University Avenue Undergraduate Journal of Economics

Volume 4 | Issue 1 Article 2

2000

How Wages are Set: Uncertain Political Marginal Productivity: Price Theory, Wage Theory, Agency Theory, and the Theory of the Firm

Thomas C. Lane

University Avenue
UNDERGRADUATE JOURNAL OF ECONOMICS

How Wages are Set: Uncertain Political Marginal Productivity: Price Theory, Wage Theory, Agency Theory, and the Theory of the Firm

Lane, Thomas C.

http://digitalcommons.iwu.edu/uauje

Abstract and Hypothesis

How do employers set their employees wages? In economics, both price theory and wage theory address this question. Price theory tells a story about marginal productivity; an employer will add employees until the marginal benefit of the addition is equal to the marginal cost of the addition, or until the additional profit to the firm is zero or less. Wage theory complicates this story by starting with price theory and then recognizing that there are market externalities and cultural biases -- discrimination -- that corrupt the marginal productivity story. While wage theory is more realistic than price theory, both stories are limited by failing to acknowledge the difficulties in measuring worker marginal productivity. This last facet is raised by the works of Alchian, Hayek, Fama, Jensen, and Klein in their contributions to the theory of the firm and agency theory, and best addressed by decision analysis, a branch of management science that provides tools for dealing with uncertainty by optimizing solutions via probabilistic assumptions.

In this paper, I will derive a new model of wage prices by starting with price theory and wage theory and then blending in the cost factors uncovered by agency theory and the theory of the firm, and Alchian's work on economic uncertainty. The final result is still theoretical and cannot be used to predict a specific workers wage, but is nevertheless more complete and realistic in detailing the process of wage determination.

Price Theory and Its Model: Marginal Productivity

Microeconomic price theory holds that wages are solely determined by the concept of marginal productivity, and provides two variants of its model: one for perfect competition and one for monopoly. In the context that price theory addresses, this is an accurate and vital depiction of how wages are set. The fundamental problem with the depiction is that it is unrealistic due to its simplicity. This is not unreasonable, price theory doesn't have modest goals; it seeks to explain a powerful concept that is bedrock to microeconomics. However, it is a mistake to believe that marginal productivity is the end of the story. It is just the opposite; it is the beginning, and, as such, that is where I will begin. It is crucial that this concept be presented in detail because, like many fundamental concepts, it is difficult to grasp due to its elegant perception.

Hirshleifer's Price Theory and Applications is a seminal intermediate microeconomics textbook. Currently in its seventh edition, it is still widely used and well regarded by the undergraduate economics curriculum. The definition of marginal productivity in the chapter on demand factors of production can be taken as representative of price theory as a whole. Hirshleifer defines marginal productivity as

$$mp_a \equiv \lim_{\Delta a \to 0} \frac{\Delta q}{\Delta a} \equiv \frac{\delta q}{\delta a} \qquad \text{(Hirshleifer, 305)}$$

or, for each additional unit of "a", how many additional "q" will be produced. The important concept for the firm is that eventually an additional unit of "a" will result in virtually no additional units of "q". At that point, it becomes untenable for the firm to use additional units of "a" because it is not realizing any improvement in its productivity or profitability. If "a" are workers, then at that point, the firm will stop hiring additional workers and the wage that the last worker hired receives will be the marginal wage for that type of worker.

The marginal wage, it is important to note, is not the wage that every worker of this type receives.

Rather, it is the lowest wage in the wage schedule that will induce workers to offer their services for hire (supply side); all of the other workers currently employed will be paid more than the marginal wage.

There is a more atomistic way to think about marginal productivity however, and that is in terms of the firm's profit function. The profit function is defined as total revenues less total costs, but since fixed costs raise the cost schedule by a predictable, consistent amount, I will ignore them here for simplicity's sake. Then, the profit function becomes total variable revenues less total variable costs. Mathematically:

$$\pi = r - c$$

where π = profit
r = total variable revenue
c = total variable costs

Total variable revenue and total variable costs can be calculated by multiplying the price by the quantity from the sales and wage schedules respectively.

$$r = P_{sales} * Q$$
$$c = P_{costs} * Q$$

Where P_{sales} = the price of the products produced
P_{costs} = the price of the factor costs used in the products produced
Q = the quantity of products produced

