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DYNAMIC ANALYSIS OF U.S. DIRECT INVESTMENT

A Trident Scholar Project Report

by

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Direct investment, the whole or partial control of overseas by companies based in one home country, constitutes an essential aspect of the pattern of international trade. This study analyzes the effects of two components of U.S. direct investment: internalization and location choice and how changes in these variables affect changes in direct investment over time. It is hypothesized that once internalization is controlled for the effects of relative endowments on location choice will be observed.

The issues of internalization are assumed to be critical. Studies by Ethier (1986) and Helpman and Krugman (1985) and results of Kulchycky (1982) and Bowen (1983) have been used. Industry level data from surveys conducted by the Bureau of Economic Analysis were used.

This study also includes a literature survey.

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ABSTRACT

This study suggests that there are two separate components to U.S. direct investment. Firms invest after considering issues of both internalization and location choice. Models of direct investment by Ethier (1986) and Helpman and Krugman (1985) that have seemingly contradictory predictions for the relationship between relative endowments and direct investment are analyzed. These models are viewed as complementary in this model, however, because they each affect direct investment behavior in a different way (i.e. internalization and location choice). It is hypothesized that once internalization is controlled for the effects of relative endowments on location choice will be observed. Thus, issues of internalization are assumed to be critical. This and other predictions are tested for 1966 and 1989 in order to lend further support to Kulchycky's 1982 results which were the first to test empirically internalization predictions. Several variables not included in Kulchycky's study are analyzed.

Bowen (1983) showed that changing relative endowments had important effects on the pattern of international trade. This study proceeds one step further and analyzes how changes in endowments and the other variables mentioned above affect changes in direct investment over time.

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A. D. Wolff
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May 1992

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CHAPTER 1

INTRODUCTION

Direct investment, the whole or partial control of overseas affiliates by companies based in one home country, constitutes an essential aspect of the pattern of international trade. Since World War II, these multinational enterprises (MNEs) have grown both in size and number and have played an important part in postwar world economic development. U.S. direct investment has been a critical source of American influence and stability throughout Europe and the Third World. Economic ties have often accomplished political objectives without diplomatic bantering or military arm flexing at little or no cost to the taxpayer.

After increasing from the 1950s into the 1970s, the rate of direct investment by U.S. multinationals has decreased alarmingly in the 1980s. Measures of the internationalization of U.S. business include the annual number of affiliates established overseas, the ratio of U.S.-owned affiliate assets to total U.S. parent assets, and the U.S. direct investment position abroad as a per cent of affiliate assets. All of these have shown a decline or stagnation which originated in the 70s and continued into the 80s. The importance of this trend rests with the critical impact it may have on the U.S. trade balance. Many empirical studies have shown strong evidence that a

complementary relationship exists between direct investment and a country's exports. That is, direct investment stimulates exports. Thus, declining direct investment may stunt U.S. export growth and U.S. competitiveness worldwide. Direct investment has traditionally been a strong component in an otherwise declining U.S. posture in world trade, and represents a growing weakness in one of our traditional strengths. Intra-firm trade accounts for one-quarter of the total U.S. exports of U.S. firms and one-fifth of the total world exports. At the same time, the total U.S. share of world exports has been steadily declining. Between 1957 and 1984, U.S. manufactured exports as a percentage of total world manufactured exports fell from 21.3 percent to 14.0 percent. (Lipsey and Kravis 1987:p. 147-154)

We need to understand further why U.S. firms invest abroad and why the rate of U.S. direct investment is declining in order to comprehend the economic and geopolitical effects that may result. One possible explanation for the United States' trade woes is that U.S. firms are losing their international advantage. A decline in U.S. research and development spending and an emphasis on short term results are all possible reasons.

Assuming the firms incur higher costs when operating in foreign markets, one widely accepted necessary condition for firms to invest is the possession of some type of <u>firm specific advantage</u> that they can exploit. This possibly

explains why the rate of direct investment is falling and illustrates the importance of understanding investment behavior. Given the necessary condition stated above there are two issues a firm takes into account when trying to minimize cost. Locational issues concern whether to produce in a foreign country based on relative costs. Internalization issues relate to investing abroad to minimize transaction costs. Firms must decide between operating at arms-length or investing directly in foreign markets.

Many empirical studies investigating firms' investment behavior have tested several types of explanatory variables ranging from firm to industry to country characteristics. Their impact on the issues that a MNE faces when making the investment decision was investigated. One important question that was not addressed in these studies is how do changes in these variables over time affect changes in direct investment. Formulating this relationship for a period of time could lead to further understanding of the international pattern of investment.

Traditional theoretical models have been based on the location choice decision, and assumed issues of internalization. The model focused on in this study was formulated by Helpman and Krugman as an extension of Hecksher-Ohlin-Samuelson trade theory. According to this model, direct investment takes place when trade by itself

does not lead to factor price equalization. Direct investment is necessary to complete the process. They predict that differences in factor endowments relate positively to the degree of direct investment between countries.

It is intuitively appealing that a MNE from a capital rich country would invest heavily in labor rich third world countries. This would be consistent with production location motivations. However, this is not the pattern found in empirical studies. In a model that focuses on internalization issues and assumes locational choice motivations, Ethier (1984) predicts that a large amount of direct investment will take place *between* countries with similar relative endowments.

The Ethier and Helpman-Krugman models would seem to be contradictory. However, as Kulchycky (1990) suggests, they might be complementary in as much as each focuses on a different aspect of direct investment. If the two are integrated and internalization controlled, Kulchycky predicted that the comparative advantage motivations of the Helpman-Krugman model would be produced. Her empirical results conducted with 1982 individual firm data fulfilled this prediction.

Guided by Kulchycky's thesis, this study seeks to find additional support for her model by estimating her equations for 1966 and 1989. Unlike Kulchycky's analysis, industry

level data was the only type available for this study. It also includes variables she did not use but which theoretical analysis suggests are important. The relationship between changes in relative endowments and changes in direct investment over time will also be examined, as will the affect of changes in firm and industry characteristics. This analysis of direct investment over time is the first to be conducted. The possible policy implications resulting from these change will then be examined.

The industry level data was taken from Benchmark surveys conducted by the Bureau of Economic Analysis for 1966 and 1989. These years were chosen because they were complete surveys as opposed to the partial ones conducted for other years. In addition, 1966 was the first year a survey was conducted and 1989 was the last. This provided the largest time spread to analyze changes in direct investment over time. Standard Industrial Classification was used as the basis for industry grouping.

Chapter 2 presents a summary and analysis of the relevant literature on direct investment to provide a background for the model developed in Chapter 3. Chapter 4 provides a description of the data and sources. The results of least squares estimations are presented and discussed in Chapter 5, and conclusions are presented in Chapter 6.

CHAPTER TWO

LITERATURE REVIEW

The effect of location choice on the pattern of international investment has been investigated in a voluminous amount of literature. Internalization is a relatively new idea and less has been written about it. Organizational theory of the MNE will not be investigated in this study. Caves (1982) and Swedenborg (1979) provide excellent discussions of firm theory. The focus of this paper deals with the effects of industry and country factors on the pattern of U.S. direct investment, and the possible complementarity between two important models of investment behavior using internalization and location choice.

The first general equilibrium model on the role of internalization in direct investment was published in 1986 by W. Ethier. The significance of this model is greatly increased by the fact that Ethier uses standard H-O-S theory as a basis and, thus, makes it possible to relate it to other models that include comparative advantage. In addition, this basis allows direct investment to be related to traditional trade determinants, and the model produces an explanation of the pattern of direct investment that is more consistent with empirical observations. H-O-S theory predicts that large differences in factor endowments would lead to product and investment movements between nations, but a large amount of direct investment takes place between

countries with similar relative endowments. Some evidence of this pattern is shown in Lipsey, Kravis, and O'Connor (1983). They show that about half of aggregate assets invested by U.S. parents are in developed countries.

Ethier centers his explanation as to why firms internalize on two issues: i)the public good nature of information and ii) the exchange of large and diverse amounts of information. First, the public good nature of information will be discussed. Assuming that they possess some special knowledge or product that they want to exploit in foreign markets, firms can carry out transactions at arms-length through an intermediary or internally through an affiliate. If the transaction is accomplished through an intermediary, the firm may lose some of its monopoly advantage by selling a portion of this information to the outside party in order to convince them that the transaction is worth undertaking. In addition, if the information is appropriable, the firm will be very reluctant to release it to foreign agents. Thus, it has an incentive to establish an affiliate. This way the firm will maintain its full monopoly advantage and reduce the risk of losing it.

The need to exchange large and diverse amounts of information also provides a motivation for a firm to internalize. Coordination and contracting with foreign agents across country boundaries is much more difficult than communication with an affiliate. Some products marketed in

foreign countries are state invariant and have an objectively measurable quality. However, for many products quality is a varying characteristic and often times it is very difficult, if not impossible, to assess. In order to establish a transaction, the firm and agent would have to agree on a payment schedule for a wide variety of product qualities. This would require a degree of cooperation and integration that is neither practical nor possible. In order to facilitate the complexities of the necessary information exchange, firms could internalize.

In his model, Ethier incorporates the public good nature of information and the problems associated with protecting firm-specific information in the variable (R) which measures research effort. Product quality (Q)measures the need for large exchanges of information. Intrinsic uncertainty faced by the agent is measured by technological dispersion (a_h-a_l) and relative endowments are included as (L/T-L*/T*) where (L) signifies land, (T) capital, and (*) denotes foreign country. $W=F(L_w,T)$ represents wheat production where L_w is the amount of labor employed and F is the neoclassical production function. Manufacturing involves production upstream, downstream, and research activity. The only input in upstream production is labor and the variable cost of production is (aQw) where (a) is the technological parameter, w is the wage rate in terms of wheat [$F(L_w,T)$], and $0<Q<Q_1$. The value of (a) is determined

in part by research activity such that an increasing amount of resources devoted to (R) increases the probability p(R) that $a = a_l$ assuming that $p' > 0$ and $p'' < 0$. The fraction of a manufactured unit consumed at home is represented by (u), the fraction consumed abroad is (1-u). Now we have the tools to proceed to the integrated equilibrium.

The model starts with a single manufacturing firm that conducts upstream production, downstream production, and research activity in both countries. The case where $w<w^*$ is first considered. Q_l is the product quality when $a=a_l$, and Q_h is the product quality when $a=a_h$. In order to optimize, the firm tries to maximize expected profit:

2.1 $p(R)Q_l(1-a_lw) + [1-p(R)]Q_h(1-a_hw) - (wR + qw^o)$

where $w^o=uw + (1-u)w^*$ and q is the total units of labor required

There are three distinct wage ranges that lead to an optimal strategy:

(i) $w > (1/a_l) > (1/a_h)$. This will result in a negative value, and the firm will choose not to produce.

(ii) $(1/a_l) > (1/a_h) > w$. Here the firm may produce, but production depends on whether the profit is nonnegative. If it is, the firm will produce goods of the highest quality Q_l and will carry out R until the marginal cost equals the marginal expected cost reduction:

$w = Q_lp'(R)[(1 - a_lw) - (1-a_hw)]$

(iii) $(1/a_l) < w < (1/a_h)$. Once again the firm may or may

not produce. If $a = a_h$ then the firm will not produce anything because Q=0 and variable cost=0. If $a = a_l$ then the firm will produce the highest quality good where:

$w = Q_l p'(R)(1 - a_l w)$ and $Q_h = 0$

Unlike in case (ii) the research effort depends upon the wage because it determines whether a firm will produce or not.

Ethier than uses this model of the firm's behavior to proceed to the next step of modeling equilibrium in the manufacturing sector. If $w < (1/a_h)$ then the zero profit condition is:

2.2 $Q_l\{1-w[p(R_l)a_l + (1 - p(R))a_h]\} - [wR_l + w^o q]$

Figure 2.1 shows the corresponding Manufacturing Equilibrium curve. Where $w < (1/a_h)$ the relation between w and w* is linear as mentioned in case (ii) above. When $w > (1/a_h)$ the curve becomes steeper because R is now a decreasing function of w as mentioned in case (iii). A similar curve (ME*) could be drawn for the foreign country manufacturing sector, and, even though we are looking at the case where $w < w^*$ (below the 45 degree line), the roles could easily be reversed.

In the labor market, Ethier describes equilibrium by:

2.3 $w = F_L(L_w, T) = F_L(L - n[a(w)Q_l + R(w) + uq] - n^*uq, T)$

and

2.4 $W^* = F_L^*(L_W^*, T^*) = F_L^*(L - n(1-u)q - n^*[a(w^*)Q_l + R(w^*) - (1-u)q], T^*)$

Ethier's LE and ME curves

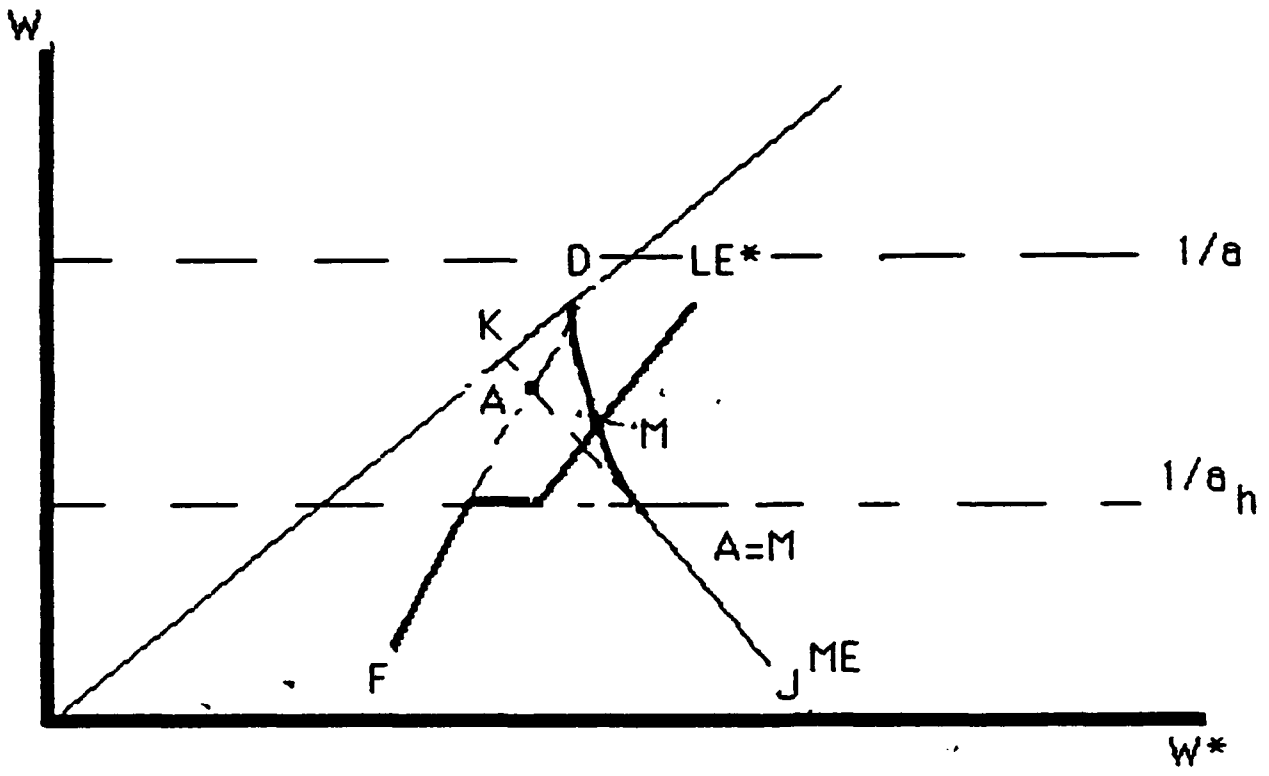


FIGURE 2.1

where n is the number of firms with research and upstream production at home and n* is the number of firms with that activity abroad. Accordingly n = 0 when w > w* and n* = 0 when w < w*. Using the case where w < w* again and eliminating n, we obtain the Labor Equilibrium (LE) curve as shown in Figure 2.1. The curve has a flat portion where w = $(1/a_h)$ because at this point the firm is indifferent about which quality to supply. It could supply the highest quality goods and produce a smaller number, or it could supply a large quantity of low quality goods. International equilibrium takes place at the intersection of the LE and ME curves (points M and M*).

