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INCOMPLETE INFORMATION, RISK SHIFTING, AND EMPLOYMENT FLUCTUATIONS

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ABSTRACT

This paper explores one of the ways in which acceptance of the hypothesis that labor market transactions involve arrangements for shifting risk from workers to employers strengthens the case for accepting the hypothesis that incomplete information is the critical factor in producing the positive effect of aggregate demand for output on aggregate employment. The analysis shows that the introduction of risk-shifting arrangements into models of incomplete information eliminates the dependence of the relation between aggregate demand and aggregate employment on the relative strengths of the usual substitution and income effects on labor supply of perceived real wage rates or perceived real interest rates. In addition, the analysis shows that the apparent fact that workers choose an amount of risk shifting that gives them constant nominal wage rates implies that incomplete information would produce a positive effect of aggregate demand on aggregate employment. The key to these results is that risk shifting allows workers to use the value of product associated with high levels of demand to supplement the income associated with low levels of demand. Consequently, they can choose high employment in states of high demand without causing a corresponding reduction in their expected marignal utility of consumption.

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This paper explores one of the ways in which acceptance of the hypothesis that labor market transactions involve arrangements for shifting risk from workers to employers strengthens the case for accepting the hypothesis that incomplete information is the critical factor in producing the positive effect of aggregate demand for output on aggregate employment. The analysis shows that the introduction of risk-shifting arrangements into models of incomplete information eliminates the dependence of the relation between aggregate demand and aggregate employment on the relative strengths of the usual substitution and income effects on labor supply of perceived real wage rates or perceived real interest rates. In addition, the analysis shows that the apparent fact that workers choose an amount of risk shifting that gives them constant nominal wage rates implies that incomplete information would produce positive effect of aggregate demand on aggregate employment. The key to these results is that risk shifting allows workers to use the value of product associated with high levels of demand to supplement the income associated with low levels of demand. Consequently, they can choose high employment in states of high demand without causing a corresponding reduction in their expected marginal utility of consumption.

We can briefly describe the two central hypotheses in this paper as follows: According to the risk-shifting hypothesis, relations between firm and workers implicitly involve two transactions, which are typically embodied in implicit contracts. First, firms purchase from workers labor services for use in the production process and, second, firms sell to workers insurance against undesirable income fluctuations. As a result of these insurance arrangements, a worker's nominal wage income equals either the value of his marginal product minus an implicit insurance premium or the value of his marginal product plus an implicit insurance indemnity, depending on whether the perceived real consumption value of his marginal product is high or low.

According to the incomplete-information hypothesis, changes in aggregate demand affect aggregate employment because

individuals, especially labor suppliers, do not have sufficient information to distinguish clearly the price and wage signals transmitted by such disturbances from the price and wage signals associated with shifts in the pattern of demand. This incomplete information causes buyers and sellers to perceive potential gains from trade incorrectly.

The analysis developed below focuses on the specific story in which workers have incomplete information about the prices of the items that they consume, and, hence, tend to over-estimate the extent to which a change in the nominal value of product, as signalled by the nominal wage rate, involves a change in the real consumption wage rate, i.e., the terms of trade between leisure and consumption--Friedman (1968). As indicated in the final section, results similar to those explicitly derived below apply to another story in which workers do not know whether a change in the wage rate is permanent or transitory, and, hence, tend to over-estimate the extent to which changes resulting from nominal disturbances, which are assumed to be permanent, involve changes in the terms of trade between current and future leisure, as measured by the real rate of interest--Lucas and Rapping (1970), Barro (1976), Lucas (1977), Azariadis (1978).

One frequent objection to incomplete-information models is that they do not relate to observed employment fluctuations, because they make no allowance for apparent symptoms of non-wage rationing of employment, such as layoffs, and also because they predict countercyclical variations in quit rates and real wage rates. Recent work, however, has shown that the incomplete-information paradigm, when extended to take account of implicit risk-shifting arrangements, can be consistent with the alleged facts of nonwage rationing of employment and stickiness of real wage rates--Grossman (1978, 1979a, 1979b, 1980).

