BREAKING VICIOUS CIRCLE OF LOW PRODUCTIVITY: A NEW THEORETICAL MODEL

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ABSTRACT

The problem of lagging productivity growth in US has attracted the attention of researchers in the recent past. It is contended that productivity growth is the source of growth in real income per capita (Dew-Becker & Gordon, 2005). Though researches debate about the causes of productivity slow down during the 1970s (Denison, 1979; Norsworthy, Harper and Kunze, 1979) and acceleration during 1990s (Jorgenson & Stiroh, 2000; Oliner & Sichel, 2000; Gordon, 2003), economists try to find ways of increasing total productivity growth. The present paper postulates that 'vicious circle of low productivity' is the basic cause of stagnant growth a model is developed to break this vicious circle. Based on the premise that the employer may have to offer higher 'wage' to attract and retain 'competent and productive workers', and based on efficiency wage models (Solow, 1979, Shapiro & Stiglitz, 1984; and Libenstein, 1963), the present model attempts to break the vicious circle of low productivity.

INTRODUCTION

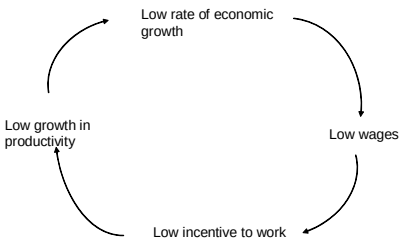
> *"Productivity growth raises our standard of living and plays a central role in our competitiveness in the worldwide economy. Productivity growth will be even more important as new technologies accelerate global economic integration as the American population ages"*
>
> *(Economic Report of the President, 2006: page 3)*

The low rate in productivity growth has been one of the major issues catching the attention of both academicians and administrators alike. The literature is replete with efficiency wage models explaining convincingly the involuntary

unemployment (Solow, 1979), (Shapiro & Stiglitz, 1984), (Salop, 1979), (Weiss, 1980), and a wide baffling variety of models, both interesting and exhaustive which discuss the operational implications of including certain contract forms (Malcomson, 1984). Though these models differ in several respects in terms of content, they have one thing in common. They explain why markets often do not clear; they do not offer any solution to problem of low productivity. For instance, if we recall the Solow (1979)condition that a profit maximizing firm is prepared to hire all the labor at the real wage w* (i.e. the elasticity of effort with respect to the wage is unity) because it minimizes the labor cost per efficiency unit. Each firm therefore optimally hire labor up to the point where marginal product equals real wage. Solow (1979) contends that any decrease in wage would result in decrease in productivity of all the employees on the job (p.13). While this is only one side of the coin, it unfolds the other side quite interestingly. Any increase in wage would automatically increase productivity but it is feared that wages can go up only at the cost of more involuntary unemployment.

Vicious circle of low productivity: It is difficult to offer any precise explanation to low productivity (e.g. of 1970s). However, researchers (Kahn, 1993; Krugman, 1993, Filardo, 1995) attempt to explain low productivity growth in terms of slowdown in labor force growth (Kahn, 1993: p 1). One plausible explanation that can be found is in terms of vicious circle of low productivity. The argument is that low rate of economic growth is caused by low productivity, which in turn is caused by low incentive for the employees to work. Low incentive to work is caused by low wages. Low wages result from low rate of economic growth. The cycle is thus complete. The vicious circle of low productivity is captured in the following figure.

Figure 1. Vicious circle of low productivity



That higher productivity is considered as one of the ingredients of economic growth and low productivity can hamper growth needs no reiteration. If efficiency of inputs rises by 8 percent per year, the real income and standard of living will be doubled every eight years [$(1.08)^8 = 2.000$ app]. A study by the Bureau of Labor Statistics 1988) has categorically pointed out that productivity growth exerts a tremendous impact on key economic parameters or performance indicators. It is felt strongly that (a) productivity growth results in higher incomes and consumption rather than in additional leisure; (b) a slowdown in productivity results in sharp increases in price level; (c) increase in productivity does not result in growing unemployment; (d) with productivity growth, real wage compensation increases; and (e) better productivity growth can provide better education, better environment, medical and health care and would increase the overall standard of living.