The next step taken is to model internalization. Ethier assumes that state-dependent contracts cannot be conducted at arms-length because of the large number of contingencies that would have to be written in the contract. If w < w* and the home and downstream production firms maintain an arms-length relationship, the contract between the two will be a state-invariant contract. When w < $(1/a_h)$ the LE and the ME curves are the same for firms operating at arms length and integrated firms because the highest quality will be produced, and firms will actually favor an arms-length contract. When $(1/a_l)$ >w > $(1/a_h)$ the home firm's maximization problem for values of Q and R is:

2.5 $\mathbf{Q[1-a^{\circ}(R)w] - [wR + w^{\circ}q]}$

where $a^{\circ}(R) = p(R)a_l + [1-p(R)]a_h$

In equilibrium, 1 must be greater than $a^{\circ}(R)w$ in order to make the profit zero. The research effort will be carried out to the point where $p'(R) = 1/Q_l(a_h-a_l)$. This is a linear relationship, and the ME curve remains a straight line JK. Along these same lines, the LE curve would become segment FD and the arm's length equilibrium will occur at point A. The equilibrium point M for an internationally integrated firm is obviously superior to point A.

Using this tool, Ethier shows that firms should internalize and produce in a foreign country if the nature of the product is multivariate. In addition, he shows that internalization is positively related to technological dispersion. If the dispersion is small and the curves intersect below the $1/a_h$ line, there will be no difference between arms-length contracting and international integration. This is illustrated in Figure 2.1.

Finally, Ethier discusses how differences in relative endowments affect the amount of direct investment. Figure 2.2 will be used to illustrate this. Assuming that relative endowments are very different and home wages are much less than foreign wages, there will be no direct investment. All production will take place at home and all trade is interindustry. As endowments become more similar home wages will rise and foreign wages will fall. The LE curve will shift radially to LE'. If endowments become similar enough w will equal w*, and LE' will lie on the 45 degree

Ethier's diagram with changing endowments

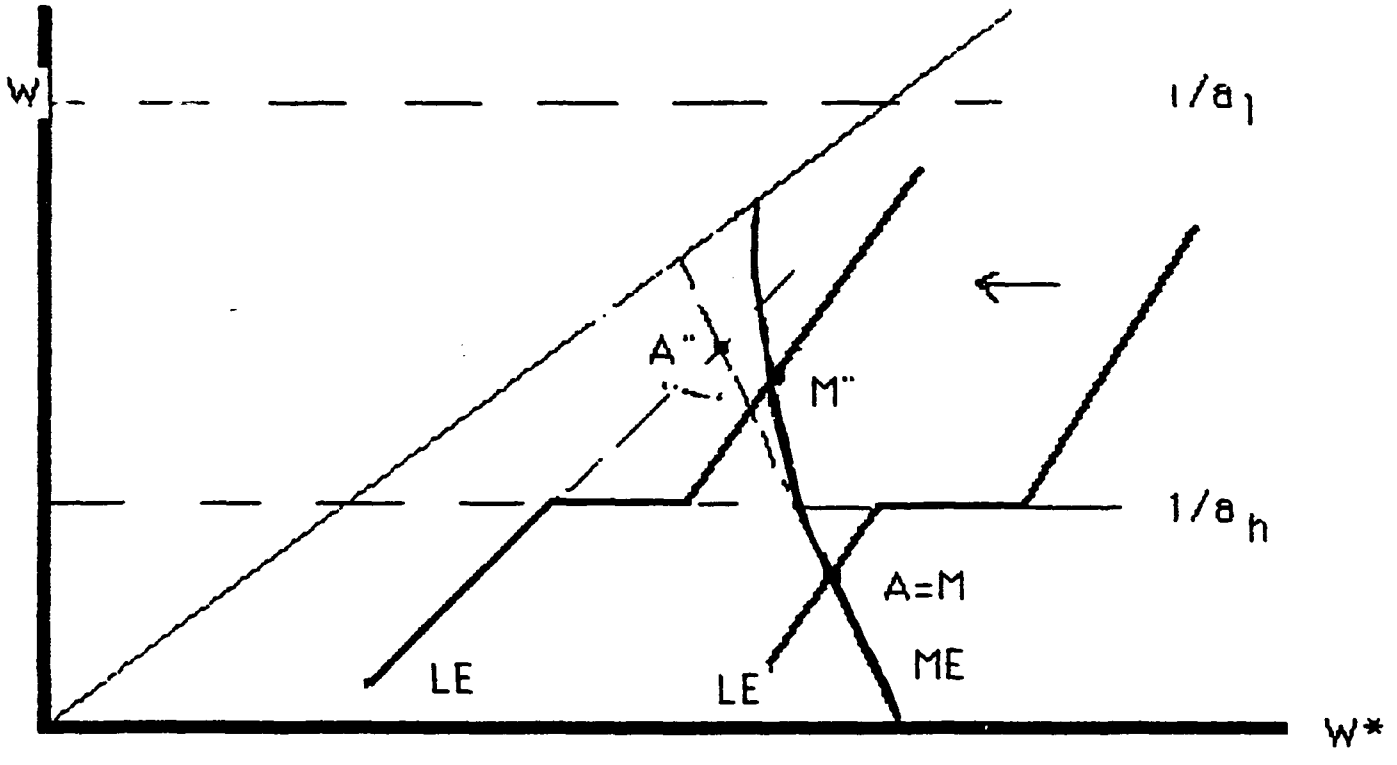


FIGURE 2.2

line. In Figure 2.2, trade will decline and, if the technological dispersion is great enough, firms will begin producing in foreign countries. Even though it appears that trade and direct investment are substitutes, there is no direct relationship between the two. Both are simply reacting to changes in relative endowments.

Ethier's conclusion showing a positive relationship between similarities in relative endowments differs distinctly from previous models of direct investment. Helpman (1984) and Helpman and Krugman (1985) propose that direct investment, like trade, increases with differences in relative endowments. However, their models sought to explain direct investment as a result of these differences, and made the simplifying assumption that firms did not invest to minimize transaction costs or transport costs. In addition, tax advantages from investing overseas were also not considered. First Helpman-Krugman mathematical model will be introduced, and this will be followed by graphical representations.

There are two products, food and manufactured products, that are produced in two countries. For the food industry competitive equilibrium:

2.6 $1=c_y(w_K, w_L)$

where the price of food, which they take to be the numeraire, equals the unit cost of food. Both factor inputs, labor and capital, are employed.

In the manufacturing sector they add one more input. In addition to labor and capital, firms use headquarter services, H. H could be in many forms (R&D, managerial aptitude, distribution mechanics), and can be used in more than one plant. $C^p(w_L,w_K,x,h)$ represents the costs of producing (x) using labor, capital, and a certain amount of H, (h). $C^p(\ )$ is an increasing returns to scale function, and the product can not be produced without (h). The costs associated in producing the right quantity of (h) are represented by $C^h(w_L,w_K,h)$. Thus, the single plant cost function becomes:

2.7 $C(w_L,w_K,x) = \min [C^p(w_L,w_K,x,h) + C^h(w_L,w_K,h)]$

The function has increasing returns to scale properties, and represents costs only for a single-product plant. Helpman and Krugman point out that there are fixed costs, such as producing and adapting (h), that are corporate as opposed to plant burdens. Hechsher-Ohlin theory assumes that factors cannot move between countries. However, Helpman and Krugman propose that (h) can serve plants in more than one country simultaneously. Obviously, a multinationally integrated firm would be much more efficient at employing this factor than an arms-length transaction. They also assume that food production is relatively more labor intensive than manufacturing.

$a_{KX}/a_{LX} > a_{KY}/a_{LY}$

X represents manufacturing output and Y represents food

output. Proceeding further to the aggregate level of an integrated economy, the factor market clearing conditions are:

2.8 $a_{LY}(w_L, w_K)Y + a_{KP}(w_L, w_K, x, h)X + a_{KH}(w_L, w_K, h)H = L$

2.9 $a_{KY}(w_L, w_K)Y + a_{KP}(w_L, w_K, x, h)X + a_{KH}(w_L, w_K, h)H = K$

where X = output of manufactures [(nx) where n = number of corporations]

Y = output of food products

H = headquarter services [(nh) where h = the equilibrium value of h such that overall costs are minimized]

$a_{LY}(\ ) = \delta C_Y(w_L, w_K)/\delta w_l$,the cost minimizing input of factor l per unit of food and $a_{KY}(\ ) = \delta C_Y(\ )$, the cost minimizing input of factor k per unit of food

$a_{KP}(\ ) = [(\delta/\delta w_K)C^P(w_L, w_K, x)/x$, the cost minimizing input of factor i per unit of manufactures

$a_{KH}(\ ) = [(\delta/\delta w_K)C^H(w_L, w_K, h)/h$, the cost minimizing input of factor i per unit of h

Thus, there are three outputs.

Using this modified version of standard H-O-S theory, Helpman and Krugman illustrate their conclusions using an Edgeworth box diagram (Figure 2.3). They first assume a two country world where there are two factors of production, labor and capital. These factors are immobile and are used to produce two products, manufactured goods and food products. Home country (O) manufacturing employment is

Edgeworth box representation of endowments

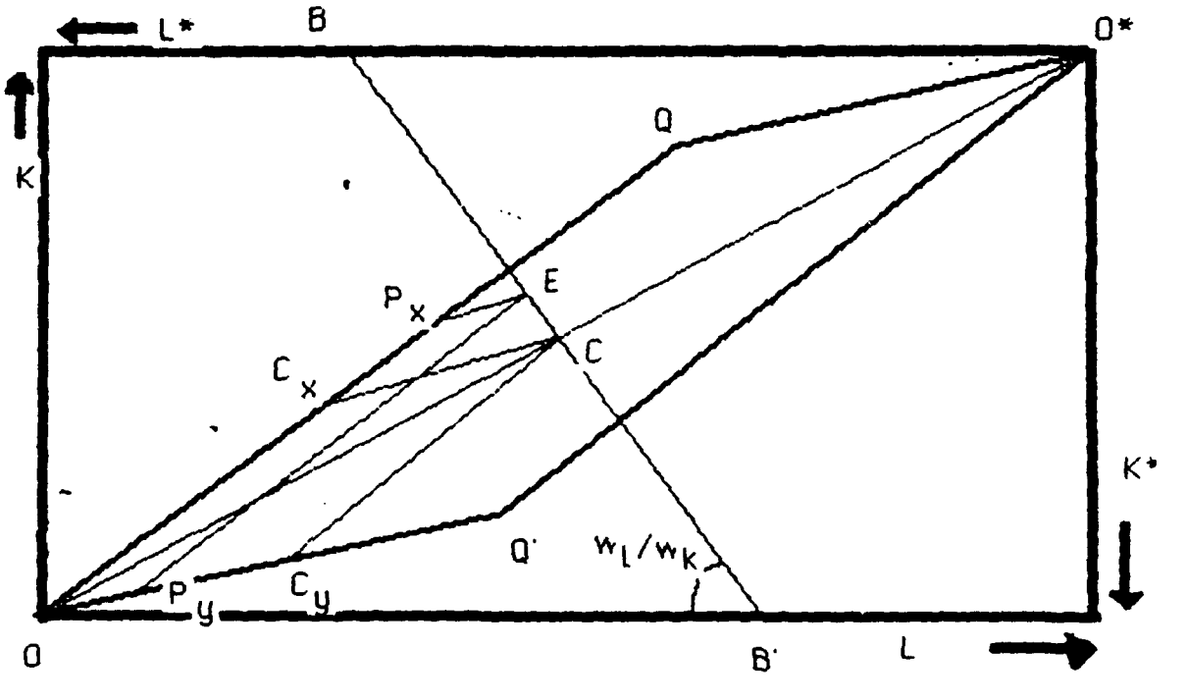


FIGURE 2.3

measured by vector OQ.

Employment in food production, which they model as labor intensive, is represented by vector OQ'. Foreign country O* employment is represented by the inverse vectors. Segment OO* represents equal allocation. They pick a random endowment point (E) above OO* which would make the home country capital intensive. OPx and OPy represent the home country production of food and manufactures. QPx and Q'Py represent foreign country production. A line (BB') is drawn through (E) with a slope of -Wl/Wk which represents the cross country income distribution. OC represents income of the home country and OC' represents the income of the foreign country. Home country consumption of food and manufactures is represented by the vectors OCx and OCy respectively. As the diagram illustrates the home country is an importer of food, and there is no motivation for firms to move out of country to produce. However, if the endowment point was outside OQO*, then factor price equalization would not occur because a country could not completely allocate its resources to these techniques of production. Equilibrium would be reached when all manufacturing was done in the home country or factor prices were equalized. Inside OQO* factor prices are equal.

