Efficiency Wage Theory, Labor Markets, and Adjustment

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Efficiency wage theory suggests that wages (and hence labor markets) may be unresponsive to typical macroeconomic policies that seek to lower real wages, change resource allocation, and reduce open unemployment. Under this theory, firms will react to macroeconomic shocks by altering employment (laying workers off), not wages.

This paper — a joint effort of the Education and Employment Division, Population and Human Resource Department, and the Macroeconomic Adjustment and Growth Division, Country Economics Department — is part of a larger effort in PRE to identify the role of alternative wage policies in achieving a better supply response to adjustment policies. Copies are available free from the World Bank, 1818 H Street NW, Washington DC 20433. Please contact Valerie Charles, room S6-228, extension 33651 (34 pages).

Conventional labor theory argues that wages are determined by the interaction of labor supply and demand — the firm takes the market wage as an exogenous parameter. Under conventional theory, policy analysis on wage rigidity has emphasized distortions arising from exogenous (union and government) intervention. Thus, one emphasis in adjustment lending has been deregulation of labor markets.

Efficiency wage models of unemployment try to explain persistent real wage rigidities when unemployment persists. Their central assumption is that higher real wages can impro' e labor productivity. A major implication of .iese theories is that wages (and hence labor markets) may be unresponsive to typical macroeconomic policies that seek to lower real wages, change resource allocation, and reduce open unemployment. Under this theory, firms will react to macroeconomic shocks by cutting back on jobs, not wages.

The three central macroeconomic implications of efficiency wage theory are these:

• There is an equilibrium "natural" level of open unemployment, which differs among

groups in the 'abor force and cannot be affected by demand management policies. Workers offering services at a lower wage rate are unable to drive the wage down and to expand employment.

• When reducing the level of production — and to the extent that other firms' wages are perceived as given — the typical firm will resort to laying off labor instead of reducing wages, thereby introducing a significant wage inertia and an overshooting of open unemployment. The firm's profit-maximizing wage may exceed the opportunity cost of redundant labor, but lower wages would entail a greater loss associated with the reduction of productivity and the "average quality" of workers than would be gained from reducing per-worker costs.

• Wages do not respond to clear the labor market and are not responsive to macroeconomic policies and microeconomic deregulation.

Riveros and Bouton conclude that applying the theory in developing countries requires suitably defining labor costs and tackling the problem of segmentation of the labor market (into formal and informal markets).

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I. INTRODUCTION.

Recently, the design and effectiveness of appropriated labor market policies in the context of structural adjustment programs in developing countries has received a great deal of attention. For the most part, structural adjustment programs seek to permanently change relative prices thereby shifting resources away from the production of non-traded towards traded goods. Inter-industry factor mobility, particularly labor mobility, is, therefore, of paramount importance in achieving this supply response.

Rigidity in the wage structure has been singled out as an important factor preventing efficient inter-industry labor mobility, thereby contributing to the persistence of high unemployment. The segmentation that characterizes most developing countries' labor markets, constrains the supply response to adjustment policies especially since the limited flexibility of real wages in the *formal* sector slows the reallocation of labor and production, and increases the burden of adjustment on the *informal* sector. Since the formal sector is normally the producer of traded goods in the economy, wage rigidity in this sector is a crucial impediment to adequate labor mobility and hence inhibits the supply response to macroeconomic policies. From a political economy perspective, the sluggish supply response and inequitable burden borne by the informal sector, which is typically increased by the presence of high unemployment, can only weaken the political support needed for successful structural adjustment.

To date, policy analysis on wage rigidity in the formal sector has emphasized the role of distortions arising from exogenous (union and government) intervention[1]. As a result, it has - within the context of macroeconomic conditionality and lending - strongly concentrated on the need to deregulate labor markets. The desire to achieve wage flexibility has led to policy prescriptions that

are particularly forceful regarding the limitation of formal wage indexation rules and other features that make the wage structure more rigid.

In contrast to the conventional view that wage rigidities are exogenously imposed, the alternative efficiency wage theories suggests that observed wage rigidities are endogenous to a firm's own optimizing behavior. These theories postulate that, in the absence of microeconomic policies that alter the efficiency wage frontier, the level of real average wages and the pattern of wage differentials across sectors will not be affected by macroeconomic structural adjustment policies except after a period of high and prolonged unemployment as firms will be reluctant to reduce real wages because of the adverse effects on labor productivity and, hence, profits. Thus, in the presence of efficiency wages, the removal of exogenously imposed labor market distortions will do little to promote wage flexibility and, hence, labor mobility and structural adjustment. *Whether the removal of exogenously imposed labor market distortions is sufficient to provide the required wage flexibility is a fundamental policy issues that remains to be resolved.*

This paper reviews the theoretical and empirical literature on efficiency wages. The implications of this literature for macroeconomic adjustment in the developing countries is highlighted. The structure of this paper is the following: in section II we briefly describe the general tenets of efficiency wage theories. In Section III we analyze some of the policy implications of efficiency wages for macroeconomic adjustment in developing countries. Section IV suggests some possible implications for human resource development. Section V reviews the microfoundations of this approach while section VI discusses the empirical literature on the subject, pointing out the *lack* of applied research aimed at a positive, comprehensive test of the theory. The paper closes with a summary presented in Section VII.