The profit function can then be respecified as:

$$\pi = (P_{sales} * Q) - (P_{costs} * Q)$$

or simplifying

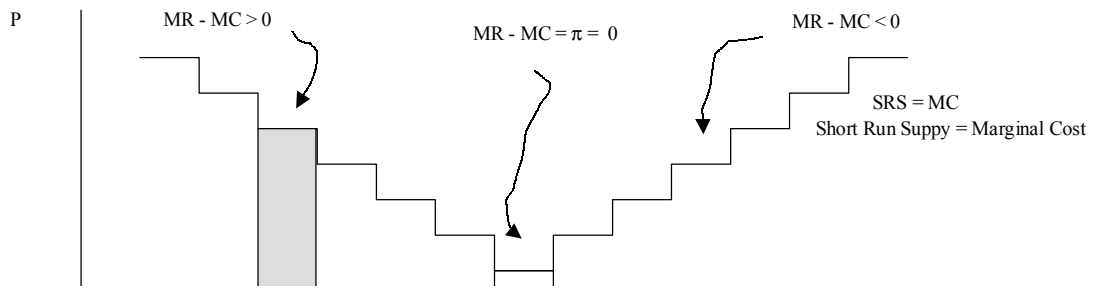
$$\pi = (P_{sales} - P_{costs}) * Q$$

But price theory talks of marginal productivity, not positive profit. There is a connection, of course, involving the quantity produced. Marginal productivity was defined above as the change in quantity produced for an additional unit of an input factor. Let me cut to the chase and use labor as the only input factor involved in the production. And, of course, the price of the product and the costs associated with producing the additional quantity will change as well, and so, the total profit will change. Thus, to reframe the profit function in marginal terms, is:

$$\pi_m = r_m - c_m$$

where π_m = marginal profit contribution
r_m = marginal revenue
c_m = marginal cost

Price theory claims that when r_m is less than or equal to c_m or, P_{sales} is less than or equal to P_{costs} then the firm will stop adding additional workers. The diagram below illustrates this graphically.



Hirshleifer explained the same concept in terms of diminishing returns:

> To determine its optimal (profit-maximizing) employment of factor A, the firm must balance the returns from hiring A against the hire-price h_a. Two elements are involved in calculating these returns: (1) the physical productivity of A as an input to production, and (2) the revenue gained from the units of commodity produced.
>
> So far as physical productivity is concerned, only marginal product will be relevant to the firm's decision. However great the contribution to total product may have been for earlier units of factor, only the incremental yield from an additional unit will be considered in hiring that last unit. Thus, the marginal product mp_a curve, as in the lower panel of Figure 11.1, pictures the physical productivity element. (Hirshleifer, 310)