Helpman and Krugman modify diagram 2.4 with a new output, headquarter services H (equations 2.8-2.9) to create Figure 2.4. The factor price equalization area is

Edgeworth box with direct investment

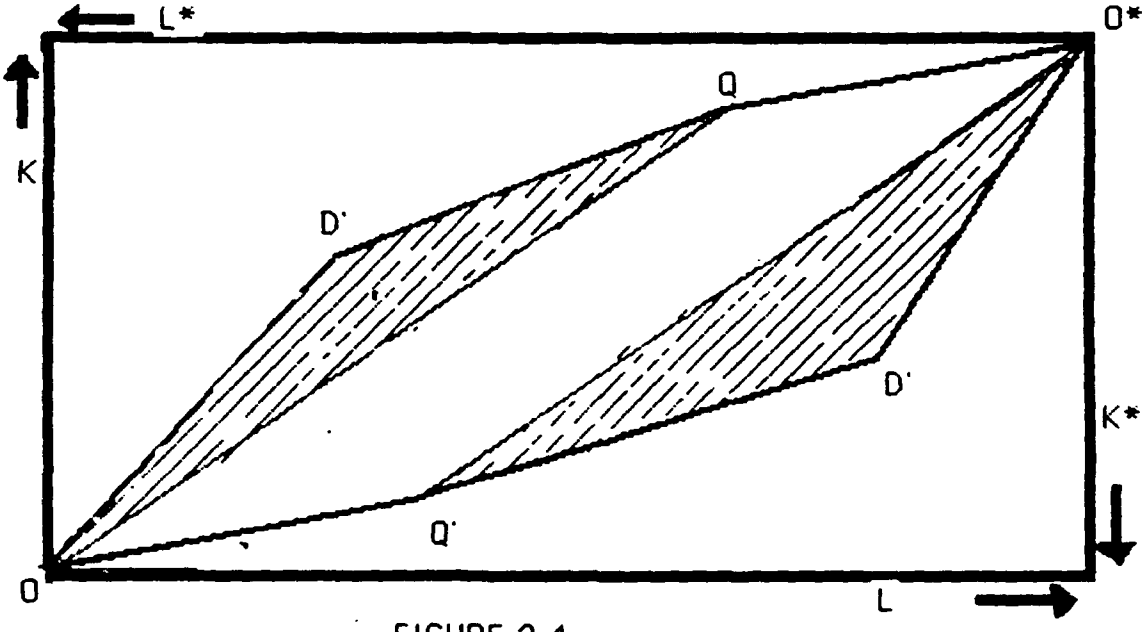


FIGURE 2.4

now expanded by the shaded areas. Since H services are firm specific and not transferred at arms-length, firms must go multinational in order for the shaded area to be entered. Thus, they conclude that trade between countries is not enough to bring about factor price equalization because if the endowment allocation lies outside the parallelogram OQO*Q′, direct investment is necessary for equalization to take place. Their model predicts that large differences in relative endowments (ie. distributions in the shaded area) will bring about a large amount of direct investment.

Helpman and Krugman then expand their model to a more realistic dimension by adding intermediate products and accounting for vertical integration of multinational firms. The beginning cost equation for food production (Equation 2.6) stays the same. Equation 2.7, the total cost function for producing manufactured good (x) becomes:

$$2.10\quad C(w_L,w_K,x) = \min_{h,z}\ [C^P(w_L,w_K,h,z,x) + C^H(w_L,w_K,h) + C^Z(w_L,w_K,h,z)]$$

where Z denotes the intermediate product

There are four products as opposed to three: food, manufactures, headquarter services, and intermediate products, but the integrated equilibrium principles stay the same. The new allocation of resources in intermediate product production further enlarges the endowment set in the Figure 2.4. The new shaded area shown in Figure 2.5 can now be utilized and even greater dissimilarities in endowments

Edgeworth box with vertical integration

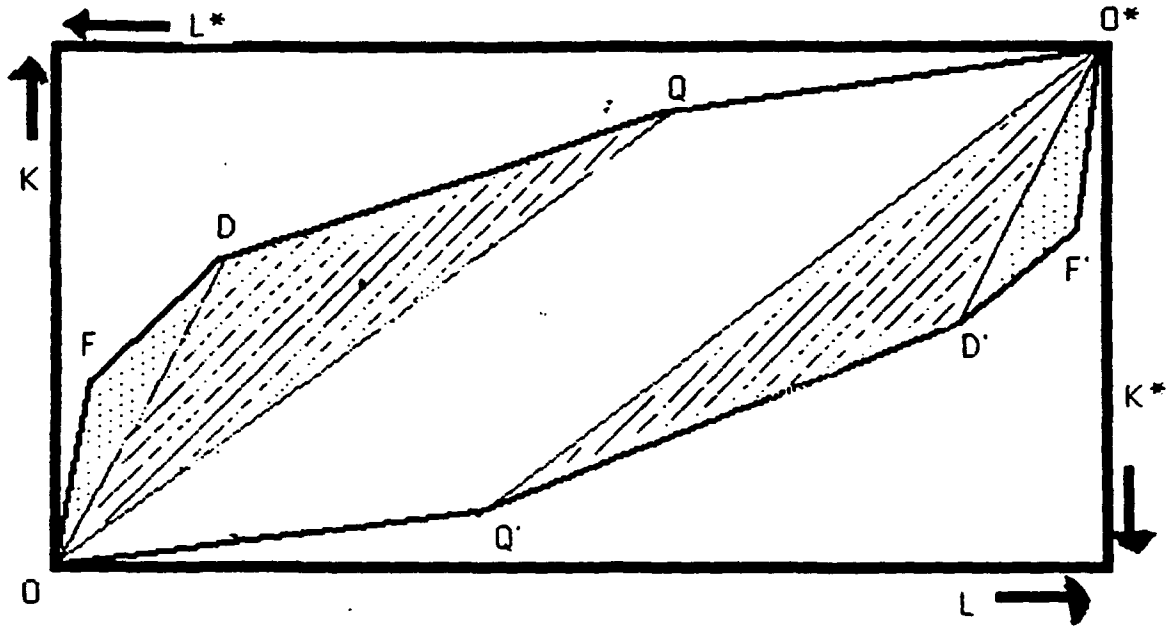


FIGURE 2.5

can still bring about factor-price equalization. However, one critical aspect they neglect are internalization issues.

Kulchycky (1990) analyzed direct investment by looking simultaneously at the internalization and production location decisions. Her analysis integrating these two models improves on the shortcomings of those models which consider only one aspect of direct investment and demonstrates the complexity of the investment decision. She successfully resolved the apparent contradictions concerning relative endowments between the Ethier and Helpman-Krugman models. The word apparent is used because the theories can also be seen as complementary. Each one simply exposes different dimensions of the investment decision. She hypothesized that once the internalization aspect is taken into account and the decision is made, the production location explanation is revealed. By using a partial equilibrium analysis, Kulchycky determined the profit maximizing behavior of multinational firms by incorporating cost functions unique to internalization with traditional production location cost functions. Since most multinationals are also multiproduct firms, she also investigated the effects of non-independent demand curves on internalization and production location. She concluded that complementarity between products magnifies the positive effect of similarities in endowments on internalization and has the opposite effect on locational considerations. In

addition, as distance and underlying transfer costs increase the production of substitutes increases and the production of complements decrease. Thus, distance has a negative effect on internalization and a positive one on location choice. These relationships serve to illuminate the complexities involved in predicting the pattern of investment and the depth of her model.

To test her hypotheses empirically, Kulchycky used data taken from the 1982 Bureau of Economic Analysis survey of U.S. multinationals. She isolated internalization and location choice by making them the dependent variables in separate equations. The focus of her analysis was the role of firm research and development expenditures (reflecting concerns over the public good nature of information) in the internalization decision and differences in relative endowments on both equations.

She also measured the effects of distance, investment incentives, and performance requirements. Distance was found to have a negative effect on internalization and a positive effect on foreign production as predicted. Investment incentives and performance requirements also had effects consistent with what one would assume. Most importantly, similarities in relative endowments and firm R&D were found to have a positive effect on internalization as predicted by Ethier's model. Furthermore, when internalization was assumed in the location choice equation,

differences in relative endowments had the predicted effects of the traditional comparative advantage theories. These results show the importance of internalization as well as the role of relative endowments in predicting the pattern of direct investment.

Many other empirical tests have been performed over the years that have led to a wide range of conclusions. Marvel and Ray(1987) empirically analyzed the pattern of intraindustry trade and found no support for the Helpman-Krugman model. They concluded that improved access to international markets had effects consistent with Ethier's theory. Technology and qualities of the industry product proved to be important factors in an industry's pattern of direct investment.

Swedenborg (1979) conducted a firm level analysis of Swedish multinationals. She found that Swedish MNE's had a high propensity to produce in foreign countries with a wage level more similar to the home country. Her prediction was that host countries with low wages would attract the most investment, and this result was unexpected. In addition, high labor skills had a positive effect on foreign production, but high capital intensity did not. Her conclusion was that Swedish MNE production is intensive in the use of highly skilled labor, and that this was an overriding factor in their investment decision. Again, her results showed no support for the Helpman-Krugman model.

Lipsey, Kravis, and O'Connor (1983), however, found no positive relationship between countries with sophisticated, educated labor and R&D intensive U.S. multinationals. Another important relationship they investigated was the one between firm size and the propensity to invest in foreign countries. They found that size is important, but only as a threshold effect. Once a certain size is reached relative to other firms in a particular industry there is no additional increase in the motivation for foreign investment.

Kulchycky and Lipsey (1984) conducted a study of the overseas operations of U.S. automobile manufacturers, and one important relationship they found was a positive relationship between market size and manufacturing in a foreign country. This tends to support the Ethier model because larger markets can reduce the uncertainties faced by firms. A large market can allow a firm to market on several different levels, choosing the best approach. In small markets, the scope of a firm's experimental base is limited, and it faces more uncertainty.

One important point, however, is that the above models investigate direct investment at a certain point in time. Factor endowments are unvarying. Bowen (1983) shows that relative endowments have changed and have had profound effects on world trade. The United States, he found, fell from first to sixth in the world rankings of capital per

worker from 1963 to 1975. U.S. abundance in skilled labor and arable land increased relative to capital during this period. As a result, Bowen found that U.S. trade became less capital intensive. He concluded that these changes in endowments are an important contributor to the increased competition in manufactures that U.S. firms are facing. This had significant effects on the pattern of trade between countries. This observation will become important later when the effects of changes in country and industry characteristics are considered. I shall expand on Bowen's analysis by extending his conclusions about the pattern of trade to the pattern of direct investment. This will be the first empirical study conducted to take this approach.

CHAPTER THREE

THE MODEL

The issues raised by the Ethier and Helpman-Krugman models will be discussed in this chapter, and a model will be developed to implement their conclusions into an econometric framework. Additionally, the static predictions will be extended to account for changes in the explanatory variables over time. The focus here will be on the seemingly contradictory implications of the two models. Instead of proving one or the other, the two will be integrated. This paper, like Kulchycky's, predicts that each model explains a separate factor of direct investment; and, when integrated, they provide a better prediction of firm behavior than earlier studies. The critical shortcoming of these analyses are their failure to distinguish between pure location choice behavior and pure internalization behavior. Kulchycky used definitions for the dependent variables that allowed for this discrimination to be made. These will be presented later in Chapter 3.

A firm can choose to internalize its activity in a country by either producing in that country or by producing at home and exporting to an affiliate. It is this decision that can be called pure location choice. The variable used to represent the production decision has to control for the internalization decision in order to show the significance of endowments. These definitions will also be presented

later in Chapter 3.

Helpman and Krugman predict that a large difference in relative endowments will positively affect the locational choice decision of MNEs, and this is the expected relationship to be found in this paper. This study assumes that there are basically two measures of endowments used in production, labor and capital. Also, many types of capital are mobile, and including physical capital will probably not show the predicted comparative advantage effect. Labor is viewed as relatively immobile. Thus, skilled and unskilled labor are left. Human capital, represented by the amount of professional and technical workers as a percentage of the economically active population, is used as the only measure of endowments because of its high correlation with capital and unskilled labor. Introducing two of these measures together would introduce an unacceptable degree of multicollinearity. Real Gross Domestic Product per Capita represents an alternate endowment measure but including it in any equation with human capital would also introduce high correlation. In this model, human capital (represented by HK in the equation) is expected to have a positive relationship with the internalization decision and a negative one with the location decision.

It should be mentioned that the amount of human capital a country possesses is not a very relative measure at all. As Kulchycky (1990:p. 94) wrote, a true relative measure

would be the difference between home and foreign country endowments divided by endowments at home. Since one country is the reference (the U.S.), this problem does not exist.

Ethier proposed that the public good nature of information might lead a firm to internalize in order to protect its advantage. Kulchycky used quantities of research and development(R&D) spending to reflect this aspect since firms would want to protect the knowledge generated by this expenditure, and it makes intuitive sense that the level of R&D spending would be positively related to the internalization decision. Firms with low R&D spending would not face the technical dispersion (uncertainty) that Ethier mentions and, thus, would not need to internalize international transactions. However, firms could still be concerned about losing appropriable technology to competitors when producing abroad. This would mean that level of R&D spending would be negatively related to the location decision.

Another salient issue raised by Kulchycky deals with advertising expenditure as a percentage of total firm sales. Distance, language, and cultural barriers increase the difficulty for a firm to rely on a foreign agent for information on market conditions in that country. Thus, marketing a product that is dependent on a large amount of advertising and feedback would tend to "raise the cost of exporting to a foreign distributor relative to establishing

a sales affiliate in that country" (Kulchycky 1990 p. 76). The degree of advertising intensity (INDAD) in an industry as a proxy for uncertainty would postively influence the degree of internalization.

In the production case, however, advertising expense would not represent uncertainty. Instead, we would predict a postive relationship because advertising in foreign markets creates a brand name and because firms often produce in foreign markets in order to adjust the product to receive the benefits of its advertising there.

Kulchycky included performance requirements and investment incentives in her model and showed that they had important effects on a firms behavior. The environment in foreign markets obviously changes over time with shifting political behavior, and changes in both investment incentives and performance requirements should be taken into account.

