

## FOREIGN DIRECT INVESTMENT AND EXCHANGE RATE RISK

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### **Abstract**

A common method of engaging in international business is foreign direct investment (FDI). Yet, its benefit must be compared with relevant risks in order to make the appropriate investment decisions. The main focus in this study is on exchange rate risk. Exchange rate risk can create a difference in the cost of capital of firms located in different currency zones, thereby influencing the flow of international investment. The premise used throughout this study is that exchange rate risk can not be fully protected against and should be an element of consideration in investment decision. This paper uses two-country model to illustrate the relationship of domestic and foreign investment to exchange rate risk. It is found that exchange rate risk affects corporate foreign investment in a significant way. It is also shown that the model embodies several results based on economic variables

### **1. Introduction**

The importance of foreign direct investment (FDI) and multinational corporation (MNC) has significantly increased since the Second World War. FDI is considered to be a common method of engaging in international business for MNC. Several researchers (Boddewyn, 1983, Kohlhagen, 1977, Thomas and Worrall, 1994 and others) indicate FDI can benefit the firms. However, these benefits must be compared with relevant risk in order to make the appropriate investment decisions. In general, there are several types of risk involved in FDI, such as a credit risk, country risk and exchange rate risk. The point to be made here is that because FDI is a long-term project, risks are uncertain during the life of FDI that can substantially influence the performance of such an investment. While such risks are impossible to predict precisely, MNCs can at least attempt to assess the exposure of FDI to these risks. Then they must decide whether the expected

benefits from FDI outweigh these risks. If their answer is affirmative, they should undertake the FDI.

This paper analyzes theoretically the effects of exchange rate risk on the international direct investment of the firm. The effect of exchange rate risk on FDI can be illustrated in this study by applying a comparative static analysis for two-country model. In the model, firms operate in different currency zones (two markets).

The paper is structured as follows: Section II reviews two types of risks that involves in international operations. Section III provides a brief literature review of the effect of exchange rate risk on FDI, and factors that create economic risk. Section IV illustrates theoretical analysis of exchange rate risk and investment decision. The results of the model (Comparative Static Analysis) are contained in Section V. Some concluding comments are presented in Section VI.

## **2. Risks on FDI**

Before turning to the study of effects of exchange rate risk on the foreign investment decision, there are two different types of risks involved in international operations. These risk will be briefly reviewed.

### **2.1. Country Risk**

Country risk represents the potentially adverse impact of a country's environment on the international firm's cash flows. For MNC, there are several reasons to analyze country risk. First, it can be used as a screening device to avoid countries with excessive risk. Screening reduces the set of possible countries to consider for proposed foreign investment opportunities. A second reason for assessing country risk is that it can be used to monitor countries where the MNC is presently engaged in international business. If the risk level of a particular country begins to rise, the firm may consider divesting its subsidiaries located here.

As one might expect, there are many country characteristics related to the political environment that influence an international firm. The extreme form

of political risk is the host country taking over a subsidiary. More common forms of country risk include (Korbin, 1979 and Dornbush, 1982):

- Attitude of host government toward the MNC (such as regulations, taxes, trade policies, macroeconomic policies)
- Blockage of profit fund transfers
- War, political unrest

Along with political factors, financial factors should also be considered when assessing country risk. One of the most obvious financial factors is the current and potential state of the country's economy. An international firm that develops a subsidiary in a country is highly concerned with that country's demand for its products. This demand is, of course, strongly influenced by the country economic conditions. A recession in the country could seriously reduce demand for products sold by the MNC's local subsidiary (Aliber, 1970).

Since that state of a country economy is dependent on several factors (i.e. interest rate, inflation, GDP growth rate, unemployment rate), the MNC should take these factors into consideration. Higher interest rate tends to slow the growth of an economy and could reduce demand for the MNC's products. Lower interest rate often stimulates the economy as well as increase demand for the MNC's products. Higher inflation can affect the purchasing power of consumers and therefore the consumer's demand for the MNC's good.