The present paper focuses on another objection to incomplete-information stories that we can get around by allowing for risk-shifting arrangements. This objection is that, in order for the predicted effect of aggregate demand on aggregate employment to be positive, incomplete-information stories require sufficient restrictions on worker utility functions to make the substitution effect of changes in either perceived real wage rates or perceived real interest rates dominate the income effect. One specific context to which this theoretical objection applies is models in which variations in aggregate employment reflect changes in the number of hours per week that workers choose to work. The main results of the analysis below of such a model are that the introduction of risk-shifting arrangements removes the need for these strong restrictions on worker utility functions and that the existence of risk shifting actually appears to insure that increases in the nominal value of marginal product relative to perceived prices have a positive effect on employment.

It is worth noting that the problem of strong restrictions on worker utility functions does not arise in a third story about incomplete information, which is that workers do not know wage rates at various places of employment and, as a result, can misjudge the probable returns from devoting time to job search--Mortensen (1970). In this model, the income effect of the perceived return to search reinforces the substitution effect--Seater (1977). However, an important reason for focusing on perceptions of the real consumption wage rate rather than on either job search or perceptions of the real interest rate is that in these other two stories analogous worker behavior in the labor and product markets would tend to produce a counter-factual negative correlation between employment and consumption expenditures--Barro and Grossman (1976, Ch. 7).

The need for strong restrictions on worker utility functions also does not arise in simplified models that focus on the choice problem of individual workers who decide between positive employment and zero employment--Grossman (1978; 1980). In

these models, income effects are unimportant, and no individual worker chooses positive employment when nominal wages are low and zero employment when nominal wages are high. However, the need for strong restrictions on utility functions would presumably reappear in the more interesting context of multi-worker families who choose between positive employment and zero employment for each of their members.

It is worth noting that the analysis below only considers fluctuations in employment. Analysis of unemployment, in a model that distinguishes properly between employment, unemployment, and nonparticipation, raises additional problems--Seater (1978).

1. Analytical Framework

Consider a representative industry in which entrepreneurs employ homogeneous labor services to produce homogeneous nonstorable output. Given the number of workers per entrepreneur, the production function for each identical firm in the industry is

$$f(\ell),\ f'(\ell) > 0,\ f''(\ell) < 0,$$

where ℓ denotes the number of hours worked per week by each identical worker in this industry. The entrepreneurs use the gross revenue from the sale of this output to pay wages to the workers and to provide income for themselves. The workers and the entrepreneurs use their income to purchase a bundle of nonstorable consumption goods. As in previous models that consider risk-shifting arrangements, the present analysis abstracts for simplicity from the holding of assets, including investment goods, commodity inventories, and financial assets.

The objective of entrepreneurs and workers is to maximize the expected value of their utility. Entrepreneurs obtain positive and either constant or decreasing marginal utility from their consumption, denoted by π. Specifically, for each entrepreneur, utility is given by the function,

$$g(\pi),\ g'(\pi) > 0,\ g''(\pi) \leq 0.$$

Workers obtain positive and decreasing marginal utility from their consumption, denoted by c, and positive and increasing marginal disutility from the number of hours worked per week. Specifically, for each worker, utility is given by the additively separable function,

$$u(c) - v(\ell),\ u'(c) > 0,\ u''(c) < 0,\ v'(\ell) > 0,\ v''(\ell) > 0.$$

As indicated above, the present analysis assumes that ℓ is always positive.

The basic assumption underlying the risk-shifting hypothesis is that entrepreneurs exhibit less risk-averse behavior than workers. Some previous studies--for example, Grossman (1978)--have focused on the special case of risk-neutral entrepreneurs--that is, $g''(\pi) = 0$--although Azariadis (1978) considers a general specification that allows universal risk aversion. In the present context, the essential condition is that the functions $u(c)$ and $g(\pi)$ are such that the vectors of c and π that would obtain in the absence of risk-shifting arrangements imply more variability in $u'(c)$ than in $g'(\pi)$. This condition creates the potential for mutually advantageous risk-shifting arrangements that reduce the variability of c and increase the variability of π.