However, performance requirement and investment incentive data was not available for this study. For 1989, a measure of country "openness" was used in order to reflect government regulation. This measure (OPEN) came from trade intensity ratios (exports plus imports divided by GNP) calculated by Leamer (1982). The relationship between direct investment and openness might be negative because firms invest in order to bypass tariff walls, or it might be positive because heavy governmental regulation discourages

firms from investing in that country.

Distance (DIST) accounts for some degree of transfer costs. A firm is less likely to purely internalize because of transfer costs resulting from distance. The relationship between distance and location choice is more ambiguous and lies in the relationship between products (Kulchycky 1990:p.81). Cultural proximity would probably be a better proxy given the advances that have been made in transportation and communication technology throughout the world. However, values would have to be arbitrarily defined and assigned. Such a method would not retain very much credibility.

One important variable mentioned by Swedenborg (1979) et al. that leads to many firm-specific advantages is firm size (TASS). Administration, research and development, and advertising are all positively related to the size of the firm. Thus, firm size can be considered a proxy for many other aspects. As Lipsey, Kravis, and O'Connor (1983) found, firm size could only be important as a threshold affect. This study sticks with the simple prediction, however, and proposes that the size of firms will have positive effect on both decisions.

Industrial organization theory tells us that industry composition could lead to behaviorial variations between industries. Oligopolistic industries have different operating characteristics than perfectly competitive

industries. Thus, it will be important to allow for some description of market structure. A concentration ratio of assets of the four largest firms to total industry assets will be used. Because of their size, lack of competition, or age, an oligopolistic industry that consists of a few large firms may possess a greater degree of direct investment. On the other hand, a competitive industry may drive more firms to overseas markets. The relationship is uncertain. Likewise, a positive or negative change in this ratio also will have uncertain effects. CONCRAT will represent this ratio in the equations below.

In order to take into account firm learning curves, a proxy for an industry's investing experience will be included. The ratio of overseas investment to domestic assets would be a good proxy for the amount of experience the industry has investing overseas as well as the international orientation of that industry. PINV (propensity to invest) will represent this ratio.

The framework has now been laid for the establishment of the basic propositions of our model. Equations 3.1-3.4 represent the basic premises of the static model.

3.1 INT=F1(UNCERTAINTY,RE)

3.2 INTEX=F2(UNCERTAINTY,RE)

3.3 PROD=F3(RE,SZ)

3.4 PRODUNC=F4(RE,SZ)

Once again, the proxies for uncertainty are advertising

expenditure and research and development spending, and the proxy for relative endowments is human capital. Expanding the above equations to include these and all hypothesized explanatory variables, we obtain the following equations (the expected relationships are annotated underneath):

INTERNALIZATION INTENSITY

3.5 INTERN=F5(HK,R&D,TASS,GDP,INDAD,PINV,CONCRAT,OPEN,DIST)
+ + ? + + + ? ? -

3.6

INTERNEX=F6(HK,R&D,TASS,GDP,INDAD,PINV,CONCRAT,OPEN,DIST)
+ + ? + + + ? ? -

LOCATION CHOICE

3.7 PROD=F7(HK,R&D,TASS,GDP,INDAD, PINV,CONCRAT,OPEN,DIST)
- ? + + ? + ? ? +

3.8

PRODUNC=F8(HK,R&D,TASS,GDP,INDAD,PINV,CONCRAT,OPEN,DIST)
+ ? + + ? + ? ? +

The above propositions will now be summarized. Direct investment can be considered to consist of two separate components: internalization and location choice. Each one can be shown to affect direct investment in a different way, and the pattern of investment cannot be explained without taking both into account. Based on the previous arguments from earlier chapters, the proxy for relative endowments (HK) can be expected to have a positive effect on the degree of internalization intensity and a negative effect on location choice. RD, which represents the degree of uncertainty faced by firms, should positively affect

internalization, but its affects on production abroad are ambiguous.

In order to lend additional support to the proposed results, two different measures of internalization were tested. The first, INTERN, measured absolute internalization intensity (total affiliate sales as a percentage of total industry activity in that country). INTERNEX measures an industry's internalized level of exports (exports to affiliates in a country as a percentage of total exports). For location choice, two measures were also used. PROD represents production activity as a percentage of affiliate sales (total affiliate sales net of imports from the U.S. divided by affiliate sales). The second measure, PRODUNC, looks at production as a percentage of total industry sales (affiliate sales net of imports divided by the sum of affiliate sales and all other industry activity in that country). Because PROD takes into account the issues that affect internalization intensity, it is expected to be related to comparative advantage motivations for direct investment. Based on the proposition that internalization needs to be controlled for in order to explain the pattern of direct investment, PRODUNC, which does not control for these factors, should not show a positive relation to relative endowments. PROD, on the other hand, should be negatively related to similarities in endowments.

By using several different functional forms of the basic equations, different relations other than linear could be estimated. Consistent results could lend further support to the linear observations previously obtained. Quadratic and log-linear estimation could be used in addition to a linear model. As an example,

LINEAR $INTERN = \beta_0 + \beta_1 HK + \beta_2 RD + \beta_3 TASS + \beta_4 GDP + \beta_5 DIST$

QUADRATIC $INTERN = \beta_0 + \beta_1 HK + \beta_2 HK^2 + \beta_3 RD + \beta_4 RD^2 + \beta_5 TASS + \beta_6 TASS^2 + \beta_7 GDP + \beta_8 GDP^2 \beta_9 DIST + \beta_{10} DIST^2$

LOG-LINEAR $LN(INTERN) = \beta_0 + \beta_1 LN(HK) + \beta_2 LN(RD) + \beta_3 LN(TASS) + \beta_4 LN(GDP) + \beta_5 LN(DIST)$

Now that we the basis has been laid for the static model to test Kulchycky's result, a simple dynamic model can be formulated. Borrowing the Edgeworth box representation from Helpman and Krugman and the method from Kulchycky, we show in Figure 3.1 how changing relative endowments affect the amount of direct investment. OF represents the employment in the capital intensive headquarters service sector in the home country. FD represents employment in the intermediate product sector, and DQ represents employment in the most labor intensive finished products sector. For one endowment allocation at time (t-1) the intermediate product employment of subsidiaries overseas is represented by vector EE_M. As endowments change and become more dissimilar (in

Changing relative endowments

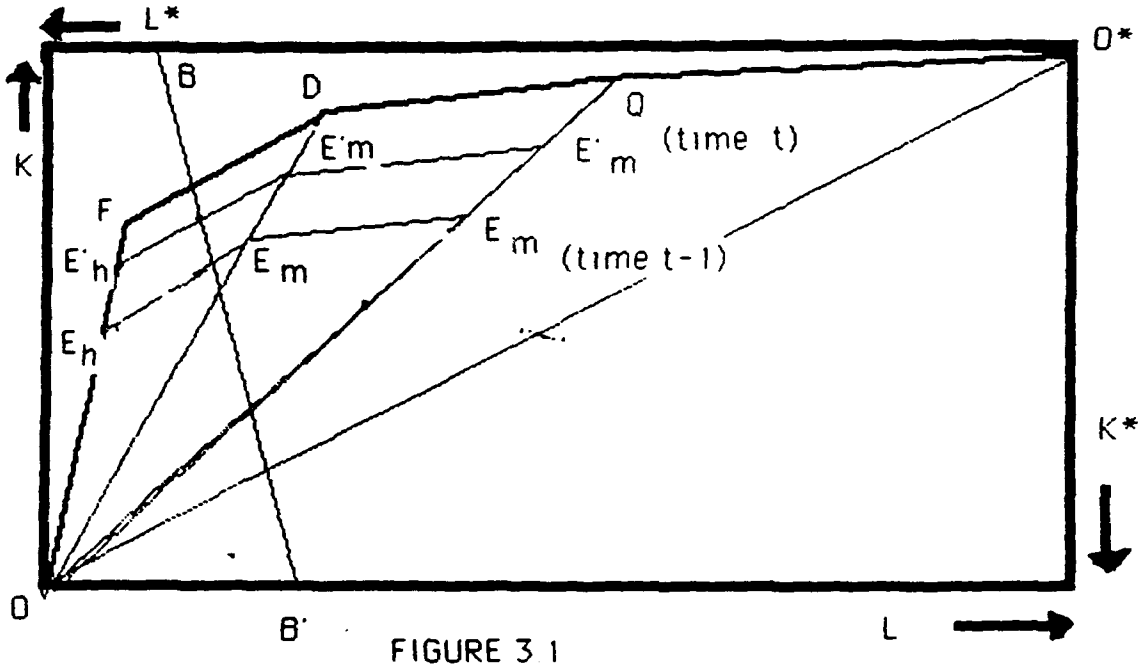


FIGURE 3.1

this case expand outward along BB), the employment by multinationals in intermediate products expands to $E'E'_M$. Whether parent firms add more production facilities or employ more in their present facilities, direct investment increases as endowments become less similar. From a factor price equalization standpoint this makes sense because as factor endowments become more different, the gap between factor prices becomes greater, and one country becomes more attractive for investment. This greater amount of investment is necessary to help bring about factor price equalization. In terms of the model, the change in production activity (PROD3) would be negatively related to a change in our proxy for endowments (HK3). Along these same lines, if INTERN is positively related to HK and RD, a change in INTERN would be positively related to changes in RD and HK. The same type of reasoning can be applied to the other variables. Transforming Equations 3.5-3.8 to reflect changes we now have:

3.9 $INTERN_t - INTERN_{t-1} = F10[(RD_t - RD_{t-1}), (TASS_t - TASS_{t-1}), (HK_t - HK_{t-1}), (GDP_t - GDP_{t-1}), (INDAD_t - INDAD_{t-1}), (CONCRAT_t - CONCRAT_{t-1})]$

3.10 $INTERNEX_t - INTERNEX_{t-1} = F11[(RD_t - RD_{t-1}), (TASS_t - TASS_{t-1}), (HK_t - HK_{t-1}), (GDP_t - GDP_{t-1}), (INDAD_t - INDAD_{t-1}), (CONCRAT_t - CONCRAT_{t-1})]$

3.11 $PROD_t - PROD_{t-1} = F12[(RD_t - RD_{t-1}), (TASS_t - TASS_{t-1}), (HK_t - HK_{t-1}), (GDP_t - GDP_{t-1}), (INDAD_t - INDAD_{t-1}),$

$(CONCRAT_t - CONCRAT_{t-1})]$

3.12 $PRODUNC_t - PRODUNC_{t-1} = F13[(RD_t - RD_{t-1}), (TASS_t - TASS_{t-1}),$

$(HK_t - HK_{t-1}), (GDP_t - GDP_{t-1}), (INDAD_t - INDAD_{t-1}),$

$(CONCRAT_t - CONCRAT_{t-1})]$

The changes in internalization intensity should be positively related to changes in research and development, relative endowments, gross domestic product, and advertising expenditure. However, effects of changes in industry concentration ratio and firm assets are uncertain. Changes in production activity should be negatively related to changes in relative endowments. Effects of changes in industry concentration ratio, advertising, and R&D are uncertain, and changes in firm assets, gross domestic product should have a complementary relationship with changes in production intensity. OPEN was not included because values for this measure were not available for 1966. PINV was not included because, PINV for 1989 was calculated by dividing assets of affiliates overseas by domestic assets, and PINV for 1966 was calculated by dividing the industry's position overseas (assets controlled by parents net of parent assets controlled by affiliates) by the industry's domestic assets. The figure for majority-owned affiliate assets for 1966 was not available. Thus, even though they both measure roughly the same thing, they are not the same ratios. Subtracting one from the other and using this change in the estimations would be misleading.

TABLE 1

VARIABLE DEFINITIONS

INTERN	Internalization intensity = (the sum of total affiliate sales of industry i in country j/ (affiliate sales of industry i in country j + the sum of industry i exports to unaffiliated foreigners in country j))*100
INTERNEX	Export internalization intensity = (Industry i exports to affiliates in country j/ total exports to country j)*100
PROD	Production intensity = (the sum of affiliate sales of industry i in country j net of imports from the U.S./the sum of total affiliate sales of industry i in country j)*100
PRODUNC	"Unconstrained" production intensity = (affiliate sales net of imports from the U.S. / (the sum of total affiliate sales of industry i in country j + industry i exports to unaffiliated foreigners in country j))*100
RD	research and development = total industry expenditures on research and development/ total industry assets
TASS	Mean firm assets ($mill) = total parent assets of industry/total numbers of industry parents reporting
HK	Professional and technical workers as a percentage of the economically active population
GDP	Real Gross Domestic Product ($mill) of country j expressed in dollars
DIST	Distance from the U.S.
INDAD	Industry advertising expense expressed as a percentage of total industry assets (average firm advertising expense * number of firms/ total assets of industry)
PINV	Propensity to invest overseas or the international orientation of the industry (assets overseas/total assets)

TABLE 1 (cont'd)

VARIABLE DEFINITIONS

OPEN	Value to describe a country's "openness" includes tarriff and non-tarriff barriers values calculated by E. Leamer from trade intensity ratios (exports + imports/ GNP)
CONCRAT	Concentration ratio (assets of top four firms in the industry/ total industry assets)
DIST squared	DIST * DIST
RD squared	RD * RD
HK squared	HK * HK
TASS squared	TASS * TASS
GDP squared	GDP * GDP
OPEN squared	OPEN * OPEN
CONCRAT squared	CONCRAT * CONCRAT
PINV squared	PINV * PINV
INTERN3	1989 value for INTERN - 1966 value for INTERN
PROD3	1989 value for PROD - 1966 value for PROD
INTERNEX3	1989 value for INTERNEX - 1966 value for INTERNEX
PRODUNC3	1989 value for PRODUNC - 1966 value for PRODUNC
RD3	1989 value for RD - 1966 value for RD
TASS3	1989 value for TASS - 1966 value for TASS
GDP3	1989 value for GDP - 1966 value for GDP
HK3	1989 value for HK - 1966 value for HK
CONCRAT3	1989 value for CONCRAT - 1966 value for CONCRAT
INDAD3	1989 value for INDAD - 1966 value for INDAD

CHAPTER 4

DATA DESCRIPTION

The main source for 1966 industry level data was U.S. Direct Investment Abroad, 1966 which was published by the Bureau of Economic Analysis (B.E.A.) of the U.S. Department of Commerce. Questionnaires were mailed to 7,500 possible U.S. reporters. The responses of about 3,400 contained suitable direct investment interests. Form BE-10A was used to report U.S. parent information, and Form BE-10B was used to report affiliate information. Both minority and majority-owned affiliate information was provided, but only majority-owned affiliates were utilized in this because of data availability. Industry level data was classified by the industry of the reporting parent using Standard Industry Classification (SIC). Data was obtained for sales of majority-owned affiliates, research and development costs for U.S. parents, assets of U.S. parents, total number of U.S. parents in each industry, exports from U.S. parents to affiliated foreigners, exports from U.S. parents to unaffiliated foreigners, and the direct investment position overseas for U.S. parents. Values for thirty-five countries and seven manufacturing industries were available. Those industries were food products, chemical products, primary and fabricated metals, machinery, transportation equipment, other manufacturing, and transportation, communication, and public utilities. The data was not complete, however,

because all tables were screened to prevent disclosure of data for individual U.S. reporters. This means that when only one firm from a given industry invested in a country, that value was not printed in order that the individual firm's position not be made public. In addition, values less than $500,000 were not included. As a result, there were many missing values. Professional and technical workers as a percentage of the economically active population was taken from the Yearbook of Labour Statistics for a range of years from 1960-1966. This range was chosen because very little of the human capital data was actually collected for the year 1966 itself. Since a variable such as HK would not change very much over the narrow range of years chosen, this would not affect the results. By collecting for a range of years, human capital for many more countries could be used. The distance measurements were generously provided by Assistant Professor Kulchycky. Gross Domestic Product for each of the thirty-five countries was obtained from the International Bank 1991 World Development Report. Concentration ratio and advertising expense as industry characteristics were obtained from Compustat, a computer database of American companies compiled and updated by Standard and Poors. The earliest year that advertising information was available from this source was 1973. Unskilled labor, included originally but later withdrawn because of high collinearity, was proxied as (1 - literacy

rate). This is the proxy that Bowen used in Sources of International Comparative Advantage. Literacy rate data was taken from World Tables 1976 and World Resources.

