

Intangible Assets and the Network Structure of MNCs

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Abstract

This paper examines the nature of the relationship between corporate intangible assets and the multinational network structure of the firm. Specifically, the question addressed in this paper is whether the nature of corporate intangible assets determines the mode of geographic expansion of the MNC. The interactive effects between the level and type of corporate intangibles and the foreign expansion path of MNCs are also examined. Based on the analysis of 362 MNCs, representing 88 three-digit SIC industries, the results of this study show that R&D-intensive MNCs maintain substantially more geographically diversified and less geographically focused operating networks than advertising-intensive MNCs. Furthermore, R&D-intensive MNCs' foreign investments create more value through geographic diversification, while non-R&D-intensive MNCs benefit the most by increasing the geographic focus of their foreign investment activities. We also document that MNCs without significant levels of technology know-how and marketing based intangible assets can benefit the most from geographic-focused rather than geographic-diversified foreign business operations.

I. Introduction

The post-second world war surge of foreign direct investment and the growth of multinational corporations (MNCs) as facilitators of international trade and economic activity in host countries, where MNCs are located, represent perhaps the most important economic phenomenon of the last half of the twentieth century. As a result, numerous theoretical and

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empirical efforts have been directed towards explaining the rapid growth of MNCs' foreign investment activities over the recent past. Yet relatively little is known about the factors that determine foreign investment, in general, and MNCs' network structure, in particular. The theory of internalization, which represents a synthesis and extension of theories of direct foreign investment that are based on market imperfections, argues that direct foreign investment occurs when a firm is in possession of proprietary, know-how based, information that can be transferred to foreign subsidiaries. Thus foreign direct investment is the outcome of firm-specific intangible assets (advantages) such as expertise in research, technology patents, marketing and management, that cannot be easily copied. Because there are no external markets for firm-specific intangible assets, MNCs are motivated to internalize the benefits associated with this type of assets by investing overseas.¹ In sum, the internalization theory predicts that direct foreign investment is value increasing when firms can internalize markets for certain intangible corporate assets. In an attempt to show that the market value of the firm is positively related to its information-based intangible assets, Morck and Yeung (1991) examine the relationship of firms' multinational structure and intangible assets with public good properties. They show that U.S. firms with intangible assets, proxied by R&D and advertising expenditures, tend to benefit from foreign investment transactions and they conclude that these findings are consistent with the internalization hypothesis. This line of research implies that foreign direct investment is primarily motivated by the intangible assets of the firm. Therefore, firms with intangible assets tend to benefit the most from foreign investing while firms that do not possess intangible assets with public good properties are not expected to gain and therefore should not be motivated to invest overseas. More recent studies such as Lang and Ofek (1995) and Doukas (1995) show that there is a positive association between U.S. bidder abnormal returns and Tobin's q . Other factors, however, were also found to be relevant in the foreign investment decision making process of U.S. firms. For instance, Doukas (1995) finds that U.S. firms' gain from foreign investments is higher for value maximizing (high q) firms than for overinvesting (low q) firms, consistent with Jensen's (1986) free cash flow/overinvestment hypothesis, and when investment is directed toward low-tax-rate jurisdictions. The latter result appears to be inconsistent with the predictions of the internalization hypothesis in the sense that MNCs foreign investment can also be influenced by external rather than only internal (i.e., corporate-specific) intangible assets (i.e., firm-specific comparative advantages) such as the low tax rate of the host country. That

is, country-specific comparative advantages (intangibles) could also explain MNCs' direct foreign investment strategy and multinational structure. Recently, Eun, Kolodny and Scheraga (1996), indeed show that corporate foreign direct investment is value increasing when investment tends to enhance the firm's (acquirer's) intangible assets' base through acquisitions of foreign information-based intangible assets in support of the reverse internalization hypothesis. In an earlier study, Doukas and Travlos (1988) examined the impact of international acquisitions on the market value of U.S. bidding firms. They show that shareholders of the U.S. bidders gain significant abnormal returns when firms expand into new geographic markets. When U.S. firms' foreign acquisitions are conducted in countries where bidders had operating exposure in the target firm's country, stockholders of bidding firms do not gain from such foreign investment transactions. Doukas (1995) provides similar evidence which shows that financial markets tend to value more the initial than subsequent foreign investment of U.S. multinational firms. Consequently, accounting for the role of MNCs' intangible assets, his evidence implies that the firm's network structure seems to influence the market's assessment of MNCs' foreign investment decisions.