II. EFFICIENCY WAGE THEORIES[2]

Efficiency wage models of unemployment are a family of conceptually distinct theories that, for the most part, seek to offer an explanation of persistent real wage rigidities in the presence of the involuntary unemployment observed in most economies. The central assumption of these theories is that higher real wages can, through various mechanisms, result in higher labor productivity. A major implication of these theories is that wages, and hence, labor markets, may be unresponsive to typical macroeconomic policies which seek to lower real wages, change resource allocation and reduce open unemployment.

A common tenet in all efficiency wage theories is their focus on the firm's production function. As in standard microeconomic models, the quantity of output (Q) that a firm produces depends upon the amount of labor measured in efficiency units(L), capital (K) and other inputs (I) it employs:

$$(1) \qquad Q = F(L, K, I)$$

Unlike the standard microeconomic model, however, the labor input in the efficiency wage approach is not simply the physical number of workers employed (N) but rather a more complex aggregate that also depends on some notion of worker efficiency or effort (ϵ). Formally, the efficiency units of labor can be written as

$$(2) \qquad L = L(W, N)$$

where the number of workers hired and the wage rate paid by the firm (W) will determine the impact of labor on output.

In determining the contribution of its labor input, the firm must not only be concerned with the number of workers it has hired (N), but also with the level of effort that those workers put forth. In most expositions on efficiency wage theories, the effort level of workers (labor efficiency units) is assumed to increase either with the higher wage relative to some average wage or with the real wage in terms of consumer prices[3]. Thus, both the number of workers hired and the wage rate paid to those workers will determine the impact of labor on output. This labor aggregate is often given the following functional form

$$(3) \qquad L = \epsilon(W, \gamma) \, N$$

where $\epsilon(W,\gamma)$ can be viewed as the function determining the effort level of the workers. This labor efficiency function is assumed to be increasing in W ($\delta\epsilon/\delta W \equiv \epsilon_w > 0$). The other variable, γ, is a vector of parameters, such as, taxes and subsidies, that may also affect the efficiency function.

In the standard competitive theory of the labor market, the wage rate is constantly adjusted to equate aggregate labor supply and demand. The individual firm takes the market clearing wage as exogenously given. That is, the firm is a price taker in the labor market. The optimal pricing decision by the firm is to equate the value of a worker's marginal product to that given wage rate (the marginal value of a worker's leisure). Changes in labor demand as a result of macroeconomic shocks or policies will result in both wage and employment fluctuations. Unemployment in this paradigm is voluntary in the sense that, at the going market wage, anybody who wishes to forgo leisure can find employment[4]. It is clear that this model's depiction of flexible wages and voluntary unemployment is too simplistic a description of observed wage and employment patterns. Further, this model is, in many ways, unrealistic regarding the actual dynamics of the wage/employment adjustment.

To add realism, earlier models attempted to address the lack of adjustment of wages and labor mobility by *asserting* that real wages are rigid and fixed above the market clearing equilibrium level. Union and government intervention has been considered the basic force which prevent wages from clearing the labor market. Under the assumption of rigid wages, unemployment is involuntary and, of course, inefficient. These models, however, have been heavily criticized for their inability to explain and rationally justify the mechanism that kept wages rigid. There is little to explain why workers seeking employment should not be able to find a job by offering to work at a lower wage.

In efficiency wage models, given the positive relationship between wages and productivity (the efficiency function), *firms will no longer view the wage rate as an exogenous parameter*, but rather will choose an optimal wage as a result of their profit maximizing behavior. Given that a higher wage will produce higher labor productivity, different wage rates will, for the same physical amount of labor, purchase different amounts of labor efficiency. The optimal behavior of the firm is to choose a wage that minimizes the average cost per unit of efficiency labor not per physical unit of labor as in the standard theory. This part of the firms problem can be formally written as

$$(4) \qquad \underset{W}{Min} \quad \frac{W}{\epsilon(W, \gamma)}$$

Assuming the firm does not face a binding labor supply constraint, the first order conditions for this problem is

$$(5) \qquad \frac{\epsilon(W, \gamma) - W \, \epsilon_W(W, \gamma)}{\epsilon(W, \gamma)^2} = 0$$

Rearranging, the first order condition can be written as

$$(6) \qquad \frac{W \; \epsilon_W(W, \gamma)}{\epsilon(W, \gamma)} = 1$$

which can be solved for the optimal efficiency wage (W*). This first order condition gives the well known "Solow" result that, at the optimal wage, the elasticity of effort with respect to the efficiency wage is unity.