The analysis assumes that all markets are competitive. Let P denote the price at which output is sold and let I denote the price at which the consumption bundle is bought. From the standpoint of the entrepreneurs and workers in this industry, these prices are stochastic variables, determined at periodic intervals by serially independent drawings from exogenously determined populations.

The time pattern of these drawings generates the information structure. Specifically, complete information would describe a situation in which entrepreneurs observe P and entrepreneurs and workers observe I before any transactions or production take place. In contrast, incomplete information describes a situation in which entrepreneurs and workers do not observe I until after they have received

their incomes from the production and sale of output at price P.

An important assumption, which creates a meaningful distinction between complete and incomplete information, in that P and I are not perfectly correlated. This assumption means that a high value of P can indicate either that P is high both absolutely and relative to I or that P is high absolutely but not relative to I. It is worth noting that in this formulation entrepreneurs and workers have the same information. Moreover, although this set-up leads to an explicit story about perceptions of the real consumption wage rate, the results derived also apply, as already mentioned, to stories about perceptions of the real interest rate.

In order to represent the informational distinction between P and I in the simplest way for present purposes, the analysis assumes that P and I are independently distributed. This polar assumption avoids the problem of calculating inferences about I from observations of P. One implication of this formulation is that the industry's own output is a negligible component of the consumption bundle. Specifically, the population of P is such that

$$P = \begin{cases} P_1 & \text{with probability } 1/2 \\ P_2 & \text{with probability } 1/2. \end{cases}$$

where $P_2 > P_1 > 0$, and the population of I is such that

$$I = \begin{cases} I_1 & \text{with probability } 1/2 \\ I_2 & \text{with probability } 1/2, \end{cases}$$

where $I_2 > I_1 > 0$. The assumption that each price can take only two equiprobable values is another convenient simplification.

Under complete information, standard results about homogeneity would imply that employment and output in this industry depend only on the relative price P/I. Thus, assuming for simplicity that $P_1/I_1 = P_2/I_2$, the level of employment associated with the combination (P_1,I_1), denoted ℓ_{11}, would be equal to the level of employment associated the combination (P_2,I_2), denoted ℓ_{22}, although ℓ_{11} and ℓ_{22} probably would not be equal to either ℓ_{12}, associated with (P_1,I_2), or ℓ_{21}, associated with (P_2,I_1). In other words, under complete information, a change in the pattern of demand probably would affect employment in this industry, but a change in aggregate demand that changed all prices equiproportunately would not affect employment in this industry or in aggregate. It is worth noting that these results would obtain with or without risk-shifting arrangements in the labor market--Barro (1977).

The purpose of introducing the case of incomplete information is to try to explain the apparently observed direct dependence of employment on aggregate demand--that is, to generate the prediction that ℓ_{22} is larger than ℓ_{11}. Under incomplete information, employment and output depend on the observed value of P, but only on the probability distribution of I, because I itself is not observed until later. Thus, there are only two possible levels of employment--ℓ_1 associated with P_1 and ℓ_2 associated with P_2. In addition, the expected value of P/I is positively related to the observed value of P, which implies that ℓ_2 might not equal ℓ_1. This potential inequality represents an effect of aggregate demand on aggregate employment. A problem, however, is that, without risk shifting, this effect is not necessarily positive.

2. Aggregate Demand and Employment Without Risk Shifting

In order to appreciate the significance of risk shifting for the effect of aggregate demand on employment, this section abstracts from such arrangements and analyses the implications of incomplete information for a spot market for the labor services employed in this industry. Competition in this market determines a nominal hourly wage rate, denoted by W, and the level of ℓ.

In this framework, transactions take place in two stages. In the first stage, the entrepreneurs observe P and W, employ ℓ, produce and sell $f(\ell)$, and receive net revenue equal to $Pf(\ell) - W\ell$. At the same time, the workers observe W, work ℓ, and receive income equal to $W\ell$. In the second stage, the entrepreneurs observe I and consume $[Pf(\ell) - W\ell]/I$ and the workers observe I and consume $W\ell/I$.