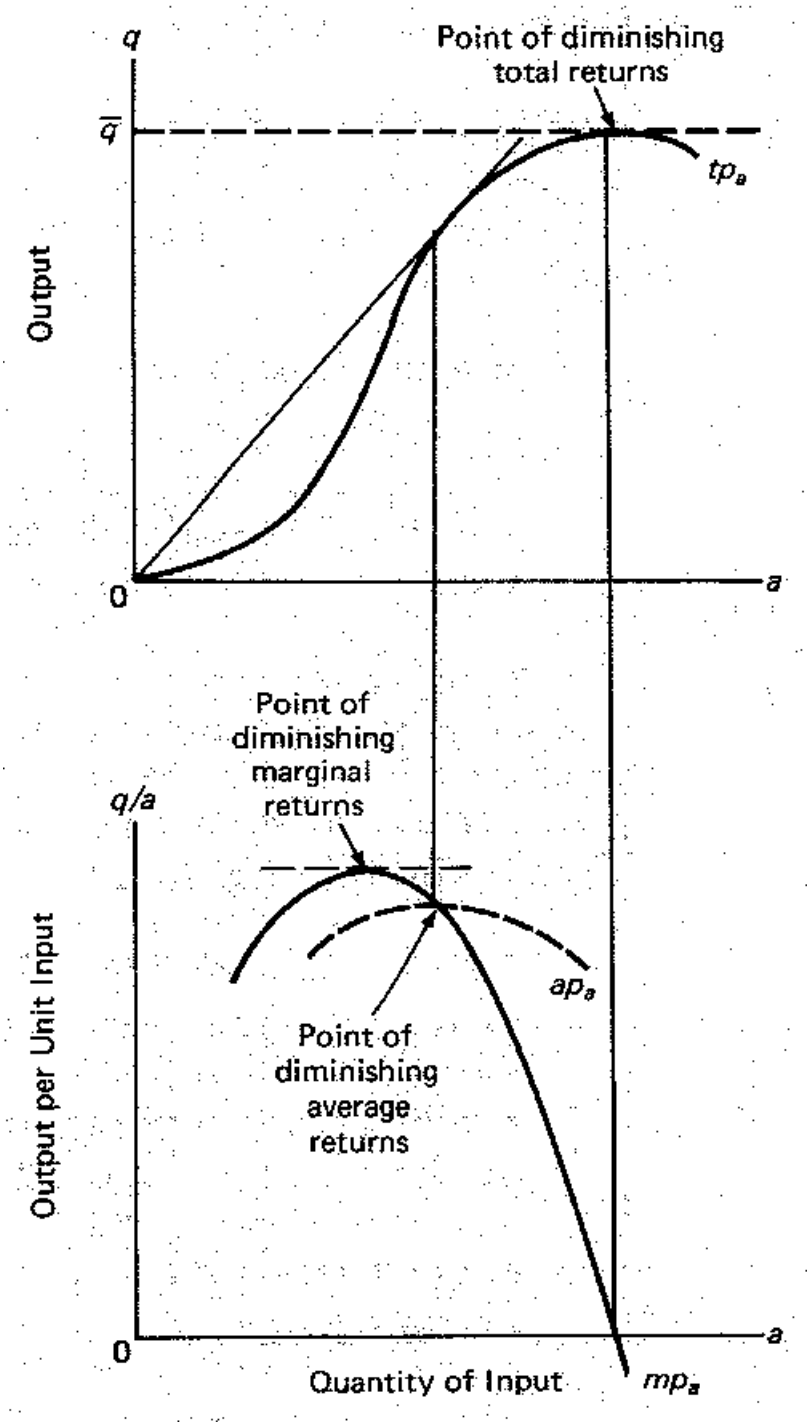


Figure 11.1 The Law of Diminishing Returns. The upper panel shows the Total Product function tp_a, and the lower panel shows the corresponding Average Product function ap_a and Marginal Product function mp_a of employing factor A. Diminishing *marginal* returns set in first (the mp_a curve reaches its peak), then diminishing average returns set in (the ap_a curve reaches its peak), and finally diminishing *total* returns set in (the tp_a curve reaches its peak, at the maximum producible output q-bar). (Hirshleifer, 306)

Hirshleifer is saying that, according to price theory, the hiring decision is solely contingent upon the marginal productivity benefit exceeding the marginal cost for the worker. His Figure 11.1 makes the point crystal clear: there is no incentive for the firm to add workers beyond the point of positive marginal profit contribution. He does go on to qualify that statement by explaining that there is a "secondary condition" (Hirshleifer, 311) that indicates that the firm will continue to add workers until their marginal profit contribution is less than or equal to zero. He additionally adapts the model to deal with the monopoly case (Hirshleifer, 312) by pointing out that since a monopoly can set its price through the quantity that it produces, there is an additional opportunity cost of hiring workers that increases with quantity. Namely, the foregone profit as the product price declines due to greater quantity produced. He is acknowledging that the monopoly will produce less than the perfectly competitive quantity and thus hire fewer workers. He also indicates that this is really the same model with an additional variable included for the number of firms in the industry.

To summarize, price theory indicates that worker's wages are bounded at the bottom by the wage at which the additional costs incurred by the addition of that worker exceed the additional profit realized by that worker; simply, the costs of the worker exceed their benefit.

Wage Theory

Professors D. Usher and M. Engineer published a paper in *Public Choice* titled "The Distribution of Income in a Despotic Society". In the abstract, Usher wrote, "A distribution of income between rulers and subjects can be derived as an equilibrium of violence, rather than from considerations of marginal products of owned factors of production." (Usher, 261) In the paper, Usher and Engineer develop an income distribution model whereby the society's GNP is distributed based on maintaining political power and providing the workers with enough resources to continue production. In Usher's model, political power is represented by the prevention of rebellion. Usher concludes:

> … the theory developed in this paper can be looked upon as one possible explanation of the distribution of property; while the marginal productivity theory is a theory of the distribution of income, given the distribution of property … our theory can be looked upon in some circumstances as the completion of, and not a rival to, the marginal productivity theory, for it may explain the distribution of property, while the marginal productivity theory takes that distribution as given prior to the commencement of economic analysis. (Usher, 272)

While giving the marginal productivity theory its due, Usher is suggesting that his politically based income distribution theory is complimentary to the marginal productivity theory. It occurred to me that there is an element of Usher's model in contemporary wage setting; that it is not just marginal productivity alone that serves to establish relative wages, but rather there is a political component as well. Wage theory confirms my intuition.

Wage theory starts with marginal productivity theory and then adds a political component. It recognizes that in contemporary societies, there are market externalities, cultural biases, and supply and demand effects that deviate wages from their marginal product predicted values. Market externalities such as government intervention and labor unions work upon the entire market sector, while cultural biases and supply and demand effects work upon the entire market. Before I can plunge into the details of wage theory, I need to define how politics effects contemporary wage setting.

Politics: A Definition and Its Effects on Wages

Politics has been described, perhaps salaciously, as force. This definition recognizes that individuals

within a society utilize politics to obtain social power in order to exercise their will; to effect changes or to maintain the status quo. In either case, obtaining political power is a necessity in any society, because without the cooperation of others, nothing of consequence can be accomplished; politics is a force present in both democracies and dictatorships.

