Note:
Labor Disputes and Direct Foreign Investment

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A theoretical model demonstrates how labor disputes exert pressure on the expected utility of a risk averse producer. The pressure from heightening uncertainty as well as increasing wage rates in production incurred by plaguing labor disputes forces domestic firms to reduce optimal domestic output levels (and profits) but does not necessarily reduce expected utility because utility is a function of variance as well as of profits and lower profits may be partly offset by reduced variance. The paper proves that the reduction of the output level is never sufficient to keep expected utility level from increasing uncertainty. Consequently, foreign countries with lower instability are more attractive, and outward DFI is accelerated. (*JEL* Classifications: F21, L20, J51)

I. Introduction

Labor disputes are considered to affect Direct Foreign Investment (DFI) through various channels. One of the most well known effects is through exerting pressure on costs, particularly the wage cost. Another consequence of labor disputes is that they increase economic instability. In contrast with the pressure on costs, the effect of labor disputes on DFI through instability has not prominently attracted systematic analyses from economists.

This paper formulates a theoretical model which explores the effect of

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labor disputes on producer's expected utility. The effect of labor disputes through uncertainty in production is emphasized and explicitly formalized in the model. Producers respond to labor disputes by reducing the amount of products, which is the rational choice for expected utility maximization. This behavior provides a theoretical background in understanding the capital flight from countries with militant labor disputes to those with lower labor unrest, i.e., lower uncertainty and wage rates.

II. Labor Disputes and Production

Assume that a producer with constant risk aversion γ (Arrow-Pratt measure of absolute risk aversion) produces a commodity y and has a profit π. Its utility function is given as

$$U(\pi) = 1 - e^{-\gamma\pi}.$$

The cost function is assumed to be quadratic and to include a random factor δ which is normally distributed with a mean zero and a variance of σ^2. The cost function is represented as

$$C = \frac{1}{2}cy^2 + \delta y,$$

where c is determined by factor prices and technology while δ represents the uncertainty which the producer faces in production. The producer's profit is now

$$\pi = py - C = py - \frac{1}{2}cy^2 - \delta y.$$

The producer maximizes its expected utility, that is

$$\text{Max } EU(\pi) = E\left[1 - \exp\left\{-\gamma\left(py - \frac{1}{2}cy^2 - \delta y\right)\right\}\right],$$

where the price of the product p is given from the market and E is an expectation operator. The optimum level of production y, which maximizes the producer's expected utility given p, γ, c and the distribution of δ, is obtained by applying Horen and Wu's (1989) lemma:[1]

[1]The rigorous process to obtain the optimum level of production y is in Appendix.

$$y^* = \frac{p}{\gamma\sigma^2 + c}.$$

Labor disputes l affect the producer's optimum choice of y through c and σ^2 as the diffusion of labor disputes will increase the cost (especially the labor cost) and the uncertainty associated with production. Therefore, the effect of labor disputes on the optimum level of output is analyzed by considering

$$\frac{\partial y^*}{\partial l} = \frac{\partial y^*}{\partial \sigma^2}\frac{\partial \sigma^2}{\partial l} + \frac{\partial y^*}{\partial c}\frac{\partial c}{\partial l},$$

which is always negative because

$$\frac{\partial \sigma^2}{\partial l} > 0, \quad \frac{\partial c}{\partial l} > 0,$$

$$\frac{\partial y^*}{\partial \sigma^2} = \frac{-\gamma p}{(\gamma\sigma^2 + c)^2} < 0, \text{ and } \frac{\partial y^*}{\partial c} = \frac{-p}{(\gamma\sigma^2 + c)^2} < 0.$$

This result implies that the producer will produce less as labor disputes increase. The reduction of production in countries with militant labor disputes has been considered as a result of working days lost by disputes. This paper, however, indicates that it is also the consequence of the expected utility maximization behavior of a producer.

III. Labor Disputes and Expected Utility

The reduction of output does not directly imply that the producer's expected utility decreases. The producer's expected utility depends not only on the expected profit but also on the variance of the profit. The expected profit $E(\pi)$ always decreases by labor disputes as

$$\frac{\partial E(\pi^*)}{\partial c} = -\frac{p^2}{2}\frac{(3\gamma\sigma^2 + c)}{(\gamma\sigma^2 + c)^3} \text{ and}$$

$$\frac{\partial E(\pi^*)}{\partial \sigma^2} = -\frac{\gamma^2 p^2 \sigma^2}{(\gamma\sigma^2 + c)^3}.$$

On the other hand, the effect of labor disputes on the variance of the profit is ambiguous. Given σ^2, the variance of a profit $\text{Var}(\pi) = \sigma^2 y^2$ decreases when c increases because producers will reduce y as c increases. The effect of labor disputes on $\text{Var}(\pi)$ is, therefore, not clear because an increase in σ^2 directly increases Var(π), however, it also reduces y which in turn decreases Var(π). Therefore, the expected utility $EU(\pi) = 1 - E(e^{-\gamma\pi})$ may increase, even though the expected profit $E(\pi)$ decreases, if the decrease in the variance of a profit by the decrease in y is dominant. Two propositions prove that the decrease in the variance of a profit by the decrease in y cannot dominate the increase in the variance of a profit by the increase in σ^2.

Proposition 1

Any increase in c reduces the producer's expected utility.