With regard to the maximization of expected utility, the only decisions that the entrepreneurs and workers have to make concern the choice of ℓ in the first stage. The specific problem for the entrepreneurs is to choose ℓ_1 and ℓ_2 to maximize

$$\frac{1}{4} \sum_{i,j} g(\pi_{ij}),$$

subject to the constraints

$$\pi_{ij} = [P_i f(\ell_i) - W_i \ell_i]/I_j,$$

where the index i $(i = 1,2)$ refers to the value of P and the index j $(j = 1,2)$ refers to the value of I. An interior solution to this solution implies the two first-order conditions

$$(1) \qquad P_i f'(\ell_i) = W_i \text{ for all } i.$$

These conditions indicate that maximization of expected utility requires maximization of actual net revenue. The entrepreneurs

choose employment such that, given the observed values of P and W, the value of marginal product equals the wage rate.

The specific problem for the workers is to choose ℓ_1 and ℓ_2 to maximize

$$\frac{1}{4} \sum_{i,j} u(c_{ij}) - \frac{1}{2} \sum_{i} v(\ell_i),$$

subject to the constraints

$$c_{ij} = W_i \ell_i / I_j.$$

An interior solution to this problem implies the two first-order conditions

$$\frac{v'(\ell_i)}{W_i} = \frac{1}{2} \sum_{j} \frac{u'(c_{ij})}{I_j} \quad \text{for all } i. \tag{2}$$

These conditions say that workers choose employment such that, given the observed value of W, the ratio of the marginal disutility of work to the wage rate equals the expected value of the ratio of the marginal utility of consumption to the price of the consumption bundle. Notice that according to both equations (1) and (2), ℓ_1 depends on W_1, but not on W_2, and vice versa.

The condition for clearing the spot labor market is that the same pairs (ℓ_1, W_1) and (ℓ_2, W_2) satisfy equations (1) and (2). Thus, we can substitute $P_i f'(\ell_i)$ from equations (1) for W_i in equations (2), and solve these equations for W_1 and ℓ_1 as functions of P_1 and for W_2 and ℓ_2 as functions of P_2. These calculations confirm that, without further restrictions on the form of u(c), beyond the assumptions of positive and diminishing marginal utility, the relation between ℓ_2 and ℓ_1 is ambiguous.

To highlight this result, consider a family of $u(c)$ functions that exhibit constant relative risk aversion. The members of this family are $u = (1-\alpha)^{-1}c^{1-\alpha}$ for $\alpha \neq 1$ and $u = \ln c$ for $\alpha = 1$, where α measures relative risk aversion. If α is less than unity, which roughly means that the marginal utility of consumption declines slowly, the substitution effect of the real consumption wage rate on labor supply dominates the income effect, and ℓ_2 exceeds ℓ_1. This case is the only one that implies a positive effect of aggregate demand on employment. If α equals unity, the substitution and income effects are exactly offsetting, ℓ_2 equals ℓ_1, and employment is independent of aggregate demand. If α is greater than unity, but $\alpha-1$ is less than $-f'(\ell)v''(\ell)/v'(\ell)f''(\ell)$ which is positive, the income effect dominates the substitution effect, ℓ_1 exceeds ℓ_2, and an increase in aggregate demand depresses employment. In all of the above cases, W_2 exceeds W_1. For larger values of α, W_2 would not exceed W_1, and Walrasian stability would be violated.

3. Aggregate Demand and Employment With Risk Shifting

The introduction of risk-shifting arrangements allows each worker to break the equality, for each value of P, between his nominal income, now denoted by Ω, and the product of the value of his marginal product and his hours worked. Specifically, contracts embodying risk shifting specify a vector of employment levels and worker incomes $(\ell_1,\Omega_1,\ell_2,\Omega_2)$ that makes employment and worker income contingent on the observed value of P. This vector implies that nominal wage rates, contingent on the observed value of P, are Ω_1/ℓ_1 and Ω_2/ℓ_2.

Competition in the market for these contracts also generates a vector of implicit prices. The elements of this vector are W_1 and W_2, which now represent implicit values for an hour of work, but do not necessarily equal hourly wage rates, and an implicit price, denoted here by λ, at which workers and entrepreneurs exchange units of Ω_2 for units of Ω_1.