Once the firm has determined that "efficiency" wage rate, they will hire as many workers and other inputs required to produce the optimal, profit maximizing level of output. This second stage of the firm's optimization problem can be written as

$$(7) \qquad \underset{L,K,I}{Max} \; P \; F(\epsilon(W^*, \gamma)N, K, I) - W^*N - rK - q_II_i$$

where the first order conditions to this problem are simply

$$(8) \qquad \begin{aligned} P \; f_N \epsilon(W^*, \gamma) - W^* &= 0 \\ P \; f_K - r &= 0 \\ P \; f_I - q &= 0 \end{aligned}$$

As usual, the firm's optimal strategy is to employ inputs until their marginal product is equal to the real input price[5].

Remarkably, the determination of the efficiency wage depends only on the characteristics of the efficiency function and not on the demand or supply conditions in the market. Further, if at the optimal efficiency wage labor supply exceeds labor demand there will be persistent involuntary

unemployment. If an unemployed worker should offer to work for less than the efficiency wage, his offer of employment would be refused. This behavior on the part of the firm is optimal. Since labor efficiency is tied to the wage rate, a fall in the wage rate would reduce worker productivity and hence the profit rate of the firm. Under the assumption of perfect competition in the output market, at the optimal efficiency wage the firm is just breaking even by employing the marginal worker. Thus, at a lower wage the firm would, paradoxically, be making a loss.

To summarize, under the efficiency wage hypothesis, the optimizing behavior of the firm can be viewed as a two stage optimization problem. In the first stage, the firm chooses a wage that minimizes the average cost of an efficiency unit of labor. The second stage of the firm's optimization problem consists of choosing the profit maximizing level of inputs given the efficiency wage, output prices and other input prices. An important implication is that firms will react to macroeconomics shocks by altering employment, not wages.

III. THE LABOR MARKET AND MACROECONOMIC ADJUSTMENT

The basic efficiency wage theory examined in the previous section, has three central macroeconomic implications: first, there is an equilibrium "natural" level of open unemployment, which differs among labor force groups and cannot be affected by demand management policies; second, when reducing the level of production -- and to the extent that other firm's wages are perceived as given -- the typical firm will resort to laying off labor instead of reducing wages, thereby introducing a significant wage inertia and an overshooting of open unemployment[6]; and third, wages do not respond to clear the labor market, and are not responsive to macroeconomic policies and microeconomic deregulation. As discussed below, these implications are of paramount importance in the context of macroeconomic adjustment policies.

The likely presence of real wage rigidity raises fundamental questions regarding the effectiveness of macroeconomic policies and the extent to which the supply response needed for adjustment will be forthcoming. The conventional view assumes that macroeconomic policies -- such as those emphasizing demand restrictions via fiscal and/or monetary policies to control inflation or exchange rate policies aimed at raising the relative price of traded goods -- reduce nominal wage increases and thereby lowering real wages. The reduction of real wages involves both an absorption component -- aimed at reducing the real domestic aggregate demand-- and a switching component -- intended to change relative wages between traded goods and non-traded goods to achieve a higher inter-industry labor mobility and a subsequent restructuring of production. These policies rely heavily on the "transitory" nature of the increased unemployment induced in order to "discipline" the labor market.

Real wage flexibility is a necessary condition to attain macroeconomic adjustment. Although

often complicated by labor market regulations, the labor reallocation between tradable and non-tradable industries is the fundamental ingredient to achieve structural adjustment.[7] For reallocation to take place, wages in terms of traded goods -- and real consumption wages -- must decline in response to a nominal devaluation. If the price of non-traded goods remains unaffected due to the use of appropriate absorption-reducing policies (restrictive fiscal and monetary policies), the relative real production wage of traded goods versus non-traded goods will decline. Because of the change in relative prices, labor will flow from the non-tradable to the tradable industry and thereby allow production of traded goods to increase relative to non-traded goods. If wages are relatively rigid, chances are that the process of labor reallocation will not take place and the economy will be dominated only by the recessionary shock associated with the mix of expenditure reducing and expenditure switching policies.

The presence of formal mechanisms of wage indexation has been usually mentioned as a deterrent of the wage flexibility needed for structural adjustment.[8] In particular, the dynamic role of minimum wages in pushing the entire wage structure (and inflation) up has been pointed out as a crucial mechanism creating wage rigidity in developing countries[9]. The implications from the viewpoint of policy making are straightforward: institutions and regulations which introduce wage rigidity in the economy must be eliminated.

Contrary to this conventional view, if real wages are rigid due to the role played by factors endogenous to the firm, such as the existence of efficiency wages, then the success of demand policies in achieving stabilization and adjustment will depend on the stability of the efficiency wage frontier underlying the process of wage determination. The efficiency wage frontier is nothing more than the positive relationship between wages and labor productivity (effort) derived from utility maximization on the part of the workers. If this frontier is very stable then it is likely that the

increased unemployment caused by demand restricting policies will have a much more moderate effect on real wages. Changes in demand and unemployment associated with structural adjustment are likely to exert very little effect on the efficiency wage frontier and, hence, on the "optimal" real wage as determined by firms. If firms are not willing to reduce real wages because of the implied drop in labor productivity, taxation and subsidization policies aimed at affecting worker behavior would be the most advisable policies.