***Proof*:** Assume that y^* maximizes the expected utility of a producer $EU(\pi^*)$ given c^* and σ^2. When c^* increases to c_1, assume that $EU(\pi_1) > EU(\pi^*)$ where $\pi_1 = py_1 - C_1 = py_1 - (1/2)c_1y_1^2 - \delta y_1$ and $\pi^* = py^* - C^* = py^* - (1/2)c^*y^{*2} - \delta y^*$. The subscript 1 denotes 'after change.' Then $y_1 < y^*$ (as $c_1 > c^*$) and $\text{Var}(\pi_1) = \sigma^2 y_1^2 < \sigma^2 y^{*2} = \text{Var}(\pi^*)$. If the producer maintains c^* but controls the output level to y_1 not y^*, its expected profit $E(\pi') = py_1 - (1/2)c^*y_1^2 > E(\pi_1) = py_1 - (1/2)c_1y_1^2$ and the variance of a profit $\text{Var}(\pi') = \sigma^2 y_1^2 = \text{Var}(\pi_1)$. Therefore $EU(\pi') > EU(\pi_1) > EU(\pi^*)$. It means that y^* does not maximize the expected utility given c^* and σ^2, which is a contradiction.

Proposition 2

Any increase in σ^2 reduces the producer's expected utility.

***Proof*:** Assume that y^* maximizes the expected utility of a producer $EU(\pi^*)$ given c^* and σ^2. Assume that $EU(\pi_1) > EU(\pi^*)$ when σ^2 increases to σ_1^2 so the new random variable δ' is normally distributed with a zero mean and a variance of σ_1^2. Note that $\pi_1 = py_1 - C_1 = py_1 - (1/2)c^*y_1^2 - \delta' y_1$ and $\pi^* = py^* - C^* = py^* - (1/2)c^*y^{*2} - \delta y^*$ where $y^* = p/(\gamma\sigma^2 + c)$ and $y_1 = p/(\gamma\sigma^2 + c)$. Given c^* and σ^2, if the producer reduces output to y_1, its expected profit $E(\pi') = py_1 - (1/2)c^*y_1^2 = E(\pi_1)$ while its variance of a profit is $\text{Var}(\pi') = \sigma^2 y_1^2 < \sigma_1^2 y_1^2 = \text{Var}(\pi_1)$. Therefore $EU(\pi') > EU(\pi_1) > EU(\pi^*)$. It means that y^* does not maximize the expected utility given c^* and σ^2, which is a contradiction.

Propositions 1 and 2 show that as c or σ^2 increases by labor disputes, the expected utility level always falls, even though the risk averse producer attempts to maximize expected utility by reducing the output level. Even when c is not affected by labor disputes for some reason such as the government's wage guidelines, labor disputes still exert pressure on producers because the increase in σ^2 adversely affects producers' expected utility. The reduction of the expected utility level in turn forces producers to consider changing their production bases to foreign countries with lower c or σ^2.

IV. Evidence

The results in Sections II and III explain why foreign countries with a lower wage or lower uncertainty become more attractive to domestic firms experiencing a militant domestic labor movement. Utilizing Korean data, Tcha (1997) proves that some measurements of labor disputes, together with other variable such as per capita GNP and the current account, explain Korea's outward DFI significantly. Explosive labor disputes around 1987 led to rapid increases in wage rates and uncertainty, which subsequently resulted in soaring up of outward DFI. That paper shows that Korea's DFI in Asia, in particular Indonesia, was significantly affected by the frequency of labor disputes over the period 1972-92 while its DFI in North America was significantly affected by working days lost over the period of 1975-92.

V. Conclusion

A theoretical model demonstrated the manner in which labor disputes erode the risk averse producers' expected utility by analyzing pressures on uncertainty and costs incurred by labor disputes. The reduction of production can mitigate the increase of the uncertainty caused by labor disputes, however, it is not sufficient for the producer to maintain the same level of the expected utility as before. The producer always experiences the reduction of the expected utility by labor disputes. The paper confirms the view that uncertainty from labor disputes should be considered as one of the most important determinants of DFI.

Appendix: The Optimum Level of Production

The producer maximizes its expected utility $EU(\pi) = E(1 - e^{-\gamma\pi})$. As risk premium B is defined as $EU(\pi) = U(E\pi - B)$,

$$\frac{1}{\sigma\sqrt{2\pi}} \int_\delta \exp\left\{-\gamma\left(py - \frac{1}{2}cy^2 - \delta y\right) - \frac{\delta^2}{2\sigma^2}\right\}d\delta$$
$$= \exp\left\{-\gamma\left(py - \frac{1}{2}cy^2 - B\right)\right\}. \tag{A1}$$

Substitute the following equation into the left side in (A1),

$$\frac{1}{\sigma\sqrt{2\pi}} \int_\delta \exp\left\{-\frac{1}{2\sigma^2}(\delta + \sigma^2\gamma y)^2\right\}d\delta = 1,$$

the following can be derived from (A1)

$$\exp\left\{-\gamma\left(py - \frac{1}{2}cy^2 - \frac{1}{2}\sigma^2\gamma y^2\right)\right\} = \exp\left\{-\gamma\left(py - \frac{1}{2}cy^2 - B\right)\right\}.$$

Therefore

$$B = \frac{1}{2}\sigma^2\gamma y^2. \tag{A2}$$

y^* which is the optimum value of y should maximize $U(E\pi - B)$, i.e.,

$$\left.\frac{dU(E\pi - B)}{dy}\right|_{y=y^*} = 0 \tag{A3}$$

From (A2) and (A3), y^* which maximizes the expected utility is

$$y^* = \frac{p}{\gamma\sigma^2 + c}.$$

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