## **2.2. Default Risk (Credit Risk)**

If the transaction with a foreign firm involves a loan, there is the standard credit risk that the borrower may default. Even when the borrower is a foreign government, credit risk may still be a factor, in 1982, the Polish government was unable to meet maturing loan obligations to Western banks (Blanchard, 1994). Although the loans were declared by the banks to be in default, the fact remains that payments were not made according to schedule and loans had to be "restructured" with new maturities and interest rates. Throughout the middle 1980s, loans to Latin American countries were a major problem for U.S. banks. Although the word "default" was avoided,

terms of loans were continually renegotiated, and most of these loans have been valued at far below its face value.

### **3. Review of Literature of Exchange Rate Risk on FDI**

Exchange risk refers to the uncertain effect changing exchange rate have on the value and operations of the firm. A sizable literature now exist which predicts that trade flows will usually be reduced in response to exchange risk and increased in response to higher exchange rate levels (Kohlhagen, 1977). In recent literature, direct investment is assumed to behave as foreign portfolio investment. Therefore, the effect of exchange risk on foreign portfolio investment has been extended to foreign direct investment (see Hopper and Kolhagen, 1978, Makin, 1978 for more details). Expectation concerning future exchange rates risk also was investigated. Ahn (1998) finds that a domestic firm expecting a foreign currency devaluation would defer direct investment until after the devaluation when it would be more profitable relative to exporting

Exchange rate risk can be separated into three broad types, “translation risk”, “transaction risk” and “economic risk”. Translation risk pertains to the impact of exchange rate changes on the firm’s balance sheet. The value of stocks and flows denominated in foreign currencies is subject to change in their domestic-currency value as the prevailing rate of exchange altered. The degree to which the value of firm’s future cash transaction can be affected by exchange rate fluctuations is referred to as transaction risk. Economic risk is the risk resulting from changes in the domestic value of non-contractual local currency flows. Economic exposure is the risk that the domestic value of the firm’s cash flow may fluctuate with changes in exchange rate. The various forms of exchange rate risk have different implications for the firm. The discussion that follows briefly identifies each form of exchange risks and highlights its relevance to the firm’s investment decisions.

Translation risk refers to the effect of exchange-rate changes on balance sheet items. More precisely, this form of accounting risk is usually termed “translation risk”. As exchange rates fluctuate, distortions began to appear in the consolidated quarterly financial statements of most multinationals.

Translation gains and losses or the change in stated values which results from changes in exchange rates are considered by most to have no direct effect on the operations of the firm. These gains and losses are accounting artifacts and do not affect actual foreign-currency revenues or costs (Giddy , 1977).

Transaction risk exist when the future cash transactions of a firm are affected by exchange rate fluctuations. It arises because of the time gap between the date when a transaction is initiated and the date when payment is made (usually on completion of the transaction). During that time the exchange rate may change with the parity converting foreign exchange into domestic currency being subject to windfall gains or losses.

Transaction risk can lead to real monetary gains or losses for the firm. If the MNC decides to hedge its transaction risk exposure, it may select from the following hedging techniques:

- Future contract hedging
- Forward contract hedging
- Money market hedging
- Currency option hedging

These techniques may reduce exposure to exchange rate risk but involve additional hedging costs.

Concerning the hedging costs, Jeff Madura (1992) pointed out the measuring way. He indicated that hedging costs can only be determined at termination of the hedging period. Considering annual percentage, the formula given by Jeff Madura is shown as following:

$$C = \frac{FR_{i,n} - SR_{i,n}}{n} \times 360 \times 100\% + T$$

C: estimated hedging cost

FR: forward rate of foreign currency (i) for (n) day forward period

SR: spot rate at the end of the (n) day forward period

T: transaction cost

100%: expressing estimated hedging cost in percentage

In general, the hedging costs consist of the difference between the forward rate and spot rate at the end of the contract period. Since the true hedging costs will only be known with certainty after realization of the contract, one can only consider estimated costs of the forward cover at the time of decision making, i.e. the difference between the forward rate and the expected spot rate. If hedging costs are measured correctly, i.e. the sum of transaction costs and the difference between the forward rate as well as one's forecast of the future spot rate, one could substantially reduce the foreign exchange rate risk at a low cost.