The stability of the efficiency wage frontier is a crucial aspect of the policy implications of the theory. The basic element determining the degree of wage flexibility in response to macroeconomic adjustment policies is the extent to which a consistent and invariant causal relationship between wages and effort prevails. If this relationship is stable, then the efficiency wage hypothesis has important policy implications; conventional macroeconomic adjustment policies will need to be complemented with microeconomic policies (i.e. taxation, subsidization, etc.) to assure the success of the adjustment policies (in terms of wage flexibility and supply response) without the creation of high and persistent unemployment. If on the contrary, this stability is rather limited, any policy implications will basically depend upon the dynamics of the forces driving the changes in the efficiency wages relationship.

The efficiency wage framework provides important insights for some observed labor market phenomena. For instance, this approach implies that the equilibrium wage is compatible with equilibrium involuntary unemployment associated to the wage premium paid by firms.[10] In fact, a standard result of efficiency wage models is that the equilibrium level of wages may exceed the "competitive" wage (the wage that equates labor supply and demand). Moreover, in the context of efficiency wage models (particularly the adverse selection theory discussed below), workers offering services at a lower wage rate are unable to drive the wage down and to expand employment[11]. The

firm's profit maximizing wage may exceed the opportunity cost of redundant labor, but lowering wages would entail a greater loss associated to the reduction of productivity and the "average quality" of workers than would be gained from the reduction of per-worker cost.

The empirical testing of the efficiency wage theory is crucial to further assess its policy implications. The macroeconomic consequences of efficiency wages have to be a crucial aspect of the empirical analysis. As discussed below, empirical studies until now have only provided indirect tests on the relevance of the theory. In general, no application has been done to the case of developing countries. The need for a more structural test stands out, which could be based on the major macroeconomic implications of the theory.

Given the positive effects that structural adjustment potentially has for future growth prospects and the role efficiency wages have in achieving this adjustment, there are three fundamental macroeconomic implications important to an empirical evaluation of the validity of efficiency wages in developing countries. First, observed wage changes will not depend upon the level of unemployment, although it can be explained by the rate of change in unemployment. Second, wages are responsive to changes in the consumer prices but not to the price of the output produced by the firm. Third, employment levels do not respond to the real price of other inputs, but only real labor compensation.

The application of efficiency wage theories to developing countries faces the problem of segmentation. As we shall discuss, the standard empirical analysis based on wage differentials, does not usually account for the structural characteristics of the labor market, which is in turn a factor affecting wage setting at firm level. However, efficiency wages can be an explanation for the existence of dual labor markets (segmentation between, for example, a formal sector where efficiency wages prevail and a neoclassical informal sector)[12], thus settling a clear challenge for designing any

empirical test. Other problems involved in designing an empirical test on the efficiency wages theory for developing countries is that it cannot be simply extended to the informal sector, which is characterized by the presence of quasi-voluntary ("wait") unemployment[13]. However, in following other empirical studies on the observed wage performance in developing countries, the role of efficiency wages is consistent with the relative wage rigidity of formal sector labor costs[14]

The concept of wages which is relevant to empirically analyze the likely important role of efficiency wages in developing countries constitutes a crucial issue. The presence of wage rigidity in the formal sector, which is usually associated to either the presence of endogenous or exogenously created indexation, has not been substantiated. Studies which have concluded that severe drop in real wages has taken place in developing countries ought to be examined with care. First, an important problem is whether the observed flexibility in wages refers to average wages or to some specific sector or industry. In fact, wages can be very flexible in the aggregate if, for instance, some informal activities or government wages are included, but still rigid in the formal sector producing tradable goods. Second, the presence of wage rigidity is an issue that involves relative wages. For instance, wages may drop in both the tradable and the non-tradable sector, but the relative decline may not be sufficient to produce substantial labor mobility. Third, wages are most likely irrelevant indicators when examining the issue of rigidity versus flexibility, as compensating changes in non-wage labor costs can introduce substantial rigidity in total labor costs -- the relevant variable when analyzing employment and production decisions.

IV. EFFICIENCY WAGES AND HUMAN RESOURCE DEVELOPMENT

The efficiency wage hypothesis also has some important implications for human resource development. For the purposes of this analysis, the latter concept is made equivalent to increments to human capital. Adequate investment in human capital, through either schooling or general and specific formal training, is among the necessary conditions for sustainable long term economy growth. As noted earlier, in the efficiency wage paradigm output is dependent not only on physical amounts of capital and labor, but also on worker effort or quality. Given that the investment in education and training is the primary means by which workers and firms can augment human capital, efficiency wages theory has implications regarding long term economic development.