While previous studies shed light on several issues concerning the flow and the valuation effects of foreign direct investment, the evidence recorded in Doukas and Travlos (1988) and Doukas (1995) suggests that the network structure of a multinational corporation has an effect on the market's valuation of intangible assets. That is, the multinational structure of an MNC seems to be one of its valuable intangible assets. Allen and Pantzalis (1996) provide an empirically grounded measure of the degree of multinationality called "flexibility of the MNC subsidiary network", and show that the foreign subsidiary network structure helps explain not only differences in market value among MNCs but also differences in the effectiveness of technology and marketing-based intangibles across MNCs with different multinational network structures. Despite the insightful contributions of previous studies, what is not known yet is the interplay between the firm's mode of foreign expansion and the nature of its corporate intangible assets.² Specifically, the question addressed in this paper is whether the nature of corporate intangible assets determines the mode of geographic expansion of the MNC.

This paper examines the nature of the relationship between corporate intangibles and the multinational network structure of the firm, and how their interaction affects the market value of MNCs. Based on the analysis of 362 MNCs representing 88 three-digit SIC industries, the results of this

study indicate that R&D-intensive MNCs' foreign investments create more value through geographic diversification, while non-R&D-intensive MNCs benefit the most by enhancing the geographic focus of their foreign investment activities. Moreover, consistent with the evidence reported by Doukas and Travlos (1988), Doukas (1995) and Eun, Kolodny and Scheraga (1996), the findings of this study show that MNCs' network expansion through foreign investment is value increasing even when MNCs do not possess significant levels of intangible assets in support of the MNC network hypothesis.

The remainder of this paper is organized as follows. The next section presents the interplay between investments in intangible assets and the dimension of the geographic expansion of MNCs' network structure. Section III describes the data and statistical methodology used in the analysis. Section IV presents the results and Section V provides a summary and concluding remarks.

II. MNCs' Nature of Foreign Investment and the Role of Intangible Assets

The most widely used measures of investments in intangibles are the R&D (hereafter RD) and advertising (hereafter AD) intensities, defined as the dollar expenses for RD and AD respectively standardized by sales revenue. Chauvin and Hirschey (1993) show that the effect of RD and AD on market value is strongest for large firms, although smaller firms seems to gain from ownership of such assets as well. They have also shown that there are thresholds of RD and AD intensity that have to be surpassed in order for such intangibles to yield significant economic rents. These two types of intangible assets differ profoundly in nature. RD intensity, which measures investment in technological know-how, and AD intensity, which measures investment in marketing ability and consumer goodwill, are investments in different means of product differentiation.³ Another difference between RD and AD intensity is that investment in RD represents a high risk-high return, long-term strategic decision, while investing in AD is a low-risk strategy that is more likely to yield results in the short run.

A firm possessing RD-related advantages (i.e., high RD-intensity firm), benefits from superior technological know-how. Technological know-how is a set of information that is specific to the particular firm, in addition to a particular product. The firm-specific nature of the information set related to technological know-how makes for an easy transfer of such information across borders within the MNC's network of subsidiaries. Alternative

modes of organizing such a transfer (e.g., contracting, licensing) that are available to a MNC are more costly because in addition to the usual transaction costs associated with external markets, they involve the cost of dissemination of potentially monopoly rent-yielding proprietary information.⁴

A firm with AD-related advantages (i.e., high AD-intensity firm) is a firm with high investment in marketing intangibles. Such intangibles are a function of a set of information that is both product- and country-specific. The country-specific nature of such know-how does not preclude the use of outside markets in organizing economic activity, but it dictates that a MNC has to pay a substantial entry fee to penetrate a new foreign market. Typically, the additional investment in AD will become proportionally smaller, if the MNC expands its operations within a country where it already has operations. Once the entry fee has been paid, serving the needs of the local market can be done by transferring marketing ability locally at a lower cost.