Political scientists are currently debating whether the contemporary U.S. is an elitist or pluralist society. There are good arguments on both sides, and the existing empirical data can be used to support both points of view (Hudson, 212). For this analysis, which side is correct is not important. What is important is that both societies are organized around political factions. In the elitist society, there is an elite faction that functions like an unofficial, but institutionalized aristocracy, using its better access to education and wealth to skew society's rules to favor themselves. In a pluralist society, there are a number of factions, such as special interest groups, who each use their resources to skew society to favor their group. A cogent example is the American Association of Retired Persons. The difference between them is in the degree of political power ascribed to the factions and number of factions vying for control. In that sense, the two theories are two poles in a continuum. Perhaps the most significant difference is in the nature of the different factions; in the elite theory, it is only a person's heritage and wealth that includes them in the controlling faction, whereas in the pluralist theory, there are any number of inclusive traits. Regardless, the point of significance to wage theory is that politics is a force in contemporary U.S. society and that that force is organized around common cultural characteristics.

Whether political force is used to cause government intervention, form unions, or propagate unacknowledged, but nevertheless institutionalized discrimination is not at issue, but rather, what is at issue is the idea that each mitigates the marginal product theory. Political force as applied to wages can be thought of as favoritism, or the other side of the coin, discrimination. Either way, to accept that politics is involved in setting wages, is to accept that wages are set subjectively and not set purely by optimizing profit.

Empirical Evidence and Examples of Politics Mitigating Marginal Product Theory

Fortunately, there are many excellent observations and some empirical evidence that support the political component of marginal product theory. I will start with the most obvious and least controversial market externalities, namely government interference and unions, then cover supply and demand, and save the most controversial, discrimination, for last.

Examples of government interference are plain to an economist, having covered minimum wage and tax legislation in detail. It is well accepted that minimum wages set a price floor for unskilled workers, which guarantees the artificial, government specified wage for those workers, and theoretically raises unemployment for those workers, by raising their marginal cost. Thus, the economic story goes that minimum wages make those workers lucky enough to get a job, better off, while making unskilled workers as a whole, worse off. While this is clearly an example of government interference in the marketplace, it is not clear that the unskilled labor market behaves as microeconomics would predict. Specifically, the empirical evidence neither corroborates nor repudiates that minimum wage laws increase unemployment among unskilled workers (Ehrenberg, 124). What is clear, however, is that this government interference is a political mitigation of marginal productivity theory, because the marginal product value for unskilled workers is, at least temporarily, higher than the unadulterated market equilibrium; i.e., before the minimum wage legislation is passed and the wage rate raised.

In the broadest sense, however, it is generally accepted that government intervention mitigates marginal productivity theory. Ehrenberg put it this way:

> … the wages workers receive, the employee benefits they qualify for, and even their working conditions are all influenced, by one degree or another, by the government. There are minimum wage laws, pension regulations, restrictions on firing workers, safety requirements, immigration controls, and government provided pension and unemployment benefits that are financed through employer payroll taxes. All these requirements and regulations have one thing in common: they increase employers' cost of hiring workers. (Ehrenberg, 60)

Ehrenberg is confirming my assertion that politics is endogenous to the marginal productivity model: that politics motivates politicians to pass legislation that raises the cost curve for labor. Theoretically, this external increase in costs should move the market equilibrium to the left and reduce GDP. Ehrenberg does say that, despite the minimum wage example above, the empirical evidence does corroborate that wages can be deviated from the market equilibrium "by government policy, through employer design, [and] as a result of collective bargaining agreements" (Ehrenberg, 54).

Labor unions deviate labor market equilibriums by artificially restraining supply. They not only restrict who may work but how many, and not surprisingly, the unions usually negotiate contracts that specify less than the optimum number of employees (Ehrenberg, 49). Effectively, unions function as monopolies (Ehrenberg, 481).

Ehrenberg provides details about how unions manipulate wages with an example on the trucking industry. The industry is divided into two sectors, the "full-truck-load" (TL) sector and the "less-than-full-truck-load" (LTL) sector. Both sectors have strong unions, but the LTL sector is an oligopoly due to the higher fixed costs and the specialization of coordinating complicated pick-up and delivery schedules. Accordingly, the LTL sector is much more profitable, but also more sensitive to union strikes, since a strike could cause financial ruin due to an unrectifiable series of breached client contracts. The LTL sector union recognizes this and is able to negotiate much better employment contracts for its members than the TL sector. Ehrenberg quantified this difference as the LTL sector employees receiving 26% more per mile than the TL sector employees (Ehrenberg, 111). This example illustrates that the union is able to force a higher wage for their members working in the less competitive portion of the industry due to the higher margins of that portion of the industry. Of greater significance is the description of the mechanism used by the unions, which, if you equate politics with social faction force, provides a concrete, detailed example of how politics can be used to deviate wages from their marginal productivity equilibrium.

