ON THE RELATIONSHIP BETWEEN RISK AVERSION AND THE DEVELOPMENT OF LONG TERM WORKER-FIRM ATTACHMENTS

by

John Haltiwanger

University of California, Los Angeles

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Recent developments have emphasized the role of long term employer-employee attachments as an essential element for explaining observed wage and layoff behavior. The first natural question to ask is what causes long term employer-employee attachments to develop. Implicit contract theory, which has been at the forefront of this emphasis on long term attachments in the labor market, suggests two primary reasons. First, contract theorists (e.g. Azariadis (1975) and Baily (1974)) have argued that long term worker firm attachments develop in an uncertain environment because workers are risk averse. They argue that firms act doubly as a worker's employer and as his insurer against fluctuations in the worker's opportunities. Secondly, contract theory borrows from the analysis of Becker (1962) and Oi (1962) by arguing that long term attachments develop because of such factors as hiring costs, training costs, search costs and moving costs.

In this note, we challenge the view that risk aversion is a critical factor promoting worker-firm immobility. First, we demonstrate that in the absence of any other factors promoting worker-firm immobility, that risk aversion on the part of workers leads to long term attachments between workers and their insurance agents but not, in general, between workers and specific employers. We argue that the optimal risk shifting arrangement in the absence of mobility costs would essentially entail the insurance agent for the worker doubling as an employment agent; placing the worker at each moment of time in the activity that yields the highest value. Previous authors (e.g., Azariadis (1975), Grossman (1978), and Holmstrom (1981)) have skirted this issue by claiming that moral hazard problems associated with monitoring a worker's activities make it optimal for a firm to act doubly as the insurance agent and the sole employer of a worker over extended periods of time. However, we examine this moral hazard argument and find it to be unsatisfactory. For, we

argue that, even in the face of monitoring costs, worker-firm risk shifting arrangements necessarily imply some inefficient use of workers' time and thus there are unexploited gains available. Hence, in the absence of any other factors promoting worker-firm immobility, such risk shifting arrangements between an individual firm and its workers are not sustainable.

This paper proceeds as follows. In the next section we develop a simple model in which there are no factors encouraging worker-firm attachments other than risk aversion. This allows us to demonstrate the above mentioned result on the insufficiency of risk aversion to generate long term worker-firm attachments. This is followed by a few concluding remarks that relate this result to other recent developments that question the role of risk aversion in the implicit contract theoretic context.

The Model

Consider a simple model in which there are no adjustment costs associated with labor turnover and workers would be perfectly mobile in the absence of risk aversion. In particular, let all workers be homogeneous in skill level but let there be two sectors in the economy, i and j, in which the value of a worker's productivity may vary as there are changes in relative product demands. We further assume that there are many firms of both types i and j so that there is perfect competition in the labor market.

To emphasize the worker's mobility, we characterize the worker's employment opportunities in a continuous time setting. At a particular moment in time let the value of a worker's product in the ith and jth sectors be $M_i(t)$ and $M_j(t)$, respectively. Prior to time t there is assumed to be uncertainty with respect to the value of the worker's product at time t in each sector but all agents in the economy are presumed to have the same subjective probability distribution about the realized values of $M_i(t)$ and

$M_j(t)$. Formally, let $M_i(t)$ and $M_j(t)$ at time t be independent draws from the same distribution with probability density function $f(.)$ where $M_i(t)$ and $M_j(t)$ may take values over the range $(0,\infty)$. It is helpful to define the variable $Z(t) = \max(M_i(t),M_j(t))$ which is a random variable with probability density function $g(Z(t)) = 2F(Z(t))f(Z(t))$ (where $F(Z(t)) = \int_0^{Z(t)} f(x)dx$.)

In this context, if the worker under consideration is risk neutral then because of the assumed absence of mobility costs the worker would simply work at each moment in time for the sector in which the value of his product is highest. Competition would force the worker's compensation to be equal to the value of his product. To be consistent with contract theory, we do allow for the possibility that the value of a worker's product associated with the best employment opportunity may occasionally fall below the value of the worker's time associated with not working. Denoting $Y(t)$ as the opportunity cost of a worker's time, $Y(t)$ can be thought to consist of the value of the additional leisure the worker acquires when not working and any government financed unemployment compensation the worker is entitled to.

The risk neutral worker would thus be engaged in the activity that yields the highest value of his time. Denoting $V(t)$ to be this highest value at time t, $V(t)$ is simply $V(t) = \max(Z(t),Y(t))$.[1] Prior to period t the expected value of the worker's time in period t is given by:

$$(1) \qquad \bar{V}(t) = \int_0^{\infty} V(t)\, g(Z(t))\, dZ(t)$$

Now consider the situation of a typical risk averse worker. In the absence of any insurance arrangement, prior to time t the worker's expected discounted utility for the time interval (t,T) is given by:

$$(2) \qquad ELU = \int_t^T \left[\int_0^\infty U(V(s))\, g(Z(s))dZ(s)\right] e^{-\rho(s-t)}ds$$

where U is twice continuously differentiable and such that $U' > 0$ and $U'' < 0$ (ρ is the discount rate). Observe that the strict concavity of U implies that $ELU < \int_t^T U(\bar{V}(s))\, e^{-\rho(s-t)}ds$.