This is an important, but largely unexplored topic that deserves further research. For now, however, we can only attempt to sketch some of the possible implications. Efficiency wages affect human resource development directly in two possible ways: through it impact on formal education and through it impact on training. As discussion in section I suggests, the higher level of unemployment implied by efficiency wages may result in a reduction in expected labor earnings, particularly for skilled workers in the formal sector. Therefore, one would expect a decline in the average rate of return to investments in schooling on the part of these workers. Moreover, insofar as some of the unemployed formal sector workers may seek employment in the informal sector, thus driving wages in that sector down, the expected earnings in the informal sector may also be lower. Lower expected earnings is important for human resource development because it implies an overall decline in the private rate of return and in the investments in educations. Again, this impact may be more important for higher education than for primary education since it is mainly the skilled work force that is affected by efficiency wage unemployment. The policy implication is that large

government subsidy to education in general, and higher education in particular, may be needed.

Efficiency wages, as explained in section IV under the turnover model, by raising the opportunity cost of leisure and by making existing efficiency wage jobs more attractive than alternative employment, may result in a lower labor turnover in efficiency wage firms. Firms, faced with a more stable work force, may be willing to invest more resources in general training. The standard human capital theory predicts that general training would financed by workers, instead of firms, given that it raises the labor productivity in the firm and elsewhere. With lower turnover the firm's would have a longer pay back period and it is less likely that worker will acquire skills and then seek employment elsewhere. In addition, workers may be willing to pay more of the training costs especially with regards to specific training. This implies that there may be less need for government subsidies for general training. In sum, efficiency wages may imply the possibility for the government to shift resources from general training to education.

V. MICROFOUNDATIONS OF EFFICIENCY WAGES

This section presents a summary review of the five main different type of theories that provide the microfoundations of efficiency wages[15] By pinpointing alternative aspects of the employment decision at the level of the firm, these theories aim at providing a rationale for the basic postulate that higher wages do convey higher productivity implying that the wage is not given to the firm by the prevailing labor market equilibrium.

Nutritional Theories

The first approach to incorporate efficiency wage behavior is known as the nutritional model. It basically emphasized the connection between wages, nutrition and productivity[16]. This model was aimed primarily at explaining the link between wages and productivity for agriculture workers in developing countries. The central focus is the connection between higher wages and a worker's health. The productivity of workers, it is assumed, can be sufficiently increased by better nutrition that the cost to the employer of the higher payment to workers is outweighed by their increased output. This implies that workers should receive a minimum subsistence wage to allow them to meet their nutritional needs and thus be more productive. However, in most economies, particularly in the industrial sectors, the link between wages and worker health is not likely to be important because wages far exceed subsistence levels. Consequently, the nutritional model is not considered relevant in this case and emphasis has been placed on the other links between wages and productivity.

Shirking Theories

In shirking theories of efficiency wages the basic premise is that workers can choose to work or shirk.[17] If they shirk, there is some chance that they will be caught and immediately fired. If there is no unemployment (above and beyond structural or natural unemployment) and all workers

are paid the ongoing market wage, there is no cost to shirking. If a worker gets fired, he/she can easily find another job at the same wage. To increase the cost of shirking, employers pay a higher than market wage, with the resulting unemployment acting as a disciplinary device on workers. Hence, these models predict that increases in the wage will raise the cost of job loss, reduce shirking and thus will raise productivity. The optimal policy for the firm, in addition to adopting an announced policy of random monitoring and dismissal of workers found shirking, would be to pay a wage in excess of the opportunity cost of labor (what the worker would get if he were fired). In the aggregate, average wages and labor productivity would rise and employment would fall.[18]

Turnover Theories

This set of theories has a similar rationale but generally emphasizes the effect of wages above the market-clearing level on the costs associated with high labor turnover.[19] These turnover costs generally consist of direct costs incurred in the hiring and training of new workers, as well as the indirect cost of lost production as these new workers take some time to achieve their full potential. Workers are less likely to quit if either the relative wage or the level of unemployment is high. The turnover model has been one of the most popular versions of efficiency wage theories. In choosing a wage, the firm faces an important tradeoff. A lower wage will have the benefit of reducing the total direct labor costs for the firm, but will increase turnover cost as more workers quit and have to be replaced. This is because the lower the firm's wage is relative to the average wage in the economy the higher the quit rate. Higher levels of unemployment, however, tend to discourage workers from quitting. Given that high turnover is associated with the loss of firm-specific skills and a decline in labor productivity, we once again have the prediction that a high relative wage and/or a high level of unemployment will increase productivity. This time, however, the benefits to the firm result from the effects of reduced turnover costs.

Sociological Theories

Another justification for efficiency wage behavior can be provided on what has been called "sociological" grounds.[20] A firm may attempt to raise the effort level of its workers by paying them a wage above what they could obtain outside the firm, on the implicit condition that workers will reciprocate by working harder. In this model, workers compare their wage with what is regarded as a "fair wage". The latter may depend, in similarity to other efficiency wage models, on the outside wage and the unemployment rate. In that case, we also have prediction that an increase in the relative wage and/or the unemployment rate will boosts productivity at the level of the firm. This time, however, productivity increases by making grateful workers feel that they must reciprocate their good treatment with higher work effort.