Ehrenberg also summarizes powerfully illustrative empirical data that detail the overall effect of unions upon wages. He writes that union workers in the U.S. receive 10 to 20% more than comparable non-union workers. In other countries, the wage-gap between union and non-union workers is between 5 and 10%, and that

> Unions everywhere tend to reduce the dispersion of earnings among workers. They raise the wages of less-skilled workers relative to higher-skilled workers within the union sector, thereby reducing the payoff to human-capital investments. They "standardize" wages within and across firms in the same industry, and reduce the earnings gaps between production and office workers. They also reduce the wage gap between white and black workers in the United States. (Ehrenberg, 508)

Ehrenberg is quantifying the effects of unions on wages including such factors as increased compensation and tendency to promote a unitary wage for all caliber of workers. These findings should convince even the most obstinate skeptic that unions, which can be thought of as political factions motivated by political rewards, deviate wages from their marginal productivity theory estimate.

Ehrenberg's discussion of supply and demand follows typical microeconomic logic. For a variety of reasons, some jobs are less popular than others and so attract fewer workers. Employer competition for those fewer workers raise the wage schedule, making some jobs better paid than others. Rarer resources are worth more and plentiful resources are worth less. It's the old diamonds-water paradox (Ehrenberg, 454). Ehrenberg also cites a convincing example about how the Black Death plague effected wages during the Middle Ages. The example says that the plague constrained labor supply while the concentration of capital increased demand and the two together doubled wages in a three-year period (Ehrenberg, 48). It shouldn't be a surprise that supply and demand effect the labor market in a similar manner as the commodities market.

Cultural biases, discrimination and favoritism, function as a discount factor of the marginal productivity theory's estimate. This discount factor can be applied to individuals based on virtually any characteristic, but common examples are racism, chauvinism, and seniority practices. Effectively, employers use cultural biases to decide that some individuals are less productive than others, and thus, should be paid less (Ehrenberg, 432).

Though generally difficult to corroborate empirically, both because of the interaction and sheer number of causal factors, Ehrenberg does provide some persuasive empirical examples. One such example, has to do with customer discrimination and professional sports. More than one empirical study found that "while 72 percent of NBA players are black, and while overall average salaries are equal for blacks and whites, there is evidence … that if black and white players were equally skilled, the white players would earn from 16 to 23 percent more." (Ehrenberg, 439) Ehrenberg explains this wage gap by stating that the studies also found that "replacing a black player with a white one of equal skill raised attendance and revenues by amounts roughly comparable to the 16 to 23 percent premium paid to whites." (Ehrenberg, 439) Thus, black NBA player's earnings are less because their marginal revenue product is less and this is because fans turnout to see white players more. It is probably safe to assume that that is due to racist attitudes since non-subjective explanations were explicitly controlled for in the studies.

The last point that I want to make about cultural biases is that they unnecessarily lower GDP. Since these biases function as a discount factor for discriminated individual's marginal productivity, they establish these individual's perceived marginal productivity below their true marginal productivity, shifting the labor market's cost curve up, and moving the market equilibrium to the left. The net result is that fewer workers are employed. The connection to GDP is, if you define GDP as the summation of all the products produced in all markets multiplied by their market prices, $P \bullet Q$, then fewer Q will produce a smaller $P \bullet Q$, or, a smaller GDP.

To summarize this section on politics and how it effects wages, I have proven that:

1) politics in the contemporary U.S. is organized around factions
2) these factions utilize their political power to promote a favorable economy for their own members (favoritism), at the expense of the rest of society (discrimination, lower GDP)
3) these factions promote their members via:
   a) legislation
   b) unions (monopolistic supply), and
   c) unacknowledged, institutionalized discrimination
4) all three of these social instruments mitigate microeconomic marginal productivity theory

The Wage Theory Model: Marginal Productivity Plus

To create a model of wage theory based on Ehrenberg's work is relatively easy, but is new work, since Ehrenberg doesn't really present a model himself. He does present a few equations in his discussion of

discrimination, and, I can begin with that. From the text, it is clear that Ehrenberg believes that the way that chauvinism effects wages is that women are perceived by employers to be worth some fraction of a man. He doesn't quantify that number, but for illustration, let's pretend employers perceive women to be, in aggregate, only 3/4s as productive as comparable men. Then, an equation for a women's wage is:

$$MRP - (MRP \bullet (1 - d)) = W_F$$

Where MRP = marginal revenue product, which is the additional profit realized by the firm by adding the last worker. This is what I have been referring to as MP: marginal product
d = the discrimination discount factor for women versus men
W_F = the aggregate wage for women versus men

Thus, a woman in a chauvinistic society that believes that women are only 3/4s as productive as men, would earn a wage equal to 3/4s that of a comparable man. With the change in nomenclature from MRP to MP, to remain consistent with the price theory model developed earlier, I can use this equation as a foundation for a wage theory model.