With risk shifting, each worker in effect receives as part of his income a net insurance indemnity equal to $(\Omega_1 - W_1 \ell_1)$, if the price of output is P_1, in exchange for a reduction in income by the amount of an insurance premium equal to $(W_2 \ell_2 - \Omega_2)$, if the price of output is P_2. The price of risk shifting, λ, is the ratio of the expected value of the premium, $\frac{1}{2}(W_2 \ell_2 - \Omega_2)$, to the expected value of the net indemnity, $\frac{1}{2}(\Omega_1 - W_1 \ell_1)$. In other words, λ represents the exchange ratio between income to be received if the price of output is low and income to be received if the price of output is high.

A hypothetical value of λ equal to unity would characterize an actuarially "fair" price for risk shifting and would imply that workers can obtain a constant nominal income at no cost to themselves in average nominal income. Actually, we seem to observe that nominal wage rates are roughly constant, which in the present context means that Ω_1/ℓ_1 and Ω_2/ℓ_2 are approximately equal. Given that employment time is variable, this stickiness of nominal wage rates is reflected in the fact that worker incomes are not constant, although they may be less variable than they would be in a spot labor market. The fact that risk shifting does not eliminate income variability suggests that λ actually exceeds unity, an outcome that, according to the analysis in Grossman (1977; 1978), implies either that entrepreneurs, as well as workers, are risk averse, or that P_2 is much larger than P_1, which more generally would be that P is highly variable, or that workers sometimes behave unreliably.

In the framework of risk shifting, transactions take place in three stages. In the first stage, before P is observed, contracts are arranged. In this process, both entrepreneurs and workers behave as if they observe the vector (W_1, W_2, λ) and then select a vector $(\ell_1, \Omega_1, \ell_2, \Omega_2)$. In the second stage, entrepreneurs observe P, employ ℓ and pay the workers Ω according to the contracts, produce and sell $f(\ell)$, and receive net revenue equal to $Pf(\ell) - \Omega$. In the third stage, entrepreneurs observe I and consume $[Pf(\ell) - \Omega]/I$ and workers observe I and consume Ω/I.

With regard to the maximization of expected utility, the only decision that the entrepreneurs and workers have to make is to choose $(\ell_1, \Omega_1, \ell_2, \Omega_2)$ in the first stage. The specific problem for the entrepreneurs is to choose this vector to maximize

$$\frac{1}{4} \sum_{i,j} g(\pi_{ij}),$$

subject to the constraints

$$\pi_{ij} = [P_i f(\ell_i) - \Omega_i]/I_j$$

and

$$\frac{1}{2} \lambda(\Omega_1 - W_1 \ell_1) = \frac{1}{2} (W_2 \ell_2 - \Omega_2).$$

An interior solution to this problem implies the first-order conditions

(1) $$P_i f'(\ell_i) = W_i \quad \text{for all} \quad i$$

and

(3) $$\frac{1}{2} \sum_j \frac{g'(\pi_{1j})}{I_j} = \frac{1}{2} \lambda \sum_j \frac{g'(\pi_{2j})}{I_j}.$$

These conditions say that the entrepreneurs again choose employment such that the value of marginal product equals the cost of an hour of labor services, and that, given this choice

of ℓ_1 and ℓ_2, they choose Ω_1 and Ω_2 such that the expected value of the ratio of the marginal utility of their consumption to the price of the consumption bundle if the price of output is P_1 equals λ times the expected value of this ratio if the price of output is P_2. According to equation (3), the shifting of risk from workers to entrepreneurs is attractive to the entrepreneurs if λ is larger than what the ratio

$$\sum_j \frac{g'(\pi_{1j})}{I_j} \Big/ \sum_j \frac{g'(\pi_{2j})}{I_j}$$

would be without risk shifting. If the entrepreneurs are risk neutral--that is, $g''(\pi) = 0$--condition (3) is replaced by a corner solution, as in Grossman (1978).