Economic risk refers to the uncertain influence changing exchange rates may have on the revenue and cost structure of the firm. It arises because the firm can not contractually fix over sufficiently long periods of time, its sales level, price level or cost of inputs. These values are subject to change as the exchange-rate changes. As a result, the local-currency profit margins of the firm become sensitive to exchange-rate movements (Hooper and Kolhagen, 1978). The discussion that follows describes factors that create economic risk.

### ***1. Deviation From Purchasing Power Parity (PPP)***

A deviation from PPP implies that the change in exchange rates is not fully reflected in price-level changes.<sup>(1)</sup> For example, if a pound of apples sells for ten francs, and the exchange rate is four francs to the dollar, the pound of apples will sell for two and half dollar. A 25 percent depreciation of the franc, coupled with a 25 percent increase in the local price of apples leaves the dollar price of apples unchanged, or PPP is maintained. If the percentage change (i.e. 10%) in local prices, the translated price will change, and the purchasing power of the currencies will have been altered. Table 1 provides an example. A more likely situation from PPP is to change the competitive position of the tradable goods sector relative to world markets. A currency depreciation will increase demand for exports, and consequently

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<sup>1</sup> . throughout this study, the exchange rate is defined as the domestic value of a unit of foreign currency. Therefore, as the exchange rate rises, the domestic currency is depreciating in value relative to the foreign currency.

increase, production, factor employment and local prices in the tradable goods sector. A currency appreciation will have a depressing effect on exports, production, employment and local prices.

**2. Unexpected Price Level Adjustments**

Local inflation and exchange rate adjustments affect local price levels. When these change are unanticipated, they will not be accurately reflected in the terms of local-currency contracts. Unanticipated-level adjustments influence local-

currency profit margins if revenues and costs are not equally fixed in contract terms (Madura, 1992).

**Table 1  
Exchange Rate Risk and Deviation from PPP**

Economic Risk When PPP holds					Economic Risk and Deviation from PPP				
Pre-Depr. Local price: 10ff 4ff=1\$	Unit sales 500	Gross income 5000ff	Profit @ 10% 500ff	Profit in dollars \$125	Pre-Depr. Local price: 10ff 4ff=1\$	Unit sales 500	Gross income 5000ff	Profit @ 10% 500ff	Profit in dollars \$125
Post-Depr. Local price: 12.5ff 5ff=1\$	Unit sales 500	Gross income 6250ff	Profit @ 10% 625ff	Profit in dollars \$125	Post-Depr. Local price: 11ff 5ff=1\$	Unit sales 500	Gross income 5500ff	Profit @ 10% 550ff	Profit in dollars \$110

### ***3. Relative Price Effects***

Relative price changes induce substitution effects which alter the demand of output. These effects can not be predicted beforehand unless estimates of the price elasticity of substitution and the effect of changing exchange-rate on the price of substitutes are available. The firm has limited operational control over these changes and as result profit flows are exposed to exchange risk. This form of exposure should be a matter of consideration in firm's investment analysis.

### ***4. Real Income Effects***

A change in the real exchange-rate alters real income in the local economy. Workers may find their wage bargaining power influenced by the changing competitive position of the products they produce. Various forms of wealth within the country may also be sensitive to exchange rates, such as the holdings of foreign assets and foreign liabilities.

FDI is exposed to several forms of risk as exchange rates change. Economic/transaction risk can not be clearly isolated or managed, although opportunities may exist to reduce risk through investment diversification. The MNC can not fully protect against such risks. Accordingly, this form of exposure needs to be considered in the investment decision of the firm. The following discussion presents a theoretical model that permits the incorporation of exchange rate risk into the investment decision of the MNC.

### **5. Theoretical Analysis of Exchange Rate Risk and the Investment Decision**

This part of the study presents a theoretical model of a firm operating in two markets. The model is used to explore how the MNC reacts to various changes in the economic environment due to exchange rate fluctuations. The changes in the environment are induced by changes in the exchange rate.

Consider a two-country world. Country 1, the source country and location of the domestic market, is where the management and the firm's shareholders reside. Transactions, financial results, and consumption are all measured in the domestic currency. Initially it is assumed that country 2, the host country and location of the foreign market, is small relative to the size of

country 1. investment in the domestic market (country 1) is subject to normal business risks but not subject to exchange risk. Besides normal business risk direct investment in country 2 is also subject to county risk, default risk, and exchange risk. Because the paper is concerned with the impact of exchange rate risk on foreign direct investment, other forms of risk are assumed away.