According to the Economic Report of the President (1994: p. 44; 2006: p 159), labor productivity in USA has declined from 2.7% in 1960-73 to 0.6% in 1973-79 and then went up mildly to 1.3% during 1979-89. The Economic Report of the President estimated that the average annual rate of growth of GDP during 1947-93 was 3.94% whereas it was only 2.3% during 1973-92. The most significant factor in 1947-73 was technological change, which alone generated about 1.63% of economic growth. The productivity growth averaged around 3.8% between 2001 through 2004 (Yellen, 2005). According to the latest Economic Report of the President (2006: p 159) "Since 1995, the US has enjoyed an acceleration in labor-productivity growth. From 1973 to 1995, output per worker grew at 1.4% per year whereas from 1995 to 2004 this rate accelerated to 2.9% per year, with rates averaging over 3% since 2000. The implication is that at 2.9% rate of growth, to double the standard of living it takes 24 years". While post 1995 has seen the period of acceleration of productivity, it is important to maintain higher productivity through escalated wage which I call 'motivating wage rate'.

Wage-productivity -employment relationship: Wage - productivity relationship is not uniform in all the sectors of the economy. The efficiency wage hypothesis is relevant particularly in primary sector (Akerlof &. Yellen, 1990), whereas it is weak in secondary sector. It is contended that wage differentials are meticulously maintained by different firms to match the workers of identical characteristics. The point is that employers are fully aware that the effort-wage-relationship differs across various groups. The idea that labor productivity depends on real wages paid by the firm is borrowed from one of the more popular micro-foundations of efficiency-wage models of Libenstein (1963).

As regards the productivity and unemployment relationship, the famous Okun's (1970) law can be recapitulated here. According to this law, higher unemployment rates correspond to lower productivity. One of the startling revelations is that even in downturn caused by decline in marginal productivity of labor to a decline in real price of output should lower real wages but leave productivity (effort) unchanged (Shapiro & Stigltz, 1984). Normally it is assumed that higher unemployment rate at higher wages will make employees more productive because of the fear of loss of employment. Therefore, higher wages result in higher productivity, especially when unemployment is high.

(A) *Traditional View:*

PRODUCTIVITY - WAGE RELATIONSHIP

Higher productivity → Higher wages
Lower productivity → Lower wages

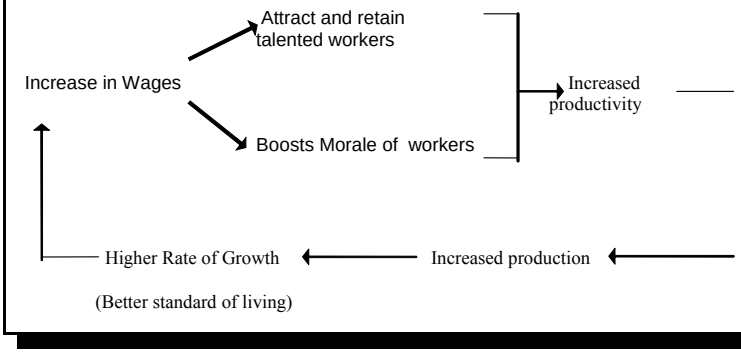
(B) *Contemporary View:* (Motivating Wage Theory)

Higher productivity → Higher wages
Higher wages → Higher productivity

Therefore,

Higher productivity ↔ Higher wages

Figure 1: Mechanism showing how increase in wages result in increased productivity and higher growth.



THE MODEL

Let us take the conventional production function $Q = F\{ L^*, K^*, e(w)\}$, where Q = Total Physical Product; L = Labor; K= Capital; e(w) is effort the labor as a function of wage (w); the after-tax profits (t = tax on profits) are derived as follows:

$$\prod^*_{BT} = p\, f(L^*, w^*, K^*, v^*) - [w(L^*) + \Psi (K^*)] \quad (1)$$

$$\prod^*_{AT} = (\prod^*_{BT} - t \prod^*_{BT}) \quad (2)$$

$$\prod^*_{AT} = \prod^*_{BT} (1 - t) \quad (3)$$

$$\prod^*_{AT} = (1 - t) \{ p\, f(L^*, w^*, K^*, v^*) - [w(L^*) + \Psi (K^*)] \} \quad (4)$$

