntary unemployment; but, as a more general point, I am quite suspicious of the competitive process that lies behind these models. This suspicion is not without justification. For example, Mason (1992) demonstrates that the choice-theoretic framework of Reich's VLE model of discrimination produces long-run equilibrium results that are identical to Arrow's (1972) more conventional analysis of discrimination: in the long run, racial wage discrimination will be eliminated by market forces although segregation may continue to exist. Similarly, the Devine and Reich paper spurred an interesting debate about whether "radicals should steal Neo-Classicals clothes" (Devine and Reich, 1983; Watts, 1982, 1983; Mitchell and Watts, 1985).

insoluble contradiction. Consider the following model:

$$e = e(w - w_r), \tag{10}$$

$$w_r = xw, \tag{11}$$

$$x = 1 - (L_c - L) / L_c. \tag{12}$$

Equation (10) states that worker effort is a function of the cost of job loss, that is, the difference between the realized wage and the reservation or alternative wage. Equation (11) states that the reservation wage is a fraction (x) of the realized wage. Equation (12) states that (x) is equal to the probability of reemployment, where L_c is the Walrasian equilibrium level of employment and L is the realized level of employment.

Assume that there are "N" firms that utilize an identical type of labor power. Each firm will hire "n_i" workers; hence, the total volume of employment $L = \Sigma n_i$. All firms within a particular industry are identical. Each firm strives to maximize profit. If θ is the rate of technological progress and "w" is the wage rate, then the firm's objective function may be written as follows[6]:

$$\max_{(w,\, n)} p_i \theta f_i\,(e_i(w(1 - L/L_c))n_i) - wn_i. \tag{13}$$

First-order conditions

$$p_i \theta f_i' e_i' (1 - L / L_c) n_i - n_i = 0; \tag{14}$$

$$p_i f_i' [-e_i' w (1 / L_c) n_i + e_i (w(1 - L / L_c))] = w. \tag{15}$$

Rearranging terms and making the appropriate substitution, one may write:

$$p_i \omega f_i' e_i' (1 - \Sigma n_i / L_c) = 1, \tag{14'}$$

$$p_i \theta f_i' e_i (w(1 - \Sigma n_i / L_c)) = w + p_i \theta f_i' e_i' w (1 / L_c)\, n_i. \tag{15'}$$

Equation (14') divided by (15') yields:

[6] The labor extraction function in the objective function is in an abbreviated form. Specifically, $e(w - w_r) = e(w - xw) = e(w(1-x)) = e[w(1-(1-\{(L_c - L) / L_c\}))] = e(L_c - L) / L_c = e(1 - L / L_c)$.

$$(16) \qquad \frac{e_i' \left[1-\Sigma n_i/L_c\right]}{e_i(w\,(1-\Sigma n_i/L_c))} = \frac{L_c}{wL_c + p_i\theta f_i' e_i' w n_i}.$$

Equation (16) is one of a system of N equations, which must be solved simultaneously. But there are $N + 1$ unknowns, that is, the wage rate (w) and the level of employment for each industry (n_i). The system is undetermined and there is no way to close it without making an arbitrary assumption. It is clearly not appropriate to assume that $\Sigma n_i < L_c$, for this is what the model is trying to prove.[7]

Although w_r is seldom assumed to be related solely to the rate of unemployment, the focus of this paper is on the use of variable labor as an explanation of involuntary unemployment and it is thereby a reasonable simplifying assumption to allow that effort extraction is a function of the wage rate as opposed to the wage rental.

Summary and remarks

The results are neither encouraging nor anomalous. Darity (1991) also takes a rather dim view of the VLE hypothesis as an explanation of involuntary unemployment. He argues that

> In the absolute wage version of the hypothesis, it is easy to demonstrate that it is possible for both wages and employment to rise relative to the conventional situation where there is no wage-productivity nexus. In Summers' (1988) relative wage version, the higher efficiency wage is associated with lower employment, but in general the efficiency wage hypothesis does not, in and of itself, dictate a decline in employment.

It thus appears that the neo-Keynesian and the neo-Marxian applications of the VLE hypothesis and the analysis of effective demand are irreconcilable concepts. Although an "effort elicitation problem" (Katz, 1986, p. 244) is certainly a fact of life in a capitalist economy, the effort-wage tradeoff of these models is not necessarily, or even likely, to induce involuntary unemployment when the connection between spending and income is made explicit. The neo-Keynesian and neo-Marxian emphasis on the relationship between worker effort and the

[7]A way out of this problem is to adopt the posture that regardless of the cause of involuntary unemployment, it should be eliminated in the face of downward wage rigidity (Weiss, 1990). Therefore, VLE theory need only find an explanation for rigid wages that is consistent with involuntary unemployment. However, this approach remains vulnerable to the earlier arguments regarding effort extraction neutrality and the entry of new firms into an industry.

wage rate is an unsuccessful attempt to confine Marx's labor/labor power distinction within the restraints of choice-theoretic analysis. The emphasis of these models on the variability of worker effort and its implications for theories of unemployment and other labor market phenomena are admirable theoretical objectives. But, ultimately, competitive models that allow a role for prices as measures of allocative efficiency are not compatible with the long-run persistence of the very phenomenon VLE theorists aspire to explain—involuntary unemployment.

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