Galbraith and Kay (1986) point out that the expansion of multinationals is facilitated by the possession of firm-specific information, such as technological skills reflected in RD-intensity levels, and inhibited by the requirement of country-specific information, such as marketing know-how. Every MNC maintains a transnational network of subsidiaries. Depending on the level of intangibles a MNC chooses to maintain, it will shape its network so as to fully exploit them.⁵

Previous evidence (Chauvin and Hirschey, 1993) supports the theory that size is correlated with high levels of intangibles and higher market values. Geringer, Beamish, and Da Costa (1989) Morck and Yeung (1991), and Allen and Pantzalis (1996) among others show that there are thresholds of size, that if surpassed, could adversely affect the market value of the firm, because of the additional organizational and agency costs associated with running a large firm. Therefore an expansion of the network's size may or may not be value creating, depending on the dimension it is pursued in. Such an expansion could be either geographic focus increasing or geographic diversification increasing. If the MNC expands its network by adding foreign subsidiaries where it did not operate before, then it increases the geographic diversification of its foreign subsidiary network. On the other hand if it chooses to add foreign subsidiaries to an already existing local foreign network it will increase the geographic focus of its network. Assuming that the network structure can adequately be described by its geographic-focus and -diversification dimensions, the MNC management will choose the focus-diversification combination that best complements its investment in intangible assets, so as to maximize

firm market value. Consequently, the network structure of a MNC whose market value is mainly generated by information technology-based intangibles (high RD-intensity MNCs) should differ from that of a MNC which possesses marketing-oriented intangibles (high AD-intensity MNCs). The different nature among intangible assets⁶ implies that a firm's multinational network structure will be shaped by the type of its intangible assets possessed.

It is hypothesized that RD-intensive MNCs should benefit from geographic diversification investments, since technological know-how advantages are easily transferable across countries. On the other hand, AD-intensive MNCs should benefit from geographic focused investments when they expand their multinational network. In the next two sections we empirically examine this issue, as well as the question of whether the relationship between firm's market value and multinationality differs among different MNC groups.

III. Sample and Methodology

A. Sample Description

The sample of MNCs is drawn from National Register's "*Directory of International Affiliations/1992*" and "*Directory of Affiliations/1992*" that provide information on foreign and U.S. affiliations of firms operating in the United States for the year 1991. These sources report a list of all domestic and foreign affiliates for all MNCs in the U.S., the percentage ownership by the parent, the nature of business (SIC code) of each affiliate, and its geographic location. Only the affiliates with at least 50% ownership by the parent are counted as foreign subsidiaries. Financial data for all manufacturing firms for 1991 were taken from Standard & Poor's "Compustat Industrial Tapes". The intersection of the two data sets includes 1192 firms, of which 626 are MNCs.⁷ The sample's MNCs are distributed among 88 three-digit SIC industries. The final sample of the MNCs contains 362 firms due to unavailability of some of the variables from the Compustat database.

B. Empirical Methodology

The main objective of this study is to investigate whether a firm's multinational structure is influenced by the nature of the firm's intangible assets. Therefore, the sample of MNCs is divided into four groups depending on

the level of RD and AD intensity they maintain. These are: (I) MNCs with few intangibles, (II) MNCs with high AD-intensity and low RD-intensity levels (i.e., AD-intensive MNCs), (III) MNCs with high RD-intensity and low AD-intensity levels (i.e., RD-intensive MNCs), and (IV) MNCs with high RD and AD intensity. Instead of choosing arbitrary cut-off points of RD and AD intensity to delineate the four distinct groups, a switching regression (SR) methodology is used, that endogenizes the functional form of the market value-intangibles relationship and determines the cut-off points, RD^* and AD^* .⁸ The four MNC types are:

- I: *Low RD and AD MNCs:* MNCs with $RD \leq RD^*$ and $AD \leq AD^*$
 II: *High AD MNCs:* MNCs with $RD \leq RD^*$ and $AD > AD^*$
 III: *High RD MNCs:* MNCs with $RD > RD^*$ and $AD \leq AD^*$
 IV: *High RD and AD MNCs:* MNCs with $RD > RD^*$ and $AD > AD^*$

Similarly to previous studies (Morck and Yeung [1991], Kim and Lyn [1990], and Chauvin and Hirschey [1993]), the MNCs' market value is modelled as a function of leverage, growth, risk, cash flow, and multinationality. As an improvement over previous studies, multinationality will not be described by a single one-dimensional variable, but by its two dimensions described earlier, GFOC (geographical focus) and GDIV (geographic diversification). Thus the market value model for the i^{th} MNC, is modelled as

$$EVS_i = a_0 + a_1 * LTD_i + a_2 * GS_i + a_3 * CF_i + a_4 * RISK_i + a_5 * GDIV_i + a_6 * GFOC_i$$

The variables used in this study are:

(a) *Market power and control variables.* Relative excess valuation (EVS). This market value measure has been interpreted as the market value analog to the return on sales, and is calculated as (market value of equity + book value of debt – book value of assets)/sales.⁹ Future growth opportunities (GS) for each firm are measured as the geometric average of the sales revenues for the last five years. The leverage measure for each firm (LTD) is the long term debt-to-total assets ratio. This variable controls for any variation in market value due to differences in capital structure. Cash flow (CF), calculated as operating income before depreciation minus interest expenses minus taxes paid minus dividends, standardized by total assets. CF is a measure of the MNC's ability to generate cash flows in the

future. Alternatively, *CF* can be seen as a measure of free cash flow. The risk measure (*RISK*) used is the log of the ratio of the high and low prices of the MNC's stock for the year of 1991.¹⁰ Advertising intensity (*AD*) is measured by the ratio of advertising expenditures to sales for the year 1991. *AD* is a proxy for the ability to generate consumer goodwill. R&D intensity (*RD*) is measured by the ratio of R&D expenditures to sales for 1991. *RD* is a proxy for technical expertise.

(b) *Multinational network variables.* The multinational network variables are variables that describe the different dimensions of a MNC's transnational network of operations. *GFOC* (geographic focus), is a concentration measure of the international component of each MNC's network. It is measured as the concentration of the foreign subsidiaries in the two largest, in terms of MNC subsidiaries' presence, foreign countries the MNC operates in. The other dimension of the network is *GDIV* (geographic diversification), which is measured as the natural logarithm of the number of foreign countries the MNC operates in (i.e., the number of foreign countries where the MNC maintains fully-owned subsidiaries).¹¹ In addition to the above variables and in order to provide a better description of the MNC network of the firms in the sample, we computed for each MNC the number of foreign subsidiaries of the MNC (*FS*).¹²

Descriptive statistics for all variables can be found in Table 1. The MNCs have, on average, an annual sales growth rate of 8.14% per year (geometric mean growth rate), and an average Long Term Debt ratio of 0.1824. On average, the firms in the sample have significantly positive market values (mean *EVS* = 0.4938). Moreover, the average MNC in the sample operates in about 10 foreign countries with about 19 foreign subsidiaries, of which about 6 are located in the two countries of the MNC network with the most subsidiaries.

The results of the switching regression (SR) model are presented in Table 2. The SR model is utilized to determine the optimal cut-off points of RD^* and AD^* around which the pooled sample was separated into the four distinct groups of MNCs (i.e., RD intensive, AD intensive, RD and AD intensive, and intangibles non-intensive MNCs).

The SR model tests the explanatory power of the model (from equation (1)) applied on the four sub-samples against that of the model applied on the pooled sample. Table 2 shows the optimal cut-off point obtained ($RD^* = 0.008$, $AD^* = 0.006$), the log-likelihood value for the pooled-sample model ($\log L_0 = -384.62$) and for the SR model ($\log L_1 = 325.51$). The statistic used for testing the significance of the cut-off point is

Table 1. Descriptive Statistics for all Variables

Variable	<i>N</i>	Mean	St.Error	St.Dev.	Q_1	Q_3
<i>EVS</i>	362	0.4938	0.0398	0.7578	0.0409	0.6967
<i>LTD</i>	362	0.1824	0.0072	0.1376	0.0765	0.2583
<i>GS</i>	362	0.0814	0.0063	0.1202	0.0277	0.1187
<i>CF</i>	362	0.0592	0.0034	0.0638	0.0330	0.0942
<i>RISK</i>	362	0.6442	0.0241	0.4589	0.4055	0.7458
<i>RD</i>	362	0.0364	0.0020	0.0387	0.0082	0.0489
<i>AD</i>	362	0.0209	0.0019	0.0367	0.0000	0.0242
<i>FC</i>	362	10.4890	0.5907	11.2393	3.0000	14.0000
<i>FS</i>	362	19.0497	1.6016	30.4728	3.0000	21.0000
<i>CON2</i>	362	0.5250	0.0164	0.3120	0.2500	0.7619

EVS = Market Value, measured by $EVS = (\text{Market Value} - \text{Book Value}) / \text{Sales}$.

LTD = (Long Term Debt)/(Total Assets).

GS = Geometric 5-year growth rate of Sales.

CF = Cash Flow, measured by $([\text{Operating Income before Depreciation}] - \text{Interest Expenses} - \text{Taxes} - \text{Dividends}) / (\text{Total Assets})$.

RISK = $\log \{ (\text{Highest Price for the stock in 1991}) / (\text{Lowest Price for the stock in 1991}) \}$.

RD = $(\text{R\&D Expenditure}) / (\text{Sales})$.

AD = $(\text{Advertising Expenditures}) / (\text{Sales})$.

FC = Number of foreign countries.