The domestic and foreign markets are assumed to be competitive. The firm sells its output in the market where it is produced. Output (Q) is a function of two inputs, physical capital (K) and labor (L).<sup>(2)</sup> Labor can be treated as a proxy of all forms of variable inputs to the production process including for instance, raw materials, intermediate products, and labor itself.

The existing capital stock is assumed to be immobile; it can not be redeployed and therefore, represent a sunk or fixed cost. The existing capital appears in the production function, since the level of output depends on the previously existing level of capital investment (K), the level of new investment (I), and the level of labor employment (L). The production function is written as  $Q_n = F_n(K_n + I_n, L_n)$ . The subscript is used to denote the location of activity. For newly established investment projects,  $K_n$  is zero.

It is assumed that the firm is faced with an upward sloped supply curve for new capital investment. There is one plausible justification for using such assumption. In the financial side, the firm may find that in the short run lenders or investors become increasingly reluctant to supply the firm with new funds as the firm's investment requirements rise. These investors or lenders may perceive that risks increase as the firm's rate of expansion rises (new investment relative to the existing capital base). Accordingly, lenders and investors would require a higher rate of return or interest rate as the firm increases its investment levels (I) in the short run. As a result, the firm will

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2. A constant return-to-scale technology is assumed for production in each market. This implies that the productivity of capital and labor keeps constant when the ratio of capital to labor is held constant.

find that  $r$ , the per-unit cost of capital, rises. This may be stated in the functional form as follows<sup>3</sup>:

$$r = r(I) = r(\sum I_n)$$

$$\text{with } r' = \frac{dr}{dI} > 0 \text{ and } r'' = 0$$

The firm will also find that the foreign local currency price of output ( $P_2$ ) and foreign local currency price of labor input ( $W_2$ ) are sensitive to the exchange rate, ( $e$ ). With ( $e$ ) defined as domestic currency (\$) per unit of foreign currency (F), we can state the following:

$$e = \frac{\$}{F}; P_2 = P_2(e); \frac{dP_2(e)}{de} \leq 0; W_2 = W_2(e); \frac{dW_2(e)}{de} \leq 0$$

Of concern to the management is the domestic currency value of these flows,  $eP_2(e)$  and  $eW_2(e)$ . When PPP holds and there are no relative price or income effects, exchange-rate changes will be identically offset by change in local-currency prices. However, if any of these conditions are not satisfied,  $eP_2(e)$  and  $eW_2(e)$  become uncertain. This indicates that cash flow from foreign operations is subject to variation when exchange rates change. The uncertain nature of  $eP_2(e)$  and  $eW_2(e)$  introduces exchange rate risk into the model. The model presented here posits the investment decision of the firm as one of selecting the appropriate portfolio of real assets. The firm (its owner or manager) is risk averse and prefers: portfolios with the lowest risk among portfolios of equivalent expected return, and portfolios with the highest expected return among portfolios of equivalent risk. Since exchange rate risk is the only source of uncertainty in this model, the variance of profits can be considered a proxy of exchange risk.

The profits of the firm are a composite of returns from different investments. In the two-country case, one investment is domestic, the other foreign. The foreign investment is denominated in the foreign currency and

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<sup>3</sup> . A single prime (') is used to denote the first derivative of the function, and a double prime (") denotes the second derivative.  $n$  represents the location where the new capital is employed.

its cash flow is sensitive to changing exchange rates. The profit of firm pursuing can be written as the following:<sup>(4)</sup>

**Market 1 Profit (domestic market)**

$$(1) \pi_1 = P_1 Q_1(K_1 + I_1, L_1) - W_1 L_1 - r(I)I_1$$

$$(2) E(\pi_1) = \bar{\pi}_1 = \pi_1$$

$$(3) Var(\pi_1) = \sigma_{\pi_1}^2 = 0$$

**Market 2 Profit (foreign local market)**

$$(4) \pi_2 = eP_2(e)Q_2(K_2 + I_2, L_2) - eW_2(e)L_2 - r(I)I_2$$

$$(5) E(\pi_2) = \bar{\pi}_2 = e\bar{P}_2(e)Q_2(K_2 + I_2, L_2) - e\bar{W}_2(e)L_2 - r(I)I_2$$