Adverse Selection Theories

An additional rationalization for efficiency wages is offered in terms of adverse selection.[21] The basic argument here is that the wage rate is a signal to attract a specific type of worker, labor is viewed as a heterogenous input differing by quality. Therefore, firms raise wages in order to attract a larger and "better" pool of suitable applicants. Hence, given that no one, except the applicant themselves, knows about these difference in quality, firms pay high relative wages to attract more and better applicant and thus achieve higher levels of productivity.

Critique of Efficiency Wage Theories

The most fundamental critique to the efficiency wage approach is the bonding argument.[22] This argument suggests that efficiency wages are unnecessary because firms do use different disciplinary devices --such as seniority wage systems and pension schemes -- based on an implicit performance bond which is waived if the worker does not perform satisfactorily.[23] In other words, this argument implies that the rents associated with efficiency wages are deferred to the future

thereby forcing worker to remain with the firm and avoid shirking. However, it has been pointed out that explicit bonding arrangement would be difficult since imperfect capital markets would not enable workers to obtain cash to post a bond or pay an employment fee.[24] In addition, is also argued that the bonding system creates a moral hazard problem on the part of the firm since nothing would prevent, once the bond is posted, the firm from cashing the bond and firing the worker on the grounds that he/she was shirking.[25]

VI. RECENT EMPIRICAL WORK ON EFFICIENCY WAGE MODELS.

Empirical testing of efficiency wages theories is still in its infancy. [26] To date, there have been two distinct empirical approaches to the testing of the efficiency wage hypothesis. The first approach explores, on the basis of case studies, the central relationship between wages and productivity. While striking at the heart of the efficiency wage hypothesis, this approach has yet to be rigorously pursued and has yielded mostly anecdotal evidence. The second approach examines wage differentials across either industries, firms and/or occupations. For the most part this empirical research has centered on statistically examining the role played by industry and labor force characteristics on inter-industry wage differentials. Given that a portion of the observed wage differentials is systematically left unexplained by the economic variables, this residual is attributed to the role played by efficiency wages[27]. Despite the use of sophisticated econometrics and data requirements, this approach has tended to produce only an indirect test and is thus subject to criticism.

Most available empirical studies deal with the case of industrial countries.[28] These studies have, therefore, not been able to capture the particularities of labor markets in developing countries. In particular, they seldom account for the role of segmentation, the different access of firms to the formal capital markets, and the different coverage of industrial and other regulations, that are often found in developing countries. These factors may be crucially linked to observed wage differentials. Therefore, accounting for the industry and labor force characteristics may not be enough, being necessary to include the structural characteristics of the labor market into the analysis.

The Case Studies Approach

As noted earlier, the positive relationship going from wages to productivity is at the heart of

the efficiency wage hypothesis. Empirical research on this direct link, however, has been very limited. The findings of two well known case studies - the Stanford Linear Accelerator Center and the Ford Motor Company - have suggested the existence of efficiency wages.[29]

In 1975, management at the Stanford Linear Accelerator Center indicated that it would reduce its work force by 10 percent. To avoid the layoff, workers responded to this announcement by volunteering to take a 10 percent cut in wages. Management, implicitly appealing to the adverse selection model of efficiency wages highlighted above, rejected this offer on the grounds that lower wages would result in a reduction in the quality of the work force ("the best workers would quit").

The other case study examines the relationship between employee compensation, output and profits of Ford Motor Company before and after the introduction of the "five dollar day" in 1914. In January of 1914, the working day at Ford was decreased from 9 to 8 hours and the minimum daily pay was increased from $2.34 to $5.00. Following the pay increase, turnover declined significantly and productivity is estimated to have increased between 30 and 70 percent. In spite of a higher wage bill, profits at Ford continued to increase. The study suggests that productivity and profits responded in a manner consistent with the efficiency wage hypothesis.

These two case studies by themselves, however, are not sufficient evidence of the widespread application of efficiency wages.[30] To support the broader claim that efficiency wages play a role in macroeconomic fluctuations, evidence of a wage-productivity link in many different sectors of the economy is needed.

The Statistical Approach

Persistent interindustry wage differentials have always been a puzzle to economists. Research on the efficiency wage hypothesis has, therefore, mainly concentrated on the examination of occupational and industrial wage differentials.[31] The standard competitive labor market model

suggests that persistent industry wage premiums can only occur if there are industry-related differences in labor quality or other aspects of work that require compensating differences. Further, transitory industry wage differences may be explained by changes in labor demand across sectors in conjunction with imperfect labor mobility. These transitional differences, however, cannot persist over the long run. Any test examining them must be based on longitudinal data with sufficient time horizon to account for those transitional differences.

Under the efficiency wage hypothesis, on the other hand, if the relationship between wages and productivity (the efficiency frontier) differs across industries, then the optimal wage will differ. This implies that workers with identical characteristics will be paid differently depending on their industry affiliation. Thus unlike the standard model, these wage differentials reflect industry characteristics that do not require compensating differentials.