FS = Number of foreign subsidiaries.

CON2 = Concentration ratio of foreign subsidiaries in the two top foreign countries i.e., countries in which the MNC maintains the most of its foreign subsidiaries.

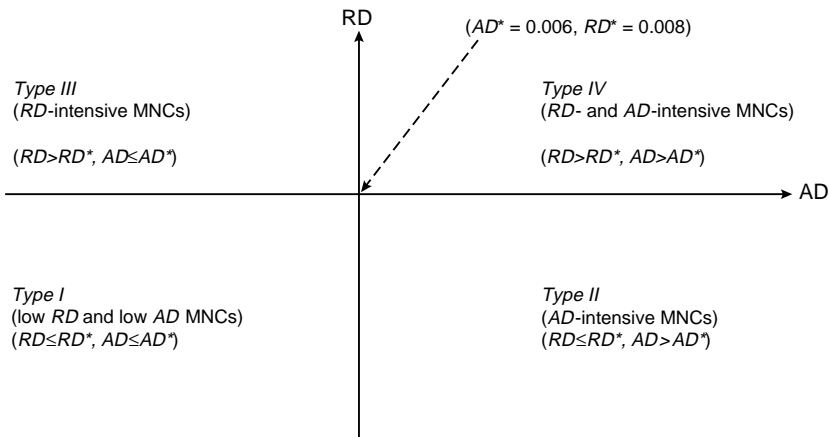
$-2\log(L_1/L_0)$ which is asymptotically chi-squared distributed. The cut-off point obtained is significant at the 1% level, and indicates that the explanatory power of the market value model increases significantly when one controls for non-linearities related to *RD* and *AD*, by separating the pooled sample into *RD*- and/or *AD*-intensive MNCs sub-samples. What the SR procedure accomplishes, is an unbiased way of separating the pooled sample and identifying structural shifts in the relationship, rather than resorting in the usual practice of choosing arbitrary cut-off points (e.g., quartiles or medians from the *RD* and the *AD* distribution).¹³ The econometric significance of the cut-off point is that, when one examines the effect of the independent variables on market value, explanatory power increases significantly when the relationship is examined separately for each group. The economic significance of the cut-off point is that the *RD** and *AD** values constitute the empirically determined threshold levels of investment in intangibles that have to be surpassed in order for the intangibles to have a profound effect on market value.¹⁴ For example, MNCs with *RD* expenditures of more than 0.8% of their sales and *AD* expenditures less or equal to 0.6% of their sales can be regarded as pure

Table 2. Summary of Results of Switching Regressions for the EVS Model (*).

Reported below are the critical cut-off points (AD^* , RD^*), the log-likelihood values for the switching regression model ($\log L_1$) and the pooled sample model ($\log L_0$), and the χ^2 -statistic ($-2\log(L_1/L_0)$) for the test of significance of the cut-off point. The variables in model (*) are $EVS = (\text{Market Value} - \text{Book Value})/\text{Sales}$. $LTD = (\text{Long Term Debt})/(\text{Total Assets})$. $GS = \text{Geometric 5-year growth rate of Sales}$. $CF = \text{Cash Flow, measured by } ([\text{Operating Income before Depreciation}] - \text{Interest Expenses} - \text{Taxes} - \text{Dividends})/(\text{Total Assets})$. $RISK = \log \{(\text{Highest Price for the stock in 1991})/(\text{Lowest Price for the stock in 1991})\}$. $GDIV = \ln(\text{Number of foreign countries})$. $GFOC (= CON2) = (\text{Number of foreign subsidiaries in the two foreign countries where the MNC has most of its subsidiaries})/(\text{Number of foreign subsidiaries})$. $RD = (\text{R\&D Expenditures})/(\text{Sales})$, and $AD = (\text{Advertising Expenditures})/(\text{Sales})$.

Model	Dep. variable	(AD^* , RD^*)	$\log L_1$	$\log L_0$	$-2\log(L_1/L_0)$	Sign. level
(*)	EVS	(0.006, 0.008)	-325.51	-384.62	59.11	0.005

(*) $EVS = a_{0j} + a_{1j} * LTD + a_{2j} * GS + a_{3j} * CF + a_{4j} * RISK + a_{5j} * GDIV + a_{6j} * GFOC$, where $j = I, II, III, IV$



RD-intensive firms. Separating the pooled sample into four distinct MNC types in such a way ensures a better detection of the effects of the explanatory variables on market value and avoids non-linearity effects that make the analysis of the pooled sample tedious.