When $t = 0$, $\prod^*_{BT} = \prod^*_{AT}$ and normally when $t > 0$, $\prod^*_{BT} > \prod^*_{AT}$

Proposition: Motivating wage increases productivity. Let us see what happens when the total tax receipts are spent on enhancing wage, we call it 'motivating wage' as distinct from 'prevailing wage'.

$$\hat{w} > w^* \quad (5)$$

where '$\hat{w}$' is the 'Motivating wage' and 'w^*' is the prevailing wage. When the total tax receipts are redistributed to enhance wage then:

$$\hat{w} = w^* + [t \prod^*_{BT} / L]$$

$$\hat{w} = [L^* w^* + t \prod^*_{BT}] / L^* \quad (6)$$

When the production is (where Ω is the rate of interest):

$$Q = \Psi \{ L^* (w), w^*, K^* (\Omega), \} \quad (7)$$

and when the prevailing wage is w^*, marginal productivity of the factor is given by:

$$MP_L = \delta Q / \delta L^* = f_L [\delta L^* / \delta w] \quad (8)$$

After increase in wage the production function is transformed as:

$$Q_1 = \Psi \{ L^* (w), \hat{w}, K^* (\Omega), \} \quad (9)$$

And, $\hat{w} > w^*$

Therefore, it is logical assume that:

$$MP_{L1} = \delta Q / \delta L^* = f_{L1} [\delta L^* / \delta w] \quad (10)$$

It should be remembered that $MP_{L1} > MP_L$

Proof: If we assume other factor (K*) is constant, when the wage is 'w*'

$P f_L - w = 0$ (by virtue of first order condition for maximizing profit), and

$$f_L = w^* / P \quad (11)$$

By the same token, at the new wage the first order condition specifies

$$P f_{L1} - \hat{w} = 0, \text{ i.e.,} \quad (12)$$

which implies $f_{L1} = \hat{w} / P$ (13)

and since $\hat{w} > w^*$; $f_{L1} > f_L$ (Holding P constant) (14)

It has long been established that when wage rate enters the production function:

$$Q = f \{ L, w^*, K, \Omega \} \quad (15)$$

It is reasonably assumed that

$$\delta Q / \delta L^* > 0 ; \delta Q / \delta \omega > 0 ; \delta_2 Q / \delta L^{*2} < 0 ; \delta_2 Q / \delta^2 \omega < 0$$

From the employer's point of view, since $L = L(Q, w^*)$ holding K* and Ω* constant, L* determines the optimum level of employment and w* is the optimum wage. There will be no incentive for the employer to change from this position. If at all he were to increase the wage rate, this will be at the cost of his total profits (which will not be maximum at this position) and further, he has to lay off some workers.

Thus L* being unalterable, and w* being sticky (rather than rigid and this is a very restrictive assumption) using the Solow's (1979) terminology, the constant (or low) productivity trap is laid. This explains the `vicious circle of low productivity' (see Figure 1).

Now, following Libenstein (1963), an increase in w* will shift the marginal productivity curve upwards (because of physical, economic, and psychological reasons). Hence to increase the productivity an external pressure may be employed by influencing the wage. As Libenstein (1963) contends, the average productivity (and marginal productivity)of a group will depend on their wage. The higher the wage the greater the units of work per laborer and hence up to some point, the higher the wage the higher the per capita productivity of the group (p.31). Figure 2 captures the relationship between wages and worker productivity and Figure 3 shows the marginal product curve shifts upwards with increases in wages.