The main source for the 1989 industry level data was U.S. Direct Investment Abroad, 1989, which had not been distributed to the public by the time this study was being written. Approximately 2,200 parents and 18,000 affiliates were included. Essentially the same methodology as the 1966 survey was used. Forms BE-10A and BE-10B were used. The data used represents majority owned non-bank affiliates. Data for research and development expenditures of parents, the number of parents, number of affiliates, assets of parents, and assets of affiliates was generously provided by Mr. Jeff Lowe of the Commerce Department. One important industry that was not available in the 1966 data but was available for the 1989 data was electric and electronic equipment. It was simply not included for the 1966 and change over time regressions but was included for the 1989 regressions. Tables for affiliate sales, exports to unaffiliated foreigners, and exports to affiliates were generated by Mr. Arnold Gilbert. Often times the affiliate and the parent may be classified in completely different industries, so all data was sorted once again by industry of the U.S. parent in order to provide consistency. Once again, however, the data was suppressed in certain cases to prevent disclosure of data for individual U.S. reporters.

Values between $-500,000 and $500,000 were also not included. Professional and technical workers as a percentage of the economically active population was once again taken from the Yearbook of Labour Statistics for the range of years from 1980-1986. Once again, this was the only way to collect a sufficient amount of human capital figures, and it is reasonable to expect that changes over this narrow range of years are insignificant. For Switzerland, Italy, Argentina, Colombia, Mexico, Bahamas, Bermuda, and Indonesia, values in that range of years were not available so they were interpolated from estimates made by Leamer and Bowen. Gross Domestic Product for each of the thirty-five countries was obtained from the 1991 World Development Report. Concentration ratio data was obtained from Compustat. Advertising data was also taken off of Compustat for the year 1989. Leamer's measure of openness for 1982 was taken from Trade Policy Issues and Empirical Analysis published by the National Bureau of Economic Research.

Because of the various suppressions for each variable that were placed in order to protect individual firm information, a complete set of observations was only available for about 50-60 percent of the data in each year. However, missing observations were consistently random across all countries, this should not affect the results.

TABLE 2

VARIABLE MEANS

VARIABLE	MEAN	STANDARD DEVIATION
YEAR:1989		
INTERN	76.1	27.63
INTERNEX	30.49	24.51
PROD	90.34	10.15
PRODUNC	68.46	28.29
RD	.035	.019
TASS	2044.90	1713.10
HK	11.19	4.83
GDP	331145.32	558756.47
INDAD	.041	.019
DIST	4056.08	1906.89
CONCRAT	33.07	13.83
OPEN	.97	.13
YEAR:1966		
INTERN	74.72	30.56
INTERNEX	33.94	26.54
PROD	89.83	11.98
PRODUNC	66.73	29.61
RD	.029	.022
TASS	198.45	150.50
HK	6.46	3.57
GDP	24865.15	31352.53

TABLE 2 (cont'd)

VARIABLE MEANS

1966:

VARIABLE	MEAN	STANDARD DEVIATION
CONCRAT	33.5	10.49
INDAD	37.71	28.67
DIST	4085.69	1913.75
PERIOD:1989-1966		
INTERN3	-.64	13.29
INTERNEX3	-1.56	26.95
PROD3	-1.44	8.59
PRODUNC3	-1.51	13.85
RD3	.0015	.0052
TASS3	1758.4	1393.5
HK3	4.81	2.12
GDP3	355457.14	526352.38
INDAD3	-46.94	26.87
CONCRAT3	-3.51	10.50

CHAPTER 5

THE RESULTS:

A CROSS SECTIONAL ANALYSIS OF INDUSTRY AND HOST-COUNTRY EFFECTS ON U.S. DIRECT INVESTMENT

Tables 3 - 20 show the results of ordinary least square estimations for the proposed models. Data for 1989 and 1966 was tested first to reaffirm Kulchycky's results as well as to examine the effects of new variables that she did not include. Some differences in results would be expected because she used individual firm data, and this study uses very aggregate level data with missing observations. The effects of changes in the specified independent variables were examined next. Ordinary least squares estimation was used, and the t-statistic presented in the parenthesis is for the two-tailed, null hypothesis (β=0). Given the data problems encountered, the results are remarkably consistent with the predictions of the model presented in Chapter 3. The principle hypotheses being tested are the predictions of the Ethier and Helpman-Krugman models, and the role each plays in explaining the direct investment decision.

Now the problem of heteroskedasticity will be addressed. Given the basic regression equation:

4.1 $Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \epsilon_i$

The variance of a homoskedastic equation is given by:

4.2 $VAR(\epsilon_i) = \sigma_i^2$ $(i = 1,2,....,n)$

However, in a heteroskedastic equation the error term is related to some variable which may or may not be one already included in the equation such that:

4.3 $VAR(\epsilon_i) = \sigma^2 Z_i^2$

The estimates in Tables 3 - 20, were corrected for heteroskedasticity using weighted least squares. This involves dividing the equation by the proportionality factor Z:

4.4 $Y/Z = \beta_0 + \beta_1 X_1/Z + \beta_2 X_2/Z + u$

where u is now the error term.

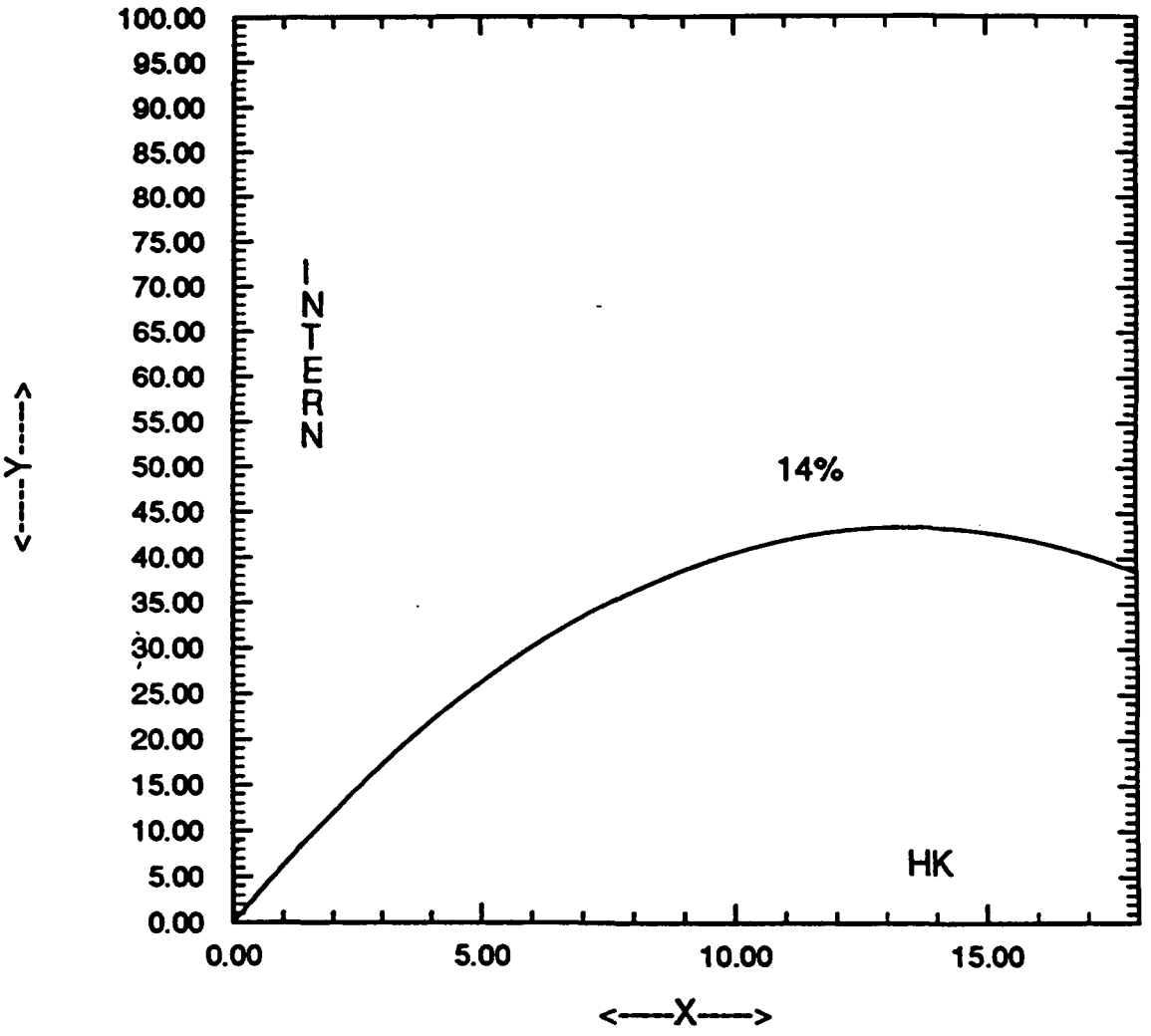
We hypothesized that there is a positive relationship of the form expressed in equation 4.3 between Gross Domestic Product and the variance in the error term. The data was tested and found to contain heteroskedasticity using the White (1980) method. A direct relationship between Gross Domestic Product and the error term was expected because larger markets would have greater differences in direct investment, and the variance in the error term would be larger.

First the regressions for 1989 will be discussed. Table 3 presents the results for linear and quadratic estimations for the dependent variable INTERN (defined as of total activity). Since no a priori expectations about the relationship between dependent and independent variables were formed, the several functional forms discussed in Chapter 3 were investigated. A positive and significant

quadratic relationship was found between relative endowments and internalization intensity. This was consistently discovered for both measures of internalization intensity INTERN and INTERNEX (internalized exports as a percentage of total exports) in Tables 3 and 5. A linear relationship was also shown for INTERNEX. Log-linear estimations also showed this result (Tables 4 and 6). For the quadratic relations, the second squared value is negative and significant. However, 90% of the values of HK lie in the positive range. The point where the sign changes is at a value of approximately 14%, which is the close to the endowment of the United States (Figure 5.1). Starting from zero, as country HK endowments become more similar to that of the U.S. the relationship is positive. As they go past this point and become more dissimilar the relationship becomes negative. These results concur with the hypotheses based on Ethier's model presented in Chapter 3. As endowments become more similar the amount of internalization increases.

The other important hypothesis presented based on Ethier's model was that internalization intensity is positively related to the degree of uncertainty. Our proxies for uncertainty, research and development expense and advertising expense, proved to be positive and significant over all functional forms estimated (Tables 3,4,5,6).[1] Thus, as uncertainty increases firms are more inclined to internalize, as Ethier predicted.

Relationship between HK and INTERN



The other hypothesis drawn from Kulchycky holds that once internalization is held constant, comparative advantage motivations predicted by Helpman-Krugman will become evident. The location choice variable PROD (production activity as a percentage of affiliate sales) controlled for the internalization decision. As expected, the relationship between the proxy for relative endowments and the location choice variable was significant and negative (Table 7). The quadratic specification supports the conclusions of Helpman and Krugman in that as endowments become more similar the relationship is negative. At the inflection point around the U.S.'s endowment value the relationship becomes positive again as they become more dissimilar.

The second measure of production activity, PRODUNC (production activity as a percentage of total firm activity in that country) did not control for internalization. Thus, the comparative advantage motivations for direct investment were not expected to be evident. As Tables 8 and 9 show, the relationship between HK and PRODUNC is positive and significant across all functional forms that were estimated. Moreover, the unconstrained production variable does not show comparative advantage results, further providing support that it is controlling for internalization which allows us to finally be able to observe the comparative advantage relationship. The quadratic

relationships are increasing for about 90% of the HK values, and the decreasing portion is consistent with the reasoning presented for INTERN (Figure 5.1). This supports the view that, as Kulchycky proposed, there are two distinct components of direct investment that can be observed by holding one constant.

The Ethier and Helpman-Krugman models provide no guidance as to the relationship between research and development and production variables because it does not function as an uncertainty proxy in the location choice equations. Research and development was included to examine the proposition in Chapter 3 that firms are concerned about the appropriability of technology when producing abroad. Kulchycky found a negative relationship and proposed that this might be the result of a concern over "leakage" of technology in foreign production locations. For PROD a negative and significant relationship was found. For PRODUNC the coefficient was positive but not significant.

As predicted, advertising expense (as a proxy for uncertainty) showed a positive and significant relationship with both internalization variables.

Advertising expense also showed a positive and significant relationship with PROD and PRODUNC. Audretsch and Yamawaki (1988) showed a positive relationship between advertising expense and the balance of trade between Japan

and the U.S.. They suggested that this could reflect the uncertainty when entering a new market. In the production case, however, advertising does not reflect uncertainty. Instead, we see this positive relationship because advertising develops a brand name and firms may need to produce abroad to adjust the product in order to get the benefits from advertising it in that market.