$$(6) Var(\pi_2) = \sigma_{\pi_2}^2 = Q_2^2(K_2 + I_2, L_2)\sigma_{ep}^2 + L_2^2\sigma_{ew}^2 - 2Q_2(K_2 + I_2, L_2)L_2\sigma_{epew}^2$$

combining markets,

(2)+(5), yields

$$(7) \bar{\pi} = \bar{\pi}_1 + \bar{\pi}_2 = P_1 Q_1(K_1 + I_1, L_1) + e\bar{P}_2(e)Q_2(K_2 + I_2, L_2) - W_1 L_1 - e\bar{W}_2(e)L_2 - r(I)I$$

(3)+(6), yields

$$(8) \sigma_{\pi}^2 = \sigma_{\pi_1}^2 + \sigma_{\pi_2}^2 = Q_2^2(K_2 + I_2, L_2)\sigma_{ep}^2 + L_2^2\sigma_{ew}^2 - 2Q_2(K_2 + I_2, L_2)L_2\sigma_{epew}^2$$

If the variance of the profit flow is small, the management might pay little attention to exchange rate risk (the variance of the profit flow) since the

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4 .  $Q_n(K_n+I_n, L_n) = F(K_n+I_n, L_n)$ , the left side of this equation will be used in profit equations for simplicity, since total revenues is represented by PQ. A bar ( ) indicates an expected value. Also note that  $I=I_1+I_2$ ,  $\sigma_{epew}^2$  denotes the covariance between  $eP_2(e)$  and  $eW_2(e)$ ;  $\sigma_{ep}^2$  denotes the variance of  $eP_2(e)$ , and  $\sigma_{ew}^2$  represents the variance of  $eW_2(e)$ .

risk we are concerned with is small. A large variance of profits would result in the opposite conclusion being reached.

Covariance is a measure of correlation between two variables. If both variables respond in a very similar fashion, then the covariance is large in magnitude. The sign of covariance is positive if the variables change in the same direction. For example, if foreign local wages and local prices both increase because of the exchange-rates change, the covariance of foreign local wages with local prices will be large and positive.

Equation (1) is the profit function for the domestic market. Total revenue is given by  $P_1Q_1$  with  $W_1L_1$  representing the wage cost for the production of  $Q_1$ , and  $rI_1$  representing the cost of employing new capital,  $I_1$ . Equation (2) states that the expected value of the profit flow,  $E(\pi_1)$  is equal to  $\pi_1$  since all terms in (1) are non-stochastic. As equation (3) indicates, the variance of a non-stochastic variable is zero.

Equation (4) is the profit function for the foreign market. In the foreign market, we should take exchange rate into consideration. Therefore, equation (5) and (6) are totally different from equations (2) and (3). Also note that the cost of investment in the second market ( $rI_2$ ) is not affected by the movement of exchange rate. In this model, it is simplicity assumed that new capital is raised in the domestic market rather than the foreign local market. Therefore, the cost of capital,  $r$ , is invariant with respect to the exchange rate.

Equation (7) represents the expected profit level for the firm, which is obtained by summing expected profits from both markets. The variance term in equation (8) covers all the risk of firm's operation. The variance is fully related to operational risks in the foreign market since domestic operations are considered exchange-risk free.

Suppose  $U\pi = \bar{\pi} - b\sigma_\pi^2$  is the utility function of firm. The value of  $b$  measures the marginal disutility of increased risk relative to the marginal utility of an increased unit of expected profit, and can be treated as a measure of the degree of risk aversion. If we incorporated equation (1) through (8) into the utility function, the problem will become one of selecting the input

levels of  $L_1, I_1, L_2, I_2$  which maximize the value of the utility function. The resultant decision model is stated in equation (9) below:

$$(9) \text{ Maximize } U\pi = \bar{\pi} - b\sigma_{\pi}^2 \quad (5)$$

$$= P_1Q_1(K_1 + I_1, L_1) + e\bar{P}_2(e)Q_2(K_2 + I_2, L_2) - W_1L_1 - e\bar{W}_2(e)L_2 - r(I)I$$

$$-b[Q_2^2(K_2 + I_2, L_2)\sigma_{ep}^2 + L_2^2\sigma_{ew}^2 - 2Q_2(K_2 + I_2, L_2)L_2\sigma_{epew}^2]$$