Figure 2: Positive relationship between wages and worker productivity

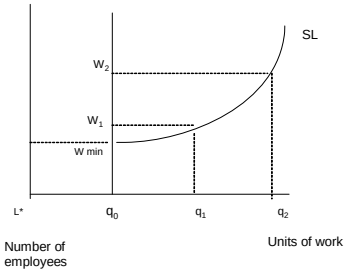


Figure 3: Product curve shifts with increase in wage

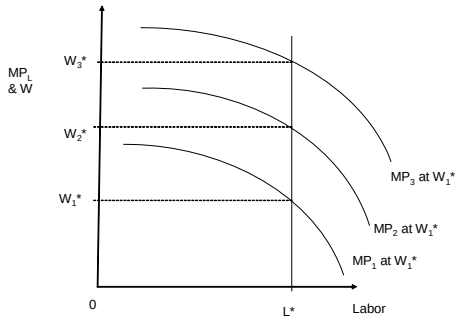
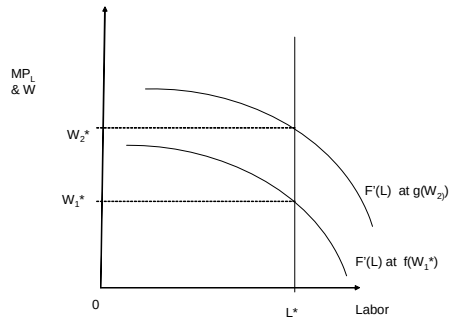


Figure 4 shows how the increased wage rate results in increased productivity.

Figure 4: Increased wage rate resulting in increased productivity



ANALYSIS

$$\Delta \text{ Productivity} = \int_0^{L^*} g(x^*)dx - \int_0^{L^*} f(x^*)dx \tag{16}$$

$$= \int_0^{L^*} F'^{1}(L)dLw_2 - \int_0^{L^*} F''(L)dLw_1 \tag{17}$$

The cost of the increase in productivity is equal to (w_2* w_1*) L*. It follows that if:

$$\int_0^{L^*} g(x^*)dx - \int_0^{L^*} f(x^*)dx > (w_2^* w_1^*) L^* \tag{18}$$

it becomes feasible to increase the wage. That is to say, it will be advantageous to implement a 'motivating wage.'

To break the vicious circle of low productivity, an entrepreneur may take the initiative in identifying the 'motivating wage' and increase productivity. If the entrepreneur is unable to do so, the State may take the initiative to increase wages. It can be argued that State can increase productivity breaking the vicious circle of low or constant productivity. The State can do so by offering a subsidy to the fullest possible extent of the increased wage. If the investment is made initially by the government (i.e. an increase in wage rate is subsidized by the state), the entrepreneur will have least objection. The government can do this conveniently by transferring the tax revenue to the 'Motivating wage fund'. Doing so will be beneficial to both the entrepreneur and the state.

I *Gross benefit to the State:* Increase in production (productive capacity) which is tangible. Other benefits include the increased corporate taxes due to increased profits, and Increased personal income taxes (from the individuals).

II *Employer's Gross Benefit:* If the increased wages are subsidized by the government, the effective wage from the viewpoint of the employer is w whereas the efficiency wage is w*. Therefore, the benefit to the employer can be seen in terms of the increased productivity associated with this new wage w*.

This relationship is:

$$[\int_0^{L^*} g(x^*)dx \; - \; (OL^* \; w_1^*)\;] - [\int_0^{L^*} f(x^*)dx \; - (OL^* \; w_2^*)\;] \qquad (19)$$

$$= \int_0^{L^*} g(x^*)dx \; - \int_0^{L^*} f(x^*)dx \quad = (.) \qquad (20)$$

New profits are therefore inflated because of the increased production as shown above.

Employer's net benefit = (1 – t) (.) (21)

Benefit for the State:

Investment = $(w_2^* - w_1^*) L^*$ (seen in terms of subsidy) (22)

Return = Increased productivity (GSP) + Tax on employer's additional profits + Personal and individual taxes:

$= (.) + t_c (.) + t_p (L^*) (w_2^* - w_1^*)$

$= (1+ t_c) (.) + t_p (L^*) (w_2^* - w_1^*)$ (23)

It can be easily inferred that Equation (23) > Equation (22).

Net benefit to individual workers = Gross Benefit – personal taxes:

$NB = (w_2^* - w_1^*) L^* - t_p$

$NB = (1 - t_p) (w_2^* - w_1^*)$

CONCLUSION

This paper is essentially a theoretical construct. Taking cue from the much illustrated Leibenstein's shifting marginal productivity curve, this paper highlights the fact that higher productivity can be achieved at higher wages, called motivating wages. Increase in wage acts as a primary motivators for increasing productivity and break the vicious circle of low productivity. As President's report (2006) mentions: "studies show that firms that are engaged in the international market place tend to exhibit higher rates of productivity growth and pay higher wages and benefits to their workers" (p.155). The present model explains how paying higher wages further increases productivity and economic growth.

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