It seems to be evident, then, that in the internalization case RD and INDAD (advertising expense) are proxies for the same parameter, and this is why they have the same sign. However, in the production location case, they represent different issues. INDAD is a proxy for marketing considerations, and RD is a proxy for concerns over leakages in technology.

Now the other explanatory traditional variables for internalization decision will be examined. TASS (average parent firm assets) was found in all cases except the log-linear estimation of INTERN to be negative and significant. This is contrary to our simple prediction in Chapter 3 that bigger firms have greater activity abroad. Lipsey, Kravis, and O'Connor (1983) suggest that firm size might be important only as a threshold effect. In other words, once a firm reaches a certain size it will invest, but after that any increases could be a hindrance because of administrative and organizational inefficiencies caused by size. The value negative coefficients for INTERN in this study and also in

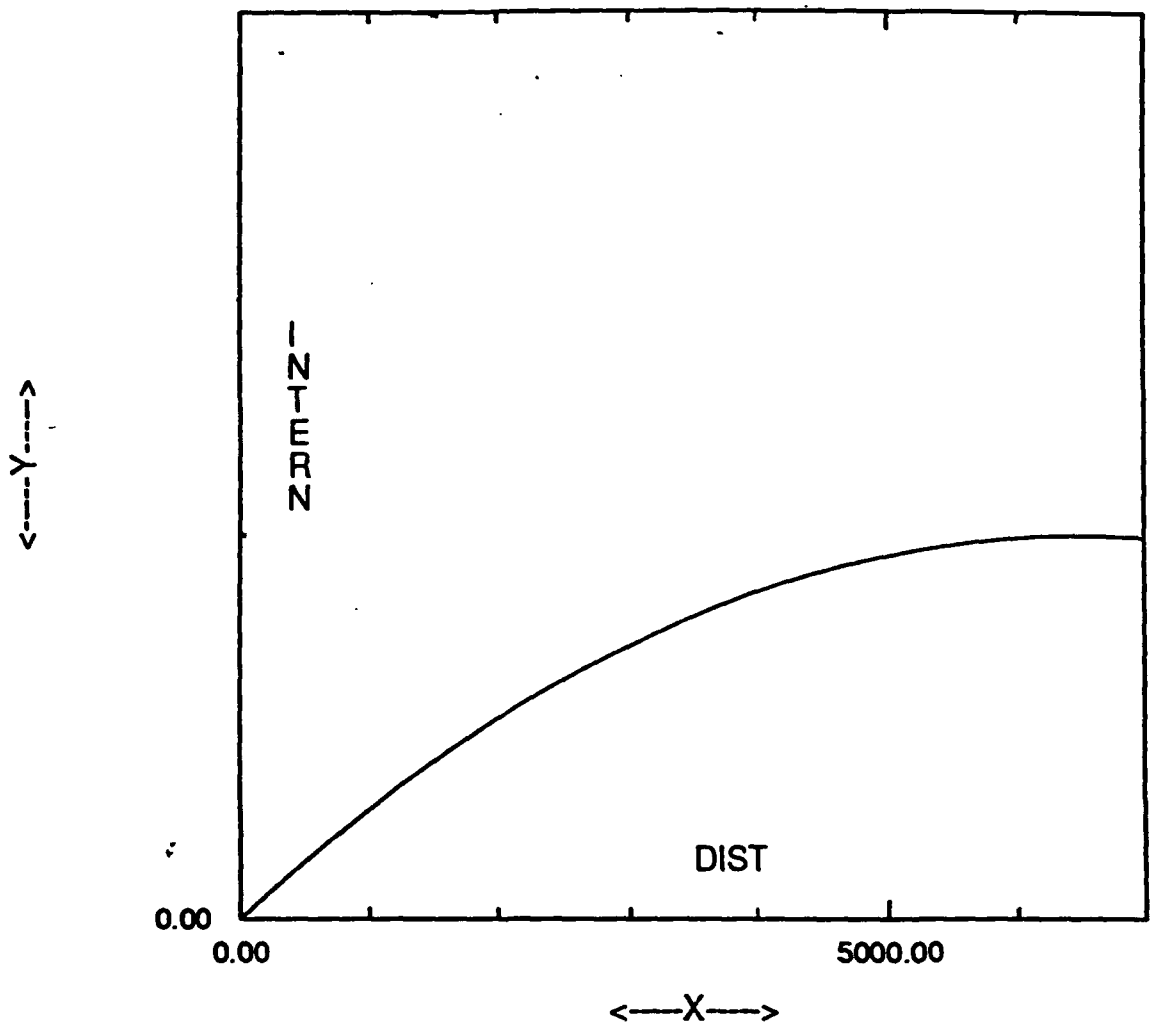
Kulchycky's study seem to lend support to this.

For PROD and PRODUNC, the relationship with TASS was positive and significant. This is the traditional relationship that was found in most earlier studies. Kulchycky's estimations for 1982 also provide this result. Swedenborg (1979) suggested that firm size could be a proxy for many things. Bigger firms may be able to borrow more money at a lower cost or operate at a lower cost by spreading risk. In addition, there could be increasing returns to scale in management, research and development spending, and advertising.

GDP (gross domestic product of the country being invested in) was a proxy for market size. It was predicted that larger markets attracted more direct investment activity including both production and internalization. However, no consistent relationship was found for the internalization or location choice estimations.

The variable DIST (distance from the U.S.) had negative effects on INTERNEX and INTERN which is consistent with the prediction that transaction costs increase with distance, and discourage internalization. The quadratic relationship investigated for INTERN (Table 3, Column 4) is curious. Even though the DIST coefficient is positive, this relationship occurs for only about 25% of the values for distance. This is shown in Figure 5.2. Over the rest of the range the relationship is negative and significant as a

Relationship between DIST and INTERN



result of the negative second order coefficient. By making the relationship quadratic, the significance greatly increased which suggests the relationship between transfer costs and internalization is not linear. This is consistent once again with Kulchycky's empirical work and standard predictions.

For PROD, Kulchycky found distance to be positive and significant which reflects the relationship between costs and transporting materials over distances. In this study the distance parameter was also found to be positive and significant. For PRODUNC, DIST was not significant in the linear form and negative and significant in the log-linear form. This negative sign could be the result of the internalization effects in the unconstrained production variable.

Variables not included in Kulchycky's work but tested here included PINV (the multinational nature of the industry), CONCRAT (the industry concentration ratio), and OPEN (openness of a country). The amount an industry has invested overseas is a proxy for the propensity of the industry to invest overseas; this also might be a proxy for the experience firms in that industry have in international investment because building assets overseas takes time. It should indicate how low on the learning curve the industry is. Even new entrants might be more likely to invest abroad if fellow firms have a broad history of experience on which

to draw. It is intuitively obvious, then, that PINV should have a positive relationship with INTERN and INTERNEX. Except for low significance in the linear estimation of INTERN, this term was positive and significant across all functional forms estimated. It was also positive and significant for all forms in the PROD and PRODUNC estimations.

The predictions for the effects of CONCRAT were uncertain. On one hand, competitiveness in an industry could drive firms to other markets. On the other hand, market power in an industry could allow firms to free up money to invest overseas. Except for the log-linear estimations of INTERN and the linear estimation of PROD where the relationship was negative and significant, the internalization regressions and location choice regressions showed no clear relationship.

The relationship of openness of a country to internalization and production was uncertain. Government regulation could encourage firms to invest in order to avoid tariff walls, or it could discourage firms because they do no not want the intrusion. Our proxy for government regulation and intervention had many shortcomings in that it did not actually measure specific investment incentives and performance requirements. Data of this type was not available for this study. A positive relationship was found for all forms of INTERN, INTERNEX, and PRODUNC although not

always significant. The PROD estimations produced no significant coefficients for OPEN. Interestingly, the adjusted R^2's for INTERN, INTERNEX, and PRODUNC are very high given that the data covers all manufacturing industries. For PROD, the R^2's were lower but still satisfactory.

So far Kulchycky's results for 1982 have been reaffirmed for 1989. There seems to be two distinct components to direct investment that are supported by the conclusions of the Ethier and Helpman-Krugman models. In order for comparative advantage motivations in direct investment to be evident, internalization has to be controlled for. This points to the central role that the internalization decision plays in investment behavior. New variables in addition to the traditional explanatory variables were tested and, with the exception of concentration ratio, found to have the predicted significant effects. The next step was to test data for 1966.

Tables 11-14 show the OLS estimation results for the two internalization measures. Once again the proxies for uncertainty, RD and INDAD, were positively and significantly related to internalization intensity across all functional forms estimated. Relative endowments, as represented by human capital, were positively related to both measures of internalization, also. As in 1989, the second order quadratic term was negative and significant (Table 10,

Column 2 and Table 12, Columns 2 and 3), but of the thirty-five countries only the value for Sweden's human capital fell in the negative portion. Further support for Ethier's model is lent by the fact that as endowments grow more similar up to a point close to the U.S. endowment figure the relationship is positive, and then at that point it becomes negative as endowments grow more dissimilar.

Unconstrained production, PRODUNC, was not expected to show a comparative advantage motivation, and in both the linear and log-linear cases the coefficient was positive and significant. PROD (location choice where internalization is controlled for) estimations did not, however, show the predicted relationship between HK and PROD. In two cases, the coefficient was not significant. Even though the second order term was negative only Sweden fell in this range (HK > 11). It was also positive and signficant in Column 2. This is inconsistent with the predictions of the Helpman and Krugman model.

There are several plausible explanations for this phenomena. Industry level data, as opposed to firm level data, has many limitations, and there were many missing observations due to confidentiality. Also, Kulchycky writes that product and firm characteristics that are critical to examining international investment behavior may be obscured. Marvel and Ray (1987) et al. have expressed little confidence in industry groupings. They

could be very inaccurate. Perhaps the relationship is not being observed because of problems associated with aggregate data.

Kulchycky proposes another possible explanation. She found that the different types of products that a firm produces may affect the relationship between relative endowments and location choice. Exports from parents to affiliates for resale only are very likely to be substitutes for products produced abroad, and exports from parents to affiliates which need further refinement or assembly are likely to be complements to production abroad.(Kulchycky p.83). This distinction could not have been made in this study, and since this is a reasonable and likely assumption, it is very plausible that the predicted relationship is hidden by the nature of the data.

Now the 1966 results for the other variables will be compared with the 1989 results. TASS was found to have a negative relationship with INTERN and INTERNEX for 1989, and a positive one with PROD and PRODUNC. For the 1966 data, the relationship was negative and significant for INTERNEX and ambiguous for INTERN. The relationship with the location choice variables, PROD and PRODUNC, was also unclear. GDP was predicted to have a complementary relationship with both types of direct investment, but no clear trend could be found for the 1989 data. It had significant negative effects on the INTERN and INTERNEX

variables for 1966. This is one of the most singular results observed thus far. As in 1989, no clear relationship resulted for the PROD and PRODUNC regressions.

Distance had negative and significant effects in the 1989 INTERN, INTERNEX, and PRODUNC regressions, and a positive and significant effect in the PROD regression. The same relationships were again observed using the 1966 data.

In addition, the positive relationships observed in 1989 for all dependent variables, were also observed in 1966. Unfortunately, Leamer's measure of openness, OPEN, was not available for 1966.

Industry concentration ratio, CONCRAT, had an ambiguous relationship in 1989. It was ambiguous in that the coefficients in the internalization regressions had negative signs, but were not significant. For PRODUNC, CONCRAT was negative and significant in the linear form but positive and significant in the log-linear form. In the PROD regressions, a quadratic relationship was investigated, and concentration ratio had negative and significant effects over all of the data values. For the 1966 data, it was found to have negative and significant effects on unconstrained production, PRODUNC, and both measures of internalization. One plausible explanation is that competition in industries either helps make firms more competitive in overseas markets or drives them to out of the

domestic market to foreign markets.

The results for both 1966 and 1989 lend support for each other and the relationships predicted and observed by Kulchycky using 1982 data. The exception is the relationship observed for 1966 between relative endowments and pure production activity abroad (PROD). Now the analysis turns to how changes in the independent variables affect the changes in the internalization and location choice variables.

Tables 17-20 show the results for the change over time regressions. Observations where the change in internalization or production activity was greater than 1.5 times the next closest observation were thrown out. This amounted to six total observations for INTERN regressions and four for the PROD regressions. They came from the countries of Bermuda, Spain, Indonesia, and the Philippines. In practice, this meant that observations where the increase in internalization was greater than fifty percent and observations where the decrease in production activity was greater than sixty percent were thrown out. Such observations were clearly outliers and were not even close to the range of dependent variable values. Errors in reporting or wide variations in an industry's investment in a country would lead to these outliers.

The tables show that changes in relative endowments were positively related to changes in INTERN, INTERNEX, and

PRODUNC as we predicted in Chapter 3. This means that as endowments grow and become more similar to the United States, the internalization intensity of U.S. direct investment also increases. This was the most significant and consistent result of all the other relationships being examined. In the regressions for PROD, HK was negative, as we predicted, but not significant. However, given the fact the negative relationship was not observed in 1966 possibly because of the previously mentioned reasons, we would not expect to see it here when we are still using the 1966 data to measure changes over time.

The change in research and development expenditures and the change in advertising expenditures were our proxies for changes in the uncertainty faced by firms. Based on Ethier's model, a positive relationship was predicted. for INTERN, the relationship was found to be quadratic. Even though the first order term is positive and significant, the relationship was only positive over 80 percent of the RD values. For INTERNEX, a positive, significant relationship was evident for the linear form. The positive quadratic relationship was not positive over 90 percent of the values. These results are a little disappointing given the strong results in the static models. However, changes in research and development spending might be a very weak proxy for changes in uncertainty over time. Even though there is a lot of empirical support for this

proxy in the static model, there really is not any for changes over time.

Our other proxy for changes in uncertainty was changes in advertising expense. Once again, it too could be a poor proxy. However, it showed a positive, significant effect for both the INTERN and INTERNEX regressions.

For changes in PROD, changes in RD in the quadratic form was significant but was negative over part of the values and positive over the other part of the values. INDAD was negative but not significant.

Changes in unconstrained production, PRODUNC3, was affected the same way by changes in advertising expense and changes in research and development spending as PRODUNC was in the static models. The coefficients for changes in RD and INDAD were negative and positive respectively. Each was significant.