So far, empirical results reached in the standard statistical exercises do not support the hypothesis that firms are wage takers, but rather support some type of efficiency wage behavior. In the case of industrial economies, and after controlling for all possible relevant variables -- such as schooling years, seniority, occupational and geographical characteristics -- a substantial proportion of wage disparities remains unexplained.[32]   More sophisticated empirical studies have proxied compensating differentials to account for their role in explaining inter-industry wage gaps, in addition to the other more standard explanatory variables. [33]   They still observe significant, stable and unexplained wage differentials across industries. Yet other empirical studies have used a special cohort sample survey and a version of the turnover model to test the explanatory power of standard economic variables, reporting the inability of the model to completely explain observed wage differentials[34].

There are four major conclusions of studies that have used the statistical approach to test the

efficiency wage theory. First, there exist substantial wage differentials among industries, even after correcting for skills, age, gender, job characteristics, compensating differentials, unionization and other demographic factors. Second, the ranking of industries according to wage paid has remained fairly constant throughout long periods of time. Third, wage differentials throughout industrial branches for several countries appear to be remarkably similar and large wage differentials persist at various levels of disaggregation. Four, the degree of unionization or the existence of compensating differentials does not appear having a central role in explaining inter-industry differentials. The existence of unexplained wage differentials is, however, more a rejection of the market competition hypothesis, than an acceptance of the efficiency wages. Nonetheless, the conclusions reached in the existing empirical literature are consistent with the predictions of the efficiency wage hypothesis.

With regard to developing countries, studies on wage differentials have been scarce and aimed at more general analyses of industrial patterns.[35] Studies based on wage setting functions have been carried out in the context of analyzing the contribution of general human capital to earnings rather than that of studying wage differentials along the lines of the efficiency wage theory.[36] There has been only one study directly applying an efficiency wage model to a developing country.[37] That study examined wages in the manufacturing sector of Sao Paulo finding that the estimated wage differentials in Brazil were large, statistically significant and highly correlated with wage differentials observed in some of the industrial countries. The study used a two-stage estimation procedure to examine the firm and industry correlates of interfirm wage differentials. In the first stage firm level earning functions were estimated. In the second stage, predicted firm-level wages for observationally equivalent workers were regressed onto firm and industry characteristics. The regression controlled for differences in capital intensity at the firm level, size, industry

concentration, percent multinational and modernity of technology. Although recognizing that wage differentials may be partly explained by industry differences in human capital, the study concludes that the strong link between firm concentration and high wages suggests that efficiency wage considerations are an important determinant of wage premium.

Research at the World Bank has touched upon the industrial wage structure in a limited way and not in the direction of examining relative wage rigidity determined by exogenous or endogenous forces. An exception is the recent Bank study on the modern sector of Cote d'Ivoire.[38] That study found that industrial restructuring and entry of new smaller firms explained the occurrence of a large drop in employment and a sharp decline in the rate of return to human capital in the Cote d'Ivoire. The study showed that wages, in the aggregate drop, by less than disaggregated wage data (measured across industries). The conclusion of the study implies that there is relative wage rigidity in the formal sector of large enterprises, supporting the idea that adjustment would require higher labor mobility from large to small firms. Along similar lines, two other recent Bank studies have shown that wages in the formal sector of four Latin American economies are relatively more rigid than those in the informal sector.[39] These studies investigated the consequences in terms of adjustment, and the implications in terms of deregulation of the labor market. In not of these studies is the probable origin of that relative rigidity in efficiency wages was explored.

Testing the empirical predictions of the efficiency wage hypothesis is still at an early stage. The examination of the direct link between wages and productivity is limited to a few case studies. The rest of the empirical work concentrates on industry wage differentials and it has been overwhelmingly applied to the case of industrial countries. These differentials, however, are neither necessary nor sufficient conditions for the existence of efficiency wages. Wage differences across industries can arise as a result of compensating differentials or unobservable specific human capital.

VII. SUMMARY

Efficiency wages provide a very plausible explanation to several empirical phenomena. The implications of efficiency wages are particularly important for the discussion of macroeconomic adjustment programs because the resulting endogenous wage rigidity will inhibit the required labor market response, leading to a limited supply response in the adjusting sectors of the economy. However, empirical testing has not yet provided a definite answer on the underlying structural causality. This paper has suggested that a more structural testing of the hypothesis has to be based upon its major macroeconomic implications in terms of the response of wages to unemployment, consumer prices and other factor prices.

The implications of the efficiency wages theory are particularly important for developing countries. Labor market segmentation and persistent unemployment can be better analyzed and understood through the application of efficiency wages theories to the impact of adjustment policies. This undoubtedly calls for specific empirical analysis. More particularly, the issue of wage rigidity must be addressed more comprehensively, including disaggregation across economic sectors and consideration of the non-wage cost component of labor costs. In general, there is an enormous potential to enrich policy recommendations by applying the efficiency wage approach to Developing Countries.

FOOTNOTES

1. This has been, for example, the main focus of studies on the labor market in Argentina, Colombia, Chile, Peru, the Philippines and other countries. See, Lopez (1987), Riveros (1990), Cox-Edwards (1987), Riveros & Sachez (1987), Suarez (1987) and World Bank (1988). See also the collection of studies in Mazumdar et al (1990). For a general review on this issue, see Fallon & Riveros (1990). Formal models analyzing rigidities created by exogenously introduced distortions are presented in Edwards (1989). Edwards & Cox-Edwards (1990) and Lopez & Riveros (1990a,b).