Now suppose that in addition to this risk averse worker there exist risk neutral agents in this economy as well. The simultaneous existence of a risk averse worker with an uncertain income stream and risk neutral agents implies that there is an incentive for a risk shifting arrangement. In particular, there is an incentive for a risk neutral "employment agent" to offer the risk averse worker a guaranteed fixed income P at each moment in time during the interval (t,T) in exchange for the worker to be at the employment agent's disposal. The optimal agreement would be such that if $Z(s) > Y(s)$ at time s, the employment agent would "rent" the worker to the sector in which the worker's value is highest for $Z(s)$ and pay the worker P. Alternatively, if $Y(s) > Z(s)$ at time s, the employment agent would leave the worker idle but pay the worker the difference between P and $Y(s)$. The employment agent's gain from such an arrangement is given by:

$$(3) \quad \int_t^T \left[\int_{Y(s)}^\infty (Z(s)-P)g(Z(s))dZ(s) + \int_0^{Y(s)} (Y(s)-P)g(Z(s))dZ(s)\right]e^{-\rho(s-t)}ds$$

$$= \int_t^T (\bar{V}(s)-P)e^{-\rho(s-t)}ds$$

Since $ELU < \int_t^T U(\bar{V}(s))\, e^{-\rho(s-t)}ds$, there exists a P such that the RHS of equation (3) is strictly positive and $\int_t^T U(P)\, e^{-\rho(s-t)}ds > ELU$. Hence, a risk shifting arrangement exists that simultaneously yields a positive gain to the employment agent and makes the worker better off.[2]

This risk shifting arrangement obviously implies a long term attachment between the worker and his insurance agent. However, observe that since the use of the worker's time that yields the highest value may require the worker to switch from the ith to the jth sector (or vice-versa) on a continual basis, this risk shifting arrangement does not imply a long term employment relationship between the worker and any specific firm. Any risk neutral firm who attempted to make an implicit contract with the worker that called for the firm to be the sole employer of the worker would in general be outbid because this would not entail the continual use of the worker's time at its highest value. Moreover, there may be no incentive for a risk shifting arrangement between an individual firm and a worker in this context. For the maximum offer that a firm in, say, the ith sector could make is to guarantee a fixed income $\tilde{P}$ for the worker at each moment in time where

$$(4)\quad \int_t^T \left[\int_0^\infty \max(M_i(s),Y(s))\, f(M_i(s))\, dM_i(s)\right] e^{-\rho(s-t)}ds \geq \int_t^T \tilde{P}e^{-\rho(s-t)}ds$$

Comparing (4) with (2) reveals that it need not be the case that $\int_t^T U(\tilde{P})\, e^{-\rho(s-t)}ds \geq ELU$. In other words, the risk averse worker may wish to forego a worker-firm risk shifting arrangement in order to take advantage of the potentially more efficient use of his time.

A potential problem with the optimal risk shifting arrangement between the employment agent and the worker described above is that the worker has little incentive to work hard since he has a guaranteed income. This means that there may be substantial costs to the insurance agent associated with monitoring the worker's activity. It may thus appear that in the presence of such monitoring costs the optimal arrangement may be for the insurance agent to be the sole employer of the worker as the firm employing the worker is

conveniently located to monitor the worker. Suppose this is the case. In particular, imagine that a firm in the ith sector and a risk averse worker have made a long term risk shifting arrangement for the interval (t,T) that calls for the firm to be the sole employer of the worker over this interval. It is important to recognize, however, that since the risk shifting arrangement will imply that the worker's income is guaranteed, then there may still be a problem of monitoring the worker's activity. For simplicity, suppose that if the firm chose not to monitor the worker's activity at time s the worker would produce zero output, but for a monitoring cost of $c_i(s)$ the value of the worker's output would be $M_i(s)$. Hence, the worker's value at time s net of monitoring costs is $N_i(s) = \max(0,M_i(s)-c_i(s))$. Then the firm would employ the worker at time s if $N_i(s) > Y(s)$ but otherwise would leave the worker idle. For a risk shifting arrangement to be incentive compatible in this situation, if $\tilde{P}$ is the income guaranteed to the worker, then $\tilde{P}$ must be such that:

$$\int_t^T \left[\int_0^\infty \max(M_i(s)-c_i(s),Y(s))f(M_i(s))dM_i(s)-\tilde{P}\right]e^{-\rho(s-t)}ds \geq 0$$