The specific problem for the workers is to choose $(\ell_1, \Omega_1, \ell_2, \Omega_2)$ to maximize

$$\frac{1}{4} \sum_{i,j} u(c_{ij}) - \frac{1}{2} \sum_i v(\ell_i),$$

subject to the constraints

$$c_{ij} = \Omega_i / I_j \quad \text{and} \quad \frac{1}{2} \lambda(\Omega_1 - W_1 \ell_1) = \frac{1}{2} (W_2 \ell_2 - \Omega_2).$$

An interior solution to this problem implies the first-order conditions

$$(2) \qquad \frac{v'(\ell_i)}{W_i} = \frac{1}{2} \sum_j \frac{u'(c_{ij})}{I_j} \quad \text{for all} \quad i$$

and

$$(4) \qquad \frac{1}{2} \sum_j \frac{u'(c_{1j})}{I_j} = \frac{1}{2} \lambda \sum_j \frac{u'(c_{2j})}{I_j}.$$

Equations (2) are the same conditions that applied without risk shifting and equation (4) has the same interpretation

as equation (3). According to equation (4), the shifting of risk from workers to entrepreneurs is attractive to the workers if λ is smaller than what the ratio

$$\sum_j \frac{u'(c_{1j})}{I_j} \Big/ \sum_j \frac{u'(c_{2j})}{I_j}$$

would be without risk shifting. Notice that equations (2) and (4) imply that ℓ_1 and ℓ_2 each depend on W_1, W_2, and λ.

The condition for clearing the market for labor contracts is that the same sets (W_1, W_2, λ) and $(\ell_1, \Omega_1, \ell_2, \Omega_2)$ satisfy equations (1) and (3) and equations (2) and (4). For present purposes, the most interesting manipulation is to combine equations (1), (2), and (4) to obtain

$$(5) \qquad \frac{v'(\ell_1)/f'(\ell_1)}{v'(\ell_2)/f'(\ell_2)} = \lambda \frac{P_1}{P_2}.$$

Equation (5) implies that, given the values of P_1 and P_2 and the restriction on λ necessary for shifting risk to the entrepreneurs to be attractive to the workers, the existence of such risk shifting causes ℓ_2 to be higher and ℓ_1 to be lower than they would be in a spot labor market. This effect results from the fact that risk shifting allows workers to use the value of marginal product associated with P_2 to supplement the income associated with P_1. This option suppresses the income effect that in the spot-labor-market model would tend to reduce ℓ_2 and increase ℓ_1 and could easily dominate the substitution effect. Specifically, with risk shifting, workers can choose a relatively high level of ℓ_2 without causing a corresponding reduction in the relative expected marginal utility of consumption associated with P_2.

From equation (5), we can infer the relation between ℓ_1 and ℓ_2 without explicitly referring to either the function

$u(c)$ or the function $g(\pi)$. The effects of the forms of these functions are summarized in the value of λ. According to equation (5), given the assumptions of positive and increasing marginal disutility from employment and positive and decreasing marginal productivity, λ less than P_2/P_1 is necessary and sufficient for ℓ_2 larger than ℓ_1.

The interesting question is whether actual risk-shifting arrangements satisfy the condition $\lambda < P_2/P_1$. This condition does not follow simply from assuming the existence of risk shifting. Specifically, analysis of the first-order conditions reveals that λ greater than P_2/P_1 does not preclude risk shifting if workers are sufficiently risk averse relative to entrepreneurs.

Assuming, however, that the above model of risk shifting is true, the fact that nominal wage rates are sticky implies that the condition $\lambda < P_2/P_1$ actually is satisfied. To derive this result, consider whether the observation that the chosen vector $(\ell_1,\Omega_1,\ell_2,\Omega_2)$ has Ω_1/ℓ_1 equal to Ω_2/ℓ_2 could be consistent with ℓ_2 being equal to or less than ℓ_1. Given the assumed form of the $v(\ell)$ and $f(\ell)$ functions, ℓ_2 equal to or less than ℓ_1 would imply, by equation (5) that λ exceeds unity. Given λ greater than unity and the assumed form of the $u(c)$ function, equation (4) would imply that Ω_2 is larger than Ω_1. However, the combination of ℓ_2 equal to or less than ℓ_1 and Ω_2 larger than Ω_1 would mean that Ω_2/ℓ_2 is larger than Ω_1/ℓ_1, a contradiction to the observation that Ω_2/ℓ_2 equals Ω_1/ℓ_1.