2. Despite its infancy, there are several excellent survey articles written on the efficiency wage hypothesis. These articles cover in greater detail the material present in this section of the paper. See, for example, Carmichael (1990), Fisher (1989), Katz (1986) and Yellen (1984).

3. The basic assumption would be that effort increases according to a non-linear relationship.

4. Unemployment in this approach can also be of a transitional nature, associated to a sluggish real wage adjustment in response to demand fluctuations.

5. An alternative approach would be to use a conditional profit function. In a first stage, the firm maximizes profits with respect to all other inputs and output levels conditional on $\epsilon(W,)N$. In the second stage the firm would solve the following problem:

$$\underset{N,W}{Max} \quad \Pi(\epsilon N, q_i, P_i; T) - WN \quad subject \ to \quad \epsilon = \epsilon(W, \gamma)$$

The first order conditions for this problem can be solved simultaneously to arrive at the Solow result presented in Equation 6.

6. The important work of Summers (1988), has pointed the existence of this coordination problem associated to the information available to the firm.

7. This point has been made by Edwards (1988),

8. See, for instance, Holland (1988), Prachowny (1980), Zandamela (1988), Gros (1986), and Williamson (1985).

9. See Paldam and Riveros (1989).

10. See Stiglitz (1987), Yellen (1984), and Solow (1979).

11. A model which points out the main characteristics of the relationship between insiders and outsiders to the firm is presented by Lindbeck & Snower (1986a, 1986b)

12. See, for example, Jones (1985) and Bulow and Summers (1986).

13. See Hall (1975), Harberger (1971) and Lopez and Riveros (1990a).

14. Lopez and Riveros (1990a, 1990b).

15. In addition to the five theories explained below, a sixth rationale for the efficiency wage approach is the "Union Threat" model (Dickens, 1986). In this variant, high wages are paid to prevent the formation of militant Unions. Again, this model points to the role of economic and institutional factors and its empirical implications are basically the same as the other four versions.

16. See Leibenstein (1957), Mirrless (1975), Bliss and Stern (1978) and Dasgupta and Ray (1986, 1987).

17. For a review of analysis of this version see, Calvo (1979), Stiglitz and Shapiro (1984), Bowles (1981), and Stoft (1982).

18. See also Foster & Wan (1984) who provide an explanation on the shirking issue based on the principal agent problem.

19. See, for example, Stiglitz (1974), and Salop (1979).

20. See, for example, Akerlof (1982).

21. See, for example, Weiss (1980).

22. This has been advanced by Lazear (1981)

23. See Fisher (1989).

24. The argument was originally developed by Shapiro and Stiglitz. See also, Dickens, Katz and Lang (1986).

25. See Fisher (1989). Carmichael (1985) indicates that the moral hazard may not be serious, but Shapiro & Stiglitz (1984) note that it is the seriousness of this problem which explains why performance bonds are rarely observed in the real world.

26. In particular, no study has attempted to use a general model to positively test the main implications of the efficiency wage hypothesis as against, for instance, the ones derived from the conventional neoclassical theory.

27. Fisher (1989) presents a critical review of studies that have undertaken a direct evaluation on the existence of a relationship between wages and productivity. See Raff & Summers (1987) for a specific case study on labor compensation and introduction of an efficiency wage.

28. The exception, of course, is the limited body of work concentrating on the nutritional model of efficiency wages. See, for example, Dasgupta and Ray (1987).

29. Weiss (1980) recounts the story of the Stanford Linear Accelerator center without directly appealing to the efficiency wage hypothesis. Raff and Summers (1987) studied the Ford case looking for evidence of efficiency wages.

30. In contrast to the positive wage productivity, Leonard (1987) looks for a negative relationship between level of supervision and wages implied by the shirking approach to efficiency wages. He finds little connection between the two. His result, however, have been criticized because his data source is not specified and it covers only one industry.

31. See Dickens and Katz, (1987, 1988), Murphy and Topel (1988) and Krueger and Summers (1988a, 1988b).

32. See Katz (1986), Dickens and Katz (1987), and Murphy and Topel (1987).Raff and Summers have studied a specific case on labor compensation and introduction of an efficiency wage.

33. See, Kreuger and Summers (1988)

34. Beaudry (1989). Campbell (1989), on the basis of an aggregate wage setting model, has also studied the hypothesis of wage rigidity in France and Canada. His findings also support the validity of the efficiency wage hypothesis.

35. See, for instance, the study by Salazar-Carrillo (1982) analyzing the structure of manufacturing wages for a sample of Latin American economies, describing their basic features with regard to both distribution and explanatory factors.

36. See Fields (1980), Riveros (1990), Uthoff (1983), and Corbo and Stelcner (1983).

37. See Robbins (1989).

38. See Levy & Newman (1989).

39. See Lopez & Riveros (1990a,b).

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