The first-order conditions of equation (9) can help us find the value of the four input stocks ( $L_1, I_1, L_2, I_2$ ) which maximize the value of the utility function. Different input levels result in different levels of production. This influences costs, revenues, and exchange risk. The following four conditions (equation (10)~(13)) must be satisfied to ensure that the utility maximizing decision has been reached.<sup>(6)</sup>

$$(10) \quad P_1Q_{L1} - W_1 = 0$$

Equation (10) states that in equilibrium, domestic labor ( $L_1$ ) should be hired to the point where the marginal revenue product of labor ( $P_1Q_{L1}$ ) is equal to its marginal cost ( $W_1$ ).

$$(11) \quad P_1Q_{I1} - r - r'I = 0$$

This equation indicates that the marginal revenue product of new capital employed in the domestic market ( $P_1Q_{I1}$ ) should be equal to its marginal cost ( $r + r'I$ ).

$$(12) \quad e\bar{P}_2 Q_{L2} - e\bar{W}_2 - b[2Q_2Q_{L2}\sigma_{ep}^2 + 2L_2\sigma_{ew}^2 - 2Q_2\sigma_{epew}^2 - 2L_2Q_{L2}\sigma_{epew}^2] = 0$$

$$(13) \quad e\bar{P}_2 Q_{I2} - r - r'I_2 - b[2Q_2Q_{I2}\sigma_{ep}^2 + 2L_2Q_{I2}\sigma_{epew}^2] = 0$$

<sup>5</sup> . Plug equation (7) and (8) into the utility function. Also note that  $Q_{L1}, Q_{I1}, Q_{L2}, Q_{I2}$  represent the marginal products with respect to the subscript inputs.

<sup>6</sup> . A condition for profit maximization is to set the level of input usage at the point where marginal revenue product is equal to marginal cost.

Equation (12) and (13) reflect the notion that utilization of  $L_2$  and  $I_2$  adds risk to the portfolio. The addition of risk requires foreign projects to earn excess returns; i.e., in equilibrium, marginal revenue products exceed marginal costs. The excess of marginal revenue over marginal cost is the payment required to compensate for risk: it is the “risk premium”.

### **6. Comparative Static Analysis (The Results of the Model)**

Of greater interest is how the optimal levels of input usage change in response to changes in the operating environment. Comparative static analysis was used to demonstrate the direction of change in the endogenous variables in response to changes in the exogenous variables.<sup>7)</sup>

The exogenous variables, including covariance measures of local prices and local wages, summarize the conditions of the operating environment, and are beyond the control of the MNC. The endogenous variables are the measures that are under the firm’s control. These variables include the levels of domestic and foreign capital investment as well as labor employment.

The signs of the comparative-static derivatives indicate how the firm should respond to changes in the operating environment to achieve the optima or utility-maximizing portfolio. For example, an increase in domestic selling prices ( $P_1$ ) indicates that the firm should increase its domestic investment and labor employment levels. In response to the same change, the firm should also reduce the levels of foreign investment and foreign labor employment. It is also not difficult to find that the domestic employment of factors ( $I_1$  and  $L_1$ ) and the level of production ( $Q_1$ ) are shown to be positively related to the price of output ( $P_1$ ), and negatively related to wage costs ( $W_1$ ). As domestic prices increase or domestic wage cost reduce, domestic profitability is enhanced, and the firm responds by increasing its domestic investment and input levels ( $I_1$  and  $L_1$ ) and the level of domestic output ( $Q_1$ ). In a similar fashion, foreign factor employment ( $I_2$  and  $L_2$ ) and foreign production ( $Q_2$ ) are positively related to the expected price of output

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7. For more detail regarding comparative static analysis, see the textbook “The Structure of Economics: A Mathematical Analysis” by Eugene Silberberg, 1990.

( $\bar{eP}_2$ ) and negatively related to expected wage costs ( $\bar{eW}_2$ ). The other relevant conditions are shown in table 2.