In the internalization case RD and INDAD proxy for the same parameter in the model. However, in the location choice case the negative relationship between changes in RD and changes in PROD is negative possibly because of a firm's concerns about "leakages" in technology as previously mentioned. Changes in INDAD could be positively related to changes in foreign production because advertising expense would most likely increase as firms produce more and have more at stake in a foreign country.

Changes in firm assets, TASS3, had some curious

coefficients in the internalization regressions. For INTERN the term was negative and significant. For INTERNEX it was both negatively and positively significant. In the static models, the results were mostly negative and significant.

Unlike 1966 and 1989 where GDP was ambiguously or negatively related to all forms of direct investment activity, changes in GDP were found to be positively related to changes in INTERN3, PROD3, INTERNEX3, and PRODUNC3. All were significant except for the PROD regression. This is consistent with our earlier predictions, and lends support to the hypothesis that growing markets attract direct investment.

Changes in industry concentration ratio had strange effects on the dependent variables. For changes in INTERN, it was positive and significant. In the 1966 static model the relationship was negative and significant and unclear for 1989. Regressions for the change in INTERNEX showed both a negative and a positive relationship. The relationships found for 1966 and 1989 were the same as those found for INTERN. The same can be observed for changes in unconstrained production, PRODUNC3. The relationship for the PROD regressions was positive and significant, also. However, this relationship only held true for 60 percent of the range of CONCRAT3 values and was negative over the rest.

TABLE 3

LINEAR AND QUADRATIC INTERNALIZATION REGRESSIONS: 1989

DEPENDENT VARIABLE: INTERN -internalized activity as a percentage of total activity

	(1)	(2)	(3)	(4)
INTERCEPT	46.09	34.11	46.38	-24.39
	(3.43)	(2.69)	(3.46)	(.80)
RD	117.90	113.06	114.56	343.64
	(2.19)	(2.26)	(2.13)	(1.88)
TASS	-.0011	-.0013	-.0012	
	(1.85)	(2.33)	(1.96)	
HK	6.46	5.63	6.35	7.90
	(3.02)	(2.82)	(2.98)	(4.28)
HK squared	-.24	-.22	-.24	-.30
	(2.83)	(2.72)	(2.79)	(4.07)
GDP	1.04E-5	2.45E-6	1.09E-5	-8.76E-6
	(1.65)	(.40)	(1.73)	(7.36)
GDP squared	-5.74E-12	-3.75E-12	-5.87E-12	
	(3.01)	(2.06)	(3.09)	
INDAD				380.58
				(2.09)
OPEN				42.88
				(1.51)
CONCRAT	-.0083	-.0091		-.0093
	(.91)	(1.08)		(1.09)
PINV				5.63
				(.28)
DIST	-9.94E-4	.013	9.82E-4	-.0007
	(.92)	(4.37)	(.91)	(.62)
DIST squared		-1.77E-6		
		(5.04)		
$\bar{R}^2$	.43	.51	.43	.53

Note: absolute value of t-statistic in parentheses
Number of observations is 166

TABLE 4

LOGARITHMIC INTERNALIZATION REGRESSIONS:1989

DEPENDENT VARIABLE: LOG(INTERN) - internalized activity as a percentage of total activity

	(1)	(2)
INTERCEPT	4.10	4.35
	(6.36)	(6.38)
LOG(RD)	.099	
	(2.16)	
LOG(HK)	.13	.13
	(2.14)	(2.18)
LOG(INDAD)	.29	.088
	(3.81)	(1.57)
LOG(TASS)	.14	.076
	(2.88)	(1.90)
LOG(GDP)	.014	.013
	(.64)	(.61)
LOG(OPEN)	.22	.21
	(.94)	(.93)
LOG(PINV)		.23
		(3.16)
LOG(CONCRAT)	-.14	-.14
	(2.92)	(3.08)
LOG(DIST)	.036	.033
	(.62)	(.58)
$\bar{R}^2$	.18	.21

Note: Absolute value of t-statistic in parentheses
Number of observations is 132.
1989 Pooled Cross-Industry, Cross-Country Estimations

TABLE 5

LINEAR AND QUADRATIC EXPORT INTERNALIZATION REGRESSIONS:1989

DEPENDENT VARIABLE: INTERNEX - internalized exports as a percentage of total exports

	(1)	(2)	(3)	(4)
INTERCEPT	-16.76	-25.43	-32.58	2.84
	(.47)	(.72)	(.91)	(.17)
RD	427.53	419.25	423.79	
	(5.20)	(5.18)	(5.07)	
INDAD				-350.66
				(4.07)
TASS	-.0063	-.0063	-.0064	-.0065
	(8.59)	(8.80)	(8.63)	(8.37)
GDP	-1.38E-6	-2.57E-6	-1.69E-6	-2.26E-6
	(.95)	(1.68)	(1.14)	(1.46)
HK	.75	5.56	1.07	6.33
	(1.81)	(2.52)	(2.72)	(2.79)
HK squared		-.19		-.22
		(2.22)		(2.52)
OPEN	33.93	14.01	34.73	
	(1.02)	(.42)	(1.03)	
PINV	50.61	50.64	50.36	88.44
	(4.84)	(4.93)	(4.73)	(9.00)
CONCRAT	-.0033	.0042	.0030	-.0032
	(.35)	(.44)	(.30)	(.32)
DIST	-.0030	-.0021		-.0047
	(2.28)	(1.54)		(1.25)
DIST squared				4.0E-7
				(.81)
$\bar{R}^2$	.60	.62	.59	.58

Note: Absolute value of t-statistic in parentheses.
Number of observations is 123.
1989 Pooled Cross-Affiliate, Cross-Country Estimates

TABLE 6

LOGARITHMIC EXPORT INTERNALIZATION REGRESSIONS:1989

INDEPENDENT VARIABLE: LOG(INTERNEX)	(1)	(2)	(3)	(4)
INTERCEPT	5.21	5.17	2.57	2.64
	(1.87)	(1.89)	(1.32)	(.96)
LOG(RD)	.29	.28	.28	
	(1.99)	(2.23)	(1.95)	
LOG(INDAD)				.37
				(1.59)
LOG(TASS)	-.49	-.50	-.49	-.47
	(3.31)	(4.20)	(3.35)	(2.99)
LOG(HK)	1.18	1.18	1.31	1.13
	(4.07)	(4.09)	(4.82)	(3.75)
LOG(GDP)	.21	.21	.20	.26
	(2.44)	(2.45)	(2.33)	(2.91)
LOG(OPEN)	2.19	2.20	2.03	2.27
	(1.00)	(1.01)	(.93)	(1.00)
LOG(PINV)	.58	.58	.57	
	(2.36)	(2.47)	(2.33)	
LOG(CONCRAT)	-.03		-.04	.34
	(.10)		(.16)	(1.23)
LOG(DIST)	-.31	-.31		-.27
	(1.33)	(1.35)		(1.14)
$\bar{R}^2$	.30	.31	.30	.25

Note: Absolute value of t-statistic in parentheses.
Number of observations 123.
1989 Pooled Cross-Industry, Cross-Country Estimations.

TABLE 7

LINEAR AND QUADRATIC LOCATION CHOICE REGRESSIONS:1989

DEPENDENT VARIABLE: PRODUNC - affiliate production activity as a percentage of total

	(1)	(2)	(3)	(4)
INTERCEPT	-58.57	-45.90	-39.85	-36.75
	(1.57)	(1.19)	(1.03)	(.92)
RD	-86.66		-144.26	
	(.24)		(1.7)	
INDAD		179.20		178.86
		(2.06)		(1.99)
RD squared	1021.16			
	(.19)			
TASS	.017	.0018	.0014	.0018
	(4.18)	(2.24)	(1.88)	(2.22)
TASS squared	-2.37E-6			
	(3.88)			
HK	7.66	7.79	7.73	.77
	(3.40)	(3.28)	(3.24)	(1.73)
HK squared	-.28	-.28	-.28	
	(3.13)	(3.00)	(2.97)	
GDP	-8.77E-6	-9.26E-6	-9.26E-6	-7.53E-6
	(5.66)	(5.71)	(5.67)	(4.79)
PINV	42.28	35.32	50.47	35.98
	(3.08)	(3.58)	(4.69)	(3.53)
OPEN	62.03	57.18	58.28	88.98
	(1.79)	(1.56)	(1.59)	(2.45)
CONCRAT		-.0076		
		(.77)		
DIST	.00015	.00026	.00031	-.00090
	(.11)	(.18)	(.21)	(.64)
$\bar{R}^2$	.52	.46	.46	.43

Note: Absolute value of t-statistic in parentheses.
Number of observations is 117.

TABLE 8

LOGARITHMIC LOCATION CHOICE REGRESSIONS:1989

DEPENDENT VARIABLE: LOG(PRODUNC) -affiliate production activity as a percentage of total firm activity

	(1)	(2)	(3)	(4)
INTERCEPT	.62	.21	.29	.33
	(.49)	(.12)	(.17)	(.19)
LOG(RD)	-.039	-.046		-.025
	(.49)	(.56)		(.27)
LOG(INDAD)			.16	
			(1.14)	
LOG(TASS)	.096	.088	.15	.11
	(1.29)	(1.18)	(1.60)	(1.19)
LOG(HK)	.82	.95	.94	.94
	(4.23)	(5.02)	(5.04)	(4.99)
LOG(GDP)	.10	.10	.11	.10
	(1.82)	(1.79)	(1.88)	(1.80)
LOG(OPEN)	3.82	3.88	3.89	3.87
	(2.70)	(2.71)	(2.73)	(2.70)
LOG(PINV)	.35	.35	.26	.33
	(2.35)	(2.32)	(1.58)	(2.12)
LOG(CONCRAT)				-.080
				(.42)
LOG(DIST)	-8.65E-5	-.022	-.018	-.019
	(1.47)	(.15)	(.12)	(.13)
$\bar{R}^2$	.24	.23	.24	.22

Note: Absolute value of t-statistic in parentheses.
Number of observations 117.
1989 Pooled Cross-Industry, Cross-Country Estimates

TABLE 9

QUADRATIC AND LINEAR LOCATION CHOICE REGRESSIONS:1989

DEPENDENT VARIABLE: PROD - production activity as a percentage of affiliate sales

	(1)	(2)	(3)
INTERCEPT	107.11	228.17	222.17
	(7.70)	(1.56)	(1.69)
RD	-257.93		-99.51
	(1.07)		(2.22)
RD squared	5706.35		
	(1.30)		
INDAD		101.41	
		(1.96)	
TASS	.011	.0028	.0027
	(3.18)	(6.13)	(6.76)
TASS squared	-1.12E-6		
	(2.33)		
HK	-3.35	-3.74	-3.70
	(1.68)	(1.77)	(2.19)
HK squared	.12	.15	.14
	(1.68)	(1.77)	(2.26)
GDP	1.86E-5	1.92E-5	1.83E-5
	(3.56)	(3.44)	(3.78)
GDP squared	-7.01E-12	-7.15E-12	-6.86E-12
	(4.51)	(4.36)	(4.85)
OPEN		-309.73	-2.92.25
		(1.08)	(1.13)
OPEN squared		169.86	162.24
		(1.18)	(1.27)
PINV	-15.23	2.62	12.51
	(.97)	(.45)	(2.21)
CONCRAT	-.31	.0014	.0015
	(1.95)	(.25)	(.28)
CONCRAT squared	5.75E-5		
	(1.96)		

TABLE 9
(cont'd)

LINEAR AND QUADRATIC LOCATION CHOICE REGRESSIONS: 1989

DEPENDENT VARIABLE: PROD - Production activity as a percentage of affiliate sales

	(1)	(2)	(3)
DIST		.0013	.0013
		(1.50)	(1.75)
$\bar{R}^2$	.51	.51	.51

Note: Absolute value of t-statistic in parentheses.
Number of observations is 95.
1989 Pooled Cross-Industry, Cross-Country Estimations

TABLE 10

LINEAR AND QUADRATIC INTERNALIZATION REGRESSIONS:1966

DEPENDENT VARIABLE: INTERN - internalized activity as a percentage of total activity

	(1)	(2)	(3)
INTERCEPT	95.47	26.60	74.55
	(9.64)	(2.14)	(8.49)
RD			206.33
			(3.00)
INDAD	.042	.23	
	(.58)	(3.49)	
TASS	.0028	.030	-.13
	(.17)	(2.22)	(1.18)
HK	2.27	12.97	2.78
	(4.10)	(5.88)	(5.69)
HK squared		-.61	
		(4.72)	
GDP	7.36E-6	-1.84E-5	-9.39E-5
	(.18)	(4.43)	(2.35)
PINV		10796	9660
		(7.29)	(6.26)
CONCRAT	-.51	-.35	-.31
	(2.94)	(2.51)	(2.06)
DIST	-.0034	-.00084	-.0029
	(3.34)	(.91)	(2.06)
$\bar{R}^2$	.30	.54	.47

Note: Absolute value of t-statistic noted in parentheses
Number of observations is 131.
1966 Pooled Cross-Industry, Cross-Country Estimations

TABLE 11

LOGARITHMIC INTERNALIZATION REGRESSIONS: 1966

DEPENDENT VARIABLE: LOG(INTERN) - internalized activity as a percentage of total activity

	(1)	(2)
INTERCEPT	8.70	6.50
	(6.29)	(3.8)
LOG(RD)	.13	
	(2.08)	
LOG(INDAD)		.14
		(.98)
LOG(TASS)	-.15	.05
	(1.53)	(.26)
LOG(HK)	.46	.45
	(3.88)	(3.73)
LOG(GDP)	.043	-.041
	(.71)	(.65)
LOG(PINV)	.20	.20
	(4.92)	(4.75)
LOG(CONCRAT)	-.28	-.35
	(1.53)	(1.81)
LOG(DIST)	-.092	-.080
	(.86)	(.74)
$\bar{R}^2$	.28	.26

Note: Absolute value of t-statistic in parentheses.
Number of observations is 131.
1966 Pooled Cross-Industry, Cross-Country Estimations

TABLE 12

LINEAR AND QUADRATIC INTERNALIZATION REGRESSIONS: 1966

DEPENDENT VARIABLE: INTERNEX - internalized exports as a percentage of total exports