and $\int_t^T U(\tilde{P})e^{-\rho(s-t)}ds \geq ELU.$

A third party employment agent could make the following arrangement with the worker and the firm in this situation. The employment agent could: guarantee $\tilde{P}$ to the worker for each period; if $M_i(s) - c_i(s) > Y(s)$ have the worker be employed with the firm and charge the firm $\tilde{P}$; and if $M_i(s) - c_i(s) \leq Y(s)$ charge the firm under consideration $\tilde{P} - Y(s)$ but have the worker not be employed with this particular firm. Under this arrangement, the worker and the firm are just as well as before because the terms of the agreement have not changed except that now the worker is at the employment

agent's disposal. The employment agent would thus face the following revenues and costs. If $M_i(s) - c_i(s) > Y(s)$, the agent would charge the firm $\tilde{P}$ but pay the worker $\tilde{P}$ and thus realize zero profits. If $M_i(s) - c_i(s) \leq Y_i(s) \geq M_j(s) - c_j(s)$, then the employment agent would leave the worker idle, charge the firm $\tilde{P} - Y(s)$, pay the worker $\tilde{P} - Y(s)$ and again earn zero profits. However, if $M_i(s) - c_i(s) \leq Y(s) < M_j(s) - c_j(s)$, then the employment agent could charge the firm in the ith sector with whom the agreement was made $\tilde{P} - Y(s)$, pay the worker $\tilde{P}$ and place the worker in the jth sector and charge $M_j(s) - c_j(s)$. In this latter situation, the employment agent earns positive profits. Since there is a positive probability that for any arbitrary time period s that $M_j(s) - c_j(s) > Y(s) \geq M_i(s) - c_i(s)$, the employment agent earns positive expected profits. While this arrangement does not yield a first best solution (since even though the worker is no longer ever suboptimally idle, the worker may not always be employed in the sector in which the value of his product is highest), this example illustrates the incentive for a third party employment agent to intervene.[3] Hence, even in light of this moral hazard argument, it is still the case that risk aversion, by itself, is not sufficient to generate long term worker-firm attachments. The key is that if monitoring a worker's activity is a problem, then the optimal arrangement may imply that the firm employing a worker at a given moment in time bear the burden of monitoring the worker's activity (given that firms are conveniently located to do so). However, this does not preclude an incentive for third party employment-insurance agents to intervene, but rather implies that an employment agent's "rental charge" for its workers will be based on a worker's value net of monitoring costs.

Concluding Remarks

The analysis in this note demonstrates that risk shifting arrangements in the labor market imply the development of long term attachments between workers and their insurance agents but not between workers and any particular firm. This result is consistent with other recent developments that have begun to cast doubt on the hypothesized critical role of risk aversion in the implicit contract theoretic context. Elsewhere it has been shown that risk aversion is neither necessary (e.g., Baily (1977), Burdett and Mortensen (1980) and Haltiwanger(1982)) nor sufficient (e.g., Akerlof and Miyazaki (1980), Mortensen (1978)) for explaining the observed occurrence of temporary layoffs. In these latter studies, the adjustment costs associated with labor turnover are hypothesized to be the reason that long term implicit contracts develop. Taken together, this analysis and these other previous developments suggest that risk aversion is neither necessary nor sufficient for explaining the observed development of long term worker-firm attachments nor for the observed occurrence of temporary layoffs. This is not meant to suggest that risk aversion has no influential role to play in explaining observed wage and layoff behavior. This analysis (as well as several others) suggests that risk aversion may be important for explaining observed payment structures. Moreover, the recent work examining the type of contracts that emerge when agents are risk averse and there is an asymmetric information problem (e.g., Grossman and Hart (1981), Green (1980)) suggests that risk aversion may play an important role in impeding efficient turnover. Nevertheless, this and the previous analyses cited above suggest that factors other than risk aversion are necessary to explain the existence of long term worker-firm attachments.

FOOTNOTES

[1]Note that when $Y(t) > \max (M_i(t), M_j(t))$ the worker is not employed. Whether this "unemployment" is observed as a quit or a layoff does not matter for the points being made here. It is worth noting, however, that this condition that the value of the worker's product must be below the opportunity cost of the worker's time for "unemployment" to be optimal is precisely the condition for layoffs to be optimal in the risk neutral implicit contract context (see, for instance, Burdett and Mortensen (1980)).

[2]We are not concerned with the precise determination of P.

[3]If there are economics of scale in monitoring costs, then the arrangement that an employment agent might make with firms and workers becomes more complicated. It may be that economies of scale in monitoring costs act as a barrier to entry for employment agents to exist so that only employment agents with many clients should be observed. Nevertheless, since a risk shifting arrangement between an individual firm and its workers necessarily implies that the workers will occasionally be suboptimally idle, there is an incentive for a third party employment agent to intervene.

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