To further highlight this result, consider again the family of $u(c)$ functions that exhibit constant relative risk aversion. For this family, equation (4) implies that workers choose Ω_1 and Ω_2 such that $(\Omega_2/\Omega_1)^{\alpha}$, where α measures worker relative risk aversion, equals λ. Consequently, the observation that the chosen vector $(\ell_1,\Omega_1,\ell_2,\Omega_2)$ has Ω_1/ℓ_1 equal

to Ω_2/ℓ_2 implies that $(\ell_2/\ell_1)^{\alpha}$ also equals λ. Substituting $(\ell_2/\ell_1)^{\alpha}$ for λ in equation (5) yields the implication that, given $\alpha > 0$ and the assumed form of the $v(\ell)$ and $f(\ell)$ functions, ℓ_2 is larger than ℓ_1.

According to the above analysis, the apparent fact that workers choose an amount of risk shifting that involves constant nominal wage rates implies that the actual pattern of supply and demand for risk shifting is generating a value of λ less than P_2/P_1. Given this pattern, the assumed structure of incomplete information yields the implication that aggregate employment depends positively on aggregate demand, without further assumptions about the degree of worker risk aversion.

4. Generalization of the Results

The existence of risk-shifting arrangements has similar implications for the relation between aggregate demand and aggregate employment in the model developed by Azariadis (1978), although he does not point out this effect. This model incorporates risk shifting into another story about incomplete information mentioned above, in which workers do not know whether a change in the wage rate is permanent or transitory and, consequently, may make employment decisions based on misperceptions of the real interest rate. Given this information structure, for aggregate demand to have a positive effect on employment in a spot labor market, the substitution effect of the perceived real interest rate on employment must dominate the income effect. Azariadis focuses on the family of utility functions that exhibit constant relative risk aversion and points out correctly that this dominance of the substitution effect requires that the relative risk aversion of the workers be less than unity. As we saw above, in a spot labor market, the story about misperceptions of the real wage rate requires this same restriction on the utility function of the workers.

Further analysis of the Azariadis model, however, shows that with the introduction of risk-shifting arrangements, much weaker restrictions, which refer mainly to the utility function of the entrepreneur, insure that aggregate employment depends positively on aggregate demand. Using Azariadis' notation, in which R denotes worker relative risk aversion, Q denotes entrepreneur relative risk aversion, and θ denotes the ratio of worker income to total product, his equation (30a) has the following implications: A necessary condition for a positive effect of aggregate demand on aggregate employment is $Q < 1$. Moreover, if $Q < 1 - \theta$, the existence of risk shifting, which implies $R < Q$, is a sufficient condition. In other words, if Q is sufficiently less than unity, no further restriction on R is required. However, if $1 > Q > 1 - \theta$, in addition to $R > Q$, a necessary and sufficient condition is $R < \theta Q/[Q - (1 - \theta)]$. In other words, if Q is larger, but still less than unity, R cannot be too large, but it can be greater than unity.

To summarize, this paper has explored one of the ways in which the hypothesis of risk-shifting arrangements in the labor market enhances the plausibility of the hypothesis that incomplete information is the critical factor in producing the positive effect of aggregate demand for output on aggregate employment. Specifically, the analysis has shown that allowing for risk shifting effectively blunts the objection that the incomplete-information hypothesis requires strong assumptions about worker utility functions. Because risk shifting allows workers to use the value of product associated with high levels of demand to supplement the income associated with low levels of demand, they can choose high employment in states of high demand without causing a corresponding reduction in their expected marginal utility of consumption. Thus, the introduction of risk shifting into

models of incomplete information removes the need to assume that the usual substitution effect of either perceived real wage rates or perceived real interest rates dominates the usual income effect. Moreover, given the risk-shifting hypothesis, the observed stickiness of nominal wage rates implies that the actual extent of risk shifting is sufficient to insure that incomplete information would produce a positive effect of aggregate demand on aggregate employment.

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