	(1)	(2)	(3)
INTERCEPT	56.34	16.89	-11.90
	(6.55)	(1.40)	(.86)
RD	156.59	165.18	
	(2.16)	(2.42)	
INDAD			.23
			(3.30)
TASS	-.040	-.041	-.00034
	(3.75)	(4.04)	(.026)
GDP	-.00012	-.00021	-.00024
	.7)	(5.10)	(1.54)
HK	2.13	11.95	13.67
	(4.38)	(5.24)	(6.03)
HK squared		-.58	-.67
		(4.39)	(5.16)
PINV	8510.51	9043.42	11104
	(5.47)	(6.16)	(7.18)
CONCRAT	-.38	-.36	-.35
	(2.65)	(2.67)	(2.74)
DIST	-.0053	-.0032	-.0027
	(5.66)	(3.20)	(2.74)
$\bar{R}^2$	.50	.56	.59

Note: Absolute value of t-statistic in parentheses.
Number of observations is 147.
1966 Pooled Cross-Industry, Cross-Country Estimations

TABLE 13

LOGARITHMIC INTERNALIZATION REGRESSIONS: 1966

DEPENDENT VARIABLE: LOG(INTERNEX) - internalized exports as percent of total exports			
	(1)	(2)	(3)
INTERCEPT	9.51	13.30	15.22
	(4.18)	(5.63)	(6.52)
LOG(RD)		.25	.36
		(2.18)	(3.17)
LOG(INDAD)	.45		
	(3.85)		
LOG(TASS)			-.56
			(3.54)
LOG(HK)	1.08	1.11	1.11
	(5.43)	(5.37)	(5.94)
LOG(GDP)	-.045	-.041	-.040
	(.44)	(.39)	(.40)
LOG(PINV)	.35	.34	.35
	(5.48)	(5.21)	(5.48)
LOG(CONCRAT)	-.59	-.91	-.60
	(2.15)	(3.27)	(2.12)
LOG(DIST)	-.59	-.63	-.61
	(3.02)	(3.27)	(3.16)
$\bar{R}^2$	.46	.42	.46

Note: Absolute value of t-statistic in parentheses
Number of observations is 147.
1966 Pooled Cross-Industry, Cross-Country Estimations

TABLE 14

LINEAR AND QUADRATIC LOCATION CHOICE REGRESSIONS: 1966

DEPENDENT VARIABLE: PRODUNC - affiliate production activity as a percentage of total firm activity

	(1)	(2)	(3)
INTERCEPT	54.71	60.28	-2.28
	(5.4)	(6.56)	(.17)
RD		136.92	137.06
		(1.90)	(1.90)
INDAD	.15		
	(2.08)		
TASS	.019	-.0094	-.0092
	(1.27)	(.80)	(.76)
HK	2.75	2.75	2.74
	(5.41)	(5.34)	(5.34)
GDP	-.000062	-.000061	-.000085
	(1.49)	(1.46)	(.47)
GDP squared			2.11E-10
			(.14)
PINV	10642	10207	10163
	(6.39)	(6.33)	(6.16)
CONCRAT	-.34	-.29	-.29
	(2.17)	(1.82)	(1.82)
DIST	-.0013	-.0014	-.0014
	(1.35)	(1.50)	(1.50)
$\bar{R}^2$	.42	.42	.41

Note: Absolute value of t-statistic in parentheses.
Number of observations is 126.
1966 Pooled Cross-Industry, Cross-Country Estimations.

TABLE 15

LOGARITHMIC LOCATION CHOICE REGRESSIONS: 1966

DEPENDENT VARIABLE: LOG(PRODUNC) - affiliate production activity as a percentage of total firm activity

	(1)	(2)	(3)
INTERCEPT	5.76	6.73	6.33
	(3.89)	(4.89)	(3.52)
LOG(RD)	.80	.079	
	(1.08)	(1.15)	
LOG(INDAD)		.089	.090
		(1.16)	(.71)
LOG(TASS)	-.10		-.0093
	(.90)		(.05)
LOG(HK)	.50	.50	.49
	(3.63)	(3.98)	(3.88)
LOG(GDP)	.035	-.035	-.032
	(.50)	(.54)	(.50)
LOG(PINV)		.22	.22
		(5.10)	(5.10)
LOG(CONCRAT)	-.41	-.36	-.36
	(1.90)	(1.85)	(1.78)
LOG(DIST)	-.077	-.027	-.018
	(.62)	(.24)	(.16)
$\bar{R}^2$	.14	.29	.28

Note: Absolute value of t-statistic in parentheses.
Number of observations is 127.
1966 Pooled Cross-Industry, Cross-Country Estimations

TABLE 16

QUADRATIC AND LINEAR LOCATION CHOICE REGRESSIONS: 1966

DEPENDENT VARIABLE: PROD - production activity as a percentage of total sales

	(1)	(2)	(3)
INTERCEPT	70.49	83.97	82.73
	(7.69)	(18.68)	(9.03)
RD	37.20		8.05
	(.17)		(.034)
RD squared	-1218.82		-557.77
	(.34)		(.15)
INDAD	18.89	-.035	
	(.56)	(1.07)	
INDAD squared	-.20		
	(.56)		
TASS	.042	-.010	.064
	(.56)	(1.53)	(.80)
TASS squared	-7.86E-5		-1.18E-4
	(.58)		(.82)
HK	.99	.45	.57
	(.83)	(1.99)	(.54)
HK squared	-.045		-.028
	(.65)		(.43)
GDP	9.48E-5	1.41E-5	-7.43E-8
	(1.10)	(.76)	(.001)
GDP squared	-6.81E-10		2.65E-10
	(.94)		(.37)
CONCRAT		-.022	
		(.32)	
PINV		2108.54	
		(2.85)	
DIST	.0048	.0011	
	(3.70)	(2.62)	

TABLE 16(cont'd)

LINEAR AND QUADRATIC LOCATION CHOICE REGRESSIONS: 1966

DEPENDENT VARIABLE: PROD - production activity as a percentage of total sales

DIST squared	-4.17E-7 (2.92)		
$\bar{R}^2$	.13	.14	.02

Note: Absolute value of t-statistic in parentheses
Number of observations is 123.
1966 Pooled Cross-Industry, Cross-Country Estimations

TABLE 17

QUADRATIC AND LINEAR INTERNALIZATION REGRESSIONS: 1989-1966

DEPENDENT VARIABLE: INTERN3 - change in internalized activity as a percentage of total activity

	(1)	(2)	(3)
INTERCEPT	60.46	5.7	10.93
	(1.66)	(.60)	(1.19)
RD3	4620.07		
	(1.53)		
RD3(squared)	-861611		
	(1.90)		
INDAD3	.77	.079	.16
	(1.77)	(.89)	(1.65)
TASS3	-.010	-.0062	-.0079
	(2.64)	(2.47)	(3.28)
HK3	1.79	1.74	1.90
	(2.88)	(2.95)	(3.02)
GDP3	8.57E-6	4.39E-6	1.03E-5
	(2.75)	(.67)	(1.41)
GDP3 (squared)		2.03E-12	-1.12E-12
		(.80)	(.37)
CONCRAT3		.73	.77
		(2.99)	(2.02)
$\bar{R}^2$	.24	.23	.22

Note: Absolute value of t-statistic in parentheses.
Number of observations is 87.
(1989-1966) Cross-Industry, Cross-Country Estimations
(1) and (3) were weighted TASS.

TABLE 18

QUADRATIC AND LINEAR INTERNALIZATION REGRESSIONS: 1989-1966

DEPENDENT VARIABLE: INTERNEX3 - change in internalized exports as a percentage of total exports

	(1)	(2)
INTERCEPT	-23.02	2141.59
	(1.64)	(1.37)
RD3	8101.71	2141.59
	(3.81)	(2.39)
RD3(squared)	-3895340	
	(3.06)	
TASS3	.039	-.011
	(2.31)	(4.35)
HK3	1.73	1.62
	(1.53)	(1.37)
GDP3	1.099E-5	1.094E-5
	(2.34)	(2.24)
CONCRAT3	-12.17	2.14
	(2.59)	(4.22)
$\bar{R}^2$	.31	.24

Note: Absolute value of t-statistic in parentheses
Number of observations is 86.
(1989-1966) Cross-Industry, Cross-Country Estimations

TABLE 19

QUADRATIC AND LINEAR LOCATION CHOICE REGRESSIONS: 1989-1966

DEPENDENT VARIABLE: PRODUNC3-change in affiliate production activity as a percentage of total firm activity

	(1)	(2)
INTERCEPT	19.13	-4.96
	(1.95)	(1.10)
RD3	-1116.99	
	(2.39)	
INDAD3		.26
		(2.83)
TASS3	-.0097	-.0039
	(3.76)	(2.74)
HK3	1.97	2.03
	(3.27)	(3.21)
GDP3	7.30E-6	7.08F-6
	(2.88)	(2.76)
CONCRAT3	1.00	.13
	(4.023)	(.50)
$\bar{R}^2$	.23	.21

Note: Absolute value of t-statistic in parentheses.
Number of observations is 87.
(1989-1966) Cross-Industry, Cross-Country Estimations

TABLE 20

QUADRATIC AND LINEAR LOCATION CHOICE REGRESSIONS: 1989-1966

DEPENDENT VARIABLE: PROD3 - change in production activity as a percentage of total sales

	(1)	(2)
INTERCEPT	-6.64	-1516.28
	(1.41)	(.73)
RD3	-1206.01	
	(3.46)	
RD3 (squared)	460467	
	(1.96)	
INDAD3		-56.16
		(.85)
INDAD3 (squared)		.62
		(.89)
TASS		-.31
		(1.69)
TASS (squared)		.00030
		(1.00)
HK3	-.39	-.55
	(.36)	(.50)
HK3 (squared)	.036	.053
	(.40)	(.60)
GDP3	5.7E-7	2.02E-6
	(.13)	(.45)
GDP3 (squared)	-7.54E-13	-1.25E-12
	(.42)	(.68)
CONCRAT3	.38	-293.18
	(1.07)	(.90)
CONCRAT3 (squared)	-.035	-10.33
	(1.90)	(.92)
$\bar{R}^2$	.10	.13

TABLE 20(cont'd)

Number of observations is 91.
(1989-1966) Cross-Industry, Cross-Country Estimations
Regression (2) weights the variable TASS3.

CHAPTER 6

CONCLUSIONS

Traditionally, U.S. multinationals have been predicted to invest in low income countries in order to capitalize on unskilled labor. However, empirical studies of U.S. direct investment have shown that this is not the case. Holding all other variables constant, U.S. direct investment is still attracted to developed countries with endowments similar to ours. Empirical studies seeking to model direct investment could not explain this observation and proved to be inadequate. The goal of this investigation was to resolve the disparity between theory and empirical results in order to provide policy makers with a better understanding of what affects MNE behavior. This way the ramifications of a decision can be more accurately predicted. Before making correct policy decisions, the mechanics of direct investment should be examined.

This study lends support to the hypothesis that there are two separate aspects to direct investment, internalization and location choice. The Ethier model which assumes location issues and the Helpman-Krugman model which assumes internalization issues each explain a differenct part. When used together a more complete understanding of investment behavior is attained. Internalization, as Kulchycky found, seems to play a very important role in this analysis. The two models had

differing predictions for the relationship between relative endowments and the amount of direct investment. Helpman and Krugman predicted that direct investment is negatively related to similarities in endowments, and Ethier predicted that direct investment was positively related to endowments. Ethier also predicted that direct investment was positively related to the amount of uncertainty faced by a firm when investing overseas. This study found support for Ethier's predictions in all cases. Additionally, once internalization was controlled for the implications of the Helpman-Krugman model were predicted to be observable. The hypothesized relationship was only found for 1989. Unfortunately, data problems did not give us a clear result for 1966. Several plausible reasons as to why this was not true for 1966 were presented in Chapter 6. Given the results for 1989 and Kulchycky's results for 1982, support is lent to our approach of dividing direct investment into two distinct parts.

Another important result from this study is that the new variables investigated were shown to have important effects on direct investment. Testing advertising expense as another proxy for uncertainty showed the positive, significant effects consistent with the predictions of the Ethier model.

A second new variable, the international experience of a firm in investing, had a consistently positive and

significant effect on the amount of direct investment. This is consistent with our expectations and probably shows that some type of firm learning curve is present when a firm is investing overseas. It may also reflect the uncertainty that a firm faces when investing overseas and that it does decrease over time as the firm "learns".

Industry structure had no clear effects in 1989, but a higher industry concentration ratio (usually considered to reflect oligoplistic structure) was negatively related to the amount of direct investment in 1966. Government promotion of competition in industry then could possibly lead to more direct investment. More investigation is necessary to further examine this hypothesis.

The relationship between the change in Gross Domestic Product and the change in investment was shown to be positive, and may possibly reflect the importance of promoting the development of new markets for investment overseas. This analysis then gives some support to aiding the republics of the former Soviet Union and the countries of Eastern Europe. Such a connection would only be effective in the very long term.

Examining the effects over time of changes in relative endowments on changes in our direct investment abroad showed a positive relationship. The recent decline in U.S. direct investment suggests that our growth in human capital is not keeping pace with the rest of the world. We are losing our

traditional comparative advantage. Looking at the figures, the number of professional and technical workers as a percentage of the economically active population only increased from 10.8 percent in 1960 to 14.8 percent in 1985. The percentage change in this figure was much larger for most of the developing and developed countries that we examined. For example, this figure almost doubled for Germany (7.6 to 13.9). In many developing countries such as Panama the change was even greater (4.5 to 10.4).

This paper provides policy makers with a better understanding of the mechanics of direct investment, and provides guidance on how to better achieve policy objectives. If the objective then is to increase direct investment, policy makers can draw from this study that investment in human capital and encouraging firm research and development may increase the internalization aspect of direct investment which this paper suggests is the most critical constituent. This may be an objective because direct investment stimulates exports, promotes U.S. interests, and creates higher paying jobs in the U.S. as MNE's based here employ managers and executives.

Objectives for further study could be to analyze all the variables in this study using firm level data. Maybe then will the comparative advantage motivation for pure production be observed for 1966. Also, another time period analysis should be conducted that utilizes firm level data

and includes a better measure of the change in government regulation across countries in order to examine its effects on changes in direct investment.

NOTES

[1] For the log-linear model of INTERN, values for Sweden and Norway were thrown out because they were strong outliers compared to the other values and were having a unbalanced effect on the estimations. That they were so high can be probably be attributed to the way the way the data was collected or reported for those two countries.

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