The model that I described in the previous section was built upon price theory's marginal productivity model and added the following political aspects:

1) government intervention
2) unions
3) supply and demand effects, and
4) cultural biases

There are additional, apolitical, factors included in the wage theory version of the marginal productivity model. They are:

5) inter-temporal considerations
6) training costs, and
7) hiring costs

Wage theory acknowledges that employers compensate their employees cognizant of their period-to-period differences in productivity. Ehrenberg discusses this topic with respect to the additional productivity realized in employees after they have received training, a future benefit, while undergoing a present-day cost. Thus, employers are motivated to pay workers less before training, to recoup their investment up-front, and then increase their pay after training to retain the employee/investment. (Ehrenberg, 155)

Ehrenberg also discusses business-cycle fluctuations in the supply and demand for labor, and how that effects employee compensation. Since employee compensation is sticky in the short-run, worker's contracts cannot be renegotiated with every slight drop-off in demand, employers are forced to try to anticipate business-cycle demand fluctuations. These fluctuations are managed by averaging them over the foreseeable future, taking into account the present value of future revenues and costs. (Ehrenberg, 157) The result is a compensation package that projects and tries to estimate marginal productivity over a short-period of time into the future, probably about two years.

The final aspects of wage theory's variant of price theory's marginal productivity are hiring costs, which are bundled with training costs. Ehrenberg defines these costs are quasi-fixed costs, because they are attached to the worker, not the labor-hour. Thus, employers quickly realize that there is a trade-off between overtime and the number of workers that justifies paying overtime rather than hiring more

workers (Ehrenberg, 144). There is a trade-off between hiring costs and training costs as well. More experienced workers require higher hiring costs, more wooing, paying employment agencies, etc, but require less training. Conversely, hiring entry level workers through newspaper ads is relatively inexpensive in hiring costs, but the training costs are much higher (Ehrenberg, 141). Ehrenberg cites two studies that quantify these two costs and corroborate his analysis (Ehrenberg, 142).

Now, that all of the factors have been explained, I can present them in mathematical notation and then discuss how each factor effects the supply/cost and demand/revenue curves, and their equilibrium.

$$W \leq D \bullet (PV((MP - (MP \bullet (1 - d)) - t - h))$$

Where MP = the marginal revenue product for the worker, which is the additional profit realized by the firm in the foreseeable future by adding the last worker.
d = the discrimination discount factor $0 \leq d \leq 1$
PV = the present value, usually defined as the summation of the marginal contribution for each future time period, discounted back to present-day dollars
t = training costs, on-going, quasi-fixed costs. Negatively correlated to hiring costs. $t > 0$
h = hiring costs, a one-time expense. Negatively correlated to training costs. $h > 0$
D = the demand factor; can be fractional $0 < D < \infty$
W = the highest wage for this type of worker

Interpreting the wage theory equation is relatively simple. All of the factors except the demand factor effect the model in the same way; they all discount the wage from its price theory estimate. Their effect on the supply/cost curve is to raise the curve; moving the equilibrium to the left. So, the fundamental difference between the price theory and the wage theory models is that wage theory recognizes the political, subjective component of establishing the wage; the rest of the difference is just in a more detailed breakdown of the costs. Note that I have included all factors except the demand factor within the present value operator. That is because employers consider future hiring and training costs as well as their initial values when determining the wage. And, even though it can be argued that the demand factor can be anticipated, which would imply that it should be included in the present value operator, I believe that employers do not attempt to forecast demand, but instead evaluate the demand for every new period. This is because, in the usual state of the world, high demand creates its own supply, thereby lowering the value of the demand factor. It is conceivable however, that for some reason such as plague, that the supply might not increase, but since this is the extraordinary case, employers do not usually anticipate that demand will increase. Finally, the demand factor is the lone exception in its effect on the wage because it can either increase or decrease the wage depending on the scarcity of the worker.

Uncertainty, Agency Costs, and the Theory of the Firm

While the wage theory model is more sophisticated and complete than the price theory model, it can still be criticized for being unrealistic. This harks back to the age-old criticism of academia for creating elegant theories that cannot be applied in the real world. The works of Alchian, Hayek, Fama, Jensen, and Klein addresses this criticism to some extent. It does so partially by bundling uncertainty into economic theory and partially by acknowledging that it is not the intent of most theories to be applied to the real world, but rather that they describe how the world works in general, not specific terms.

Alchian, et al, contributions to the theory of the firm can improve wage theory with two additions:
1) by factoring uncertainty into comparative statics models, and

2) by refining the costs inherent in the relationship between employers and their employees (agency theory and theory of the firm).