**Table (2)\***  
**Results of Comparative Static Analysis**

Endogenous Variables	Exogenous Variables								
	$P_1$	$W_1$	$r$	$\bar{eP}_2$	$\bar{eW}_2$	$\sigma_{ep}^2$	$\sigma_{ew}^2$	$\sigma_{epew}^2$	$b$
$L_1$	+	-	-	-	+	+	+	-	+
$I_1$	+	-	-	-	+	+	+	-	+
$L_2$	-	+	-	+	-	-	-	+	-
$I_2$	-	+	-	+	-	-	-	+	-

\*Note: A positive sign indicates that the endogenous variable will change in the same direction as the change in the exogenous variable. A negative sign indicates that the endogenous variable responds in the opposite direction to the change in the exogenous variable.

As above table indicated, activities in both markets are shown to be sensitive to foreign exchange risk. When exchange rate risk rises, the risk-averse firm shifts the allocation of capital investment from the foreign market to the domestic market. This is demonstrated by reductions in foreign investment levels in response to increase in the variance of foreign prices,  $\sigma_{ep}^2$ , and the variance of foreign wages,  $\sigma_{ew}^2$ . Labor employment and production, as related to capital investment, is also found to fall (rise) in the foreign (domestic) market in response to a rise in the level of exchange rate risk (see the signs of  $\sigma_{ep}^2$  and  $\sigma_{ew}^2$  in table 2).

The related nature of foreign price and wages is recognized by the covariance term which is negatively entered in the variance-of-profit term (see equation (6)). The variance-of-profit term (a proxy for exchange risk) is lower if foreign prices and wages are positively correlated with respect to exchange-rate change. This positive correlation reduces the negative impact of exchange rate risk on FDI and level of foreign activity.

The firm's investment decisions are also sensitive to the tradeoff between risk and return implicit in the utility function. An increase in the degree of risk aversion,  $b$ , shifts activity from the risk-exposed foreign market to the domestic market.

The two-country model presented here demonstrates some results. FDI is shown to be influenced by the profitability of the foreign market, the domestic market and the level of exchange rate risk. In addition, the model also points out the interrelationships between exchange-rate-induced price changes and wage changes. When price and wage movements are positively correlated, exchange rate risk is reduced and the attractiveness of FDI is enhanced.

## VI. Conclusion

In a world where exchange rate is uncertain, random fluctuations can lead to a variety of risks on direct investment. In this paper, the effect of exchange rate risk on FDI is theoretically analyzed by applying two-country model. The model uses a comparative static approach to illustrate the direction of change in the endogenous variables in response to changes in the exogenous variables. The results show that when exchange rate risk rises, firms shift its investment from the foreign market to the domestic market. This can be attributed to the increase in the variance of foreign prices and the variance of foreign wages. The results show also that when price and wage move in the same direction, the international firm is enhanced to increase its capital investment. Thus, it appears that firms activities are sensitive to exchange rate fluctuations (risk).

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إن إحدى الطرق الشائعة للمشاركة في التجارة الدولية هي الاستثمار الأجنبي المباشر. ولكن عوائد الاستثمار الأجنبي المباشر يجب أن تقارن مع مخاطر سعر الصرف عند القيام بالعملية الاستثمارية في الخارج حتى يصبح القرار الاستثماري مناسباً. وإن مخاطر سعر الصرف تتسبب في اختلاف تكلفة رأس المال للشركات الواقعة في مناطق تختلف فيها العملات ، وبذلك تؤثر على تدفق الاستثمارات الأجنبية (الدولية). وفي هذه الدراسة يفترض أن مخاطر سعر الصرف لا يمكن تفاديها بشكل تام لذلك فإنها تعتبر أحد العناصر الرئيسية التي يأخذها القرار الاستثماري في الاعتبار. كما تستخدم الدراسة الحالية نموذج لدولتين وذلك لعرض علاقة الاستثمار المحلي بالأجنبي مع مخاطر سعر الصرف. وقد توصلت الدراسة إلى إن مخاطر سعر الصرف تؤثر بشكل فعال في استثمارات الشركات الأجنبية. وأيضاً وجدت هذه الدراسة بان النموذج المستخدم يتضمن نتائج متعددة بناء على العوامل الاقتصادية المستخدمة.