Alchian concluded that economic comparative statics analysis could not be used to forecast the future, but rather, only as an historical analysis of business practices that had been successful (Alchian, 26). Alchian's logic is that comparative statics analysis cannot be applied to the real world because of its inability to specify a single set of future actions that will produce the best possible result, and this is due to the unrealistic assumption of ceteris paribus. It is such a basic building block of economics that economists tend to accept ceteris parabis as a necessary assumption, and reasonably so, because without it, comparative statics models don't work, but Alchian rocked the economic paradigmatic boat, and seriously considered economic theory sans ceteris paribus. His results offer far more realistic economic models because they acknowledge the lack of certainty inherent in making decisions in a world in which nothing remains the same and knowledge is imperfect. Because of the deficiency of the ceteris parabis assumption, the analyst can never know with certainty the consequences of an action, and therefore, can never predict with certainty future consequences. Once you acknowledge this flaw in comparative statics analysis, then you must concede that it loses its predictive ability. The consequences of this realization are momentous. The economist can no longer forecast demand, supply, or marginal costs and revenue, or profit. The best that an analyst can do is to forecast a probabilistic, expected result, with the associated probabilistic guarantee.

The impact of Alchian's work on uncertainty is that it is no longer reasonable to expect that it is possible to ascertain an employee's marginal productivity. Clearly, it's not possible to determine with certainty that the change in production after the addition of a new worker is solely attributable to that new worker. There could be many other reasons for the change in productivity, some due to the additional worker, some not. Alchian would further argue that it's not possible to determine the marginal costs of that additional worker either, because in any situation involving more than one worker, the impact of that additional worker on the team becomes complex. This is due to the interaction between the new worker and the rest of the team environment. The true marginal cost of an additional worker as part of a team is partially a function of how well that new worker integrates into the team (Alchian, 77). Thus, due to the complexity of the environment, the impossibility of ceteris paribus, and the imperfection of information, (Hayek, 77) it is impossible to measure, in any but the grossest scale, a worker's marginal productivity.

Alchian provides a clue to the remedy for the uncertainty problem: statistical expected value. In the best possible case, ceteris paribus can be approximated by repeatedly hiring and then firing, in quick succession, a statistically significant number of workers for a single team position. The goal is to test the effect of adding a generic worker to the team, by controlling for individual worker characteristics by keeping every other variable as identical as possible, while changing the worker. Obviously, this is an interesting experiment for an economist, but it's impractical from a business perspective, since no employer could afford the transaction costs involved in repeatedly hiring and firing workers. Further, in such an experiment, it is virtually impossible to maintain the environment over the time span required. The next best possible case, which is more practical, but still infrequently applied, is to look back at the accounting records each time a new worker of this type has been added and to attempt to access the change in profit. Assuming that the environment is similar, there is still little guarantee that the change is completely due to the additional worker. I believe that what is usually done, is that the individual controlling the budget "guess-timates" the change in profit that will result after the new worker is added. In a competitive industry, with near-normal profits, a consensus appears as firms that "guess-timate" incorrectly go out of business, and competition for workers sets the wage right about at their marginal cost. A less-competitive industry is more tolerant of incorrect guesses because profits are abnormal, and so I would expect to see a wider variance in the consensus wage. Alchian supports my analysis when he asserts that the inefficiency of public utilities is due to their above-normal profits; he cites studies that indicate that public utilities can afford labor unions and racist hiring practices (Alchian, 247). Both

suggest a subjective wage setting mechanism. Since the budget-holder cannot know in advance how productive a given worker will be, the most cost-effective strategy for them to employ is first, to seek out the industry consensus, and second, failing that, attempt to estimate the average productivity of the average worker. In other words, the statistical expected value.

Agency theory and the theory of the firm provide a more general framework for analyzing the costs associated with an employee. They include acknowledging that there are costs associated with obtaining and utilizing information, and transaction, management, and agency costs associated with utilizing employees. Wage theory specifies many of these costs, but is talking trees, while agency theory and the theory of the firm are talking forests. Agency theory discusses the asymmetry of information in the employer-employee relationship, and that there are transaction, management, monitoring, and search costs because of it. Wage theory includes hiring versus training costs, which are transaction, search, and management costs. But wage theory does not mention the costs of firing an employee, which require additional transaction, management, and monitoring costs. Wage theory also does not mention shirking (Alchian, 79), a concept of agency theory that recognizes that employees do not always act in their employer's interest. Shirking costs raise employee costs by recognizing that since employees are acting in their employer's interests less than 100% of the time, then the employee's wages should be discounted accordingly (Fama, 61). In addition, shirking requires the absorbing of detection, monitoring, and punishment costs by the employer (Jensen, 40). All of these costs are inter-related with the cost of information as well. Wage theory observes this when it discusses the trade-off between hiring experienced versus inexperienced workers. If you consider that a large part of the difference between experienced and inexperienced workers is knowledge, and that knowledge can be thought of as acquired and processed information, then employer's are paying for information by hiring experienced workers. Also, employer's are paying for information through the search, detection, and monitoring costs associated with hiring and managing employees. The last point that I want to make regarding the effects of information costs and asymmetry on the costs of an employee is made by Klein: "Where more trust is present and implicit rather than explicit contracts are used, contract prices including wages are likely to be more flexible." (Klein, 318) Klein is pointing out that where the statistically expected value of the employee's labor is higher, due to the strategic alignment of employer+employee goals, the wage will more closely follow the employee's true profit contribution, otherwise, the employer will risk-adjust the wage down to anticipate future downturns.

To fold in agency theory and the theory of the firm into the wage theory model is relatively straightforward. The aspect of uncertainty can be embodied by replacing the marginal productivity variable with its estimated average. The list of costs: information, transaction, management, search, monitoring, detection, agency, shirking, punishment, hiring, firing, and training can be summed up in information costs, modified by the degree of asymmetry, and agency costs. In mathematical notation, the model is:

$$W \leq D \bullet \{ PV [\hat{MP} - (\hat{MP} \bullet (1 - d)) - ((i(e) + g(u)) \bullet a)] \}$$

Where $\hat{MP}$ = the expected value of the marginal revenue product for the worker, which is the estimate of the average of the additional profit realized by the firm in the foreseeable future by adding the last typical worker.

d = the discrimination discount factor $0 \leq d \leq 1$

PV = the present value, usually defined as the summation of the marginal contribution for each future time period, discounted back to present-day dollars

i = information costs: a function of the worker's experience, and includes:
transaction: hiring, firing, and search costs

management: shirking, monitoring, detection, punishment, training
$i \geq 0$

e = the worker's level of experience
a = the degree of the information asymmetry
g = the agency costs, which include:
hiring and firing: search, monitoring, detection, punishment, and shirking
$g \geq 0$
u = the degree of autonomy required in the job
D = the demand factor; can be fractional $0 < D < \infty$
W = the aggregate wage for this type of worker

Note that this model is very similar to the wage theory model with the exception of the marginal product variable and the framework for the costs of the employee. Both are important, but the crucial difference is in using the expected value of the marginal productivity value. Using the expected value acknowledges the uncertainty faced by businesses in the real world, and brings the analysis one step closer to real world applicability, as adding the political component to the price theory model brought the wage theory model closer to reality. Regardless, I don't pretend that this model will be used by businesses to set wages. Instead, I believe that the model successfully analyzes the thought processes followed by budget-holders as they contemplate adding additional workers to an existing work team, and does so built upon well accepted economic theory.

Epilogue

It occurred to me, as I was performing this analysis, that if I were to continue this project, my next step would be to try to develop some sort of empirical support for the theory. The most likely tillage for such work would be in a well-paid sales force, mostly because the measurement and ceteris paribus problems are less than in other fields. It is usually quite clear what a sales person costs, both in marginal costs, and in their share of fixed and/or overhead costs, and it is fairly clear what their marginal revenue is, although it is less clear than their costs. Their marginal revenue is less clear because of plain, blind luck, and political favoritism, which may skew a salesperson's perceived contribution, and because, even though salespeople usually work independently, they do not work entirely so, and so there is yet a team factor involved.

Works Cited

Alchian, Armen A. Economic Forces at Work. Indianapolis, Liberty, 1977.

Ehrenberg, Ronald G. and Robert S. Smith. Modern Labor Economics: Theory and Public Policy. 6th ed. New York: Addison-Wesley, 1996.

Fama, Eugene. "Agency Problems and the Theory of the Firm," in Demsetz, Harold, Ownership, Control, and the Firm, vol. 1, Basil Blackwell, 1988, 144-165.

Hayek, Fridrich. "The Use of Knowledge in Society," American Economic Review (September, 1945), 519-30, reprinted in Individualism and Economic Order, University of Chicago Press, Chicago, (1948), 77-91.

Hirshleifer, Jack. Price Theory and Applications. 4th ed. Englewood Cliffs, N.J.: Prentice Hall, 1988.

Hudson, William E. American Democracy in Peril: Seven Challenges to America's Future. Revised ed. Chathan, N.J., 1996.

Jensen, Michael and William Meckling. "Theory of the Firm: Managerial Behavior, Agency Costs, and Ownership Structure," Journal of Financial Economics(3), 1976, 305-360, reprinted in Richard Posner and Kenneth Scott (eds.), Little, Brown, & Co., Boston, 1980, 56-62.

Klein, Benjamin, Robert Crawford, and Armen Alchian. "Vertical Integration, Appropriable Rents, and the Competitive Contracting Process," Journal of Law and Economics(21), 1978, 297-236.

Usher, D. and M. Engineer. "The Distribution of Income in a Despotic Society," Public Choice (1987), 61:261-276.