IV. Empirical Results

The descriptive statistics for all variables for each of the four MNC samples based on the solution of the switching regression with $RD^* = 0.008$ and $AD^* = 0.006$ as the cut-off point, are presented in Panel A of Table 3.

Table 3.

Panel A: Descriptive statistics for the four MNC groups obtained as the solution of the switching regression with cut-off point ($RD^* = 0.008$, $AD^* = 0.006$).

	<i>EVS</i>	<i>LTD</i>	<i>GS</i>	<i>CF</i>	<i>RISK</i>	<i>RD*10³</i>	<i>AD*10³</i>	<i>FS</i>	<i>FC</i>	<i>CON2</i>
Low RD and AD MNCs (Type I): N = 47										
<i>Mean</i>	0.198	0.240	0.063	0.043	0.621	3.877	0.003	15.085	8.213	0.654
<i>s.d.</i>	0.319	0.186	0.168	0.044	0.335	2.531	0.005	39.070	15.256	0.312
AD-intensive MNCs (Type II): N = 40										
<i>Mean</i>	0.588	0.161	0.050	0.047	0.712	3.265	43.141	13.175	6.875	0.663
<i>s.d.</i>	0.750	0.117	0.098	0.070	0.543	3.068	36.363	21.081	7.727	0.317
RD-intensive MNCs (Type III): N = 132										
<i>Mean</i>	0.388	0.183	0.087	0.069	0.636	41.404	0.138	16.939	9.758	0.534
<i>s.d.</i>	0.615	0.139	0.117	0.043	0.563	37.708	0.782	22.556	8.908	0.308
RD- and AD-intensive MNCs (Type IV): N = 143										
<i>Mean</i>	0.662	0.169	0.091	0.059	0.641	51.742	40.612	23.944	12.923	0.435
<i>s.d.</i>	0.923	0.118	0.109	0.081	0.351	39.717	44.461	35.094	12.012	0.286

Type I: $RD \leq RD^*$ and $ADV \leq ADV^*$; Type II: $RD \leq RD^*$ and $ADV > ADV^*$; Type III: $RD > RD^*$ and $ADV \leq ADV^*$; Type IV: $RD > RD^*$ and $ADV > ADV^*$: *EVS* = (Market Value – Book Value)/Sales. *LTD* = (Long Term Debt)/Total Assets. *GS* = Geometric 5-year growth rate of Sales. *CF* = (Operating Income before Depreciation – Interest Expenses – Taxes–Dividends)/Total Assets *RISK* = $\log(\text{High Price '91}/\text{Low Price '91})$. *RD* = (RD Expenditures)/Sales. *AD* = (AD Expenditures)/Sales. *FS* = Number of foreign subsidiaries. *FC* = Number of foreign countries. *CON2* = Percentage of foreign subsidiaries in the top two foreign countries.

Table 3. *Continued*

Panel B: Means difference significance tests among different types of MNCs: *I* (low RD and AD MNCs), *II* (AD-intensive MNCs), *III* (RD-intensive MNCs), *IV* (RD- and AD-intensive MNCs) and the pooled sample (*ALL*) respectively. Reported are the z-statistics.

<i>Variable</i>	<i>I–II</i>	<i>I–III</i>	<i>I–IV</i>	<i>I–ALL</i>	<i>II–III</i>	<i>II–IV</i>	<i>II–ALL</i>	<i>III–IV</i>	<i>III–ALL</i>	<i>IV–ALL</i>
<i>EVS</i>	–3.06*	–2.68*	–5.15*	–4.83*	1.54	–0.52	0.75	–2.92*	–1.01	1.94*
<i>LTD</i>	2.41*	1.92*	2.32*	2.05*	–1.00	–0.38	–1.08	0.90	0.05	–1.10
<i>GS</i>	0.45	–0.90	–1.07	–0.73	–2.00*	–2.28*	–1.88*	–0.29	0.47	0.87
<i>CF</i>	–0.31	–3.50*	–1.71*	–2.23*	–1.88*	–0.92	–1.05	1.29	1.95*	–0.03
<i>RISK</i>	–0.92	–0.22	–0.35	–0.43	–0.77	0.78	0.79	–0.08	–0.34	–0.08
<i>RD</i>	1.00	–11.36*	–14.32*	–15.73*	–11.50*	–14.44*	–15.89*	–2.21*	1.33	3.94*
<i>AD</i>	–7.50*	–1.98*	–10.92*	–10.83*	7.48*	0.37	3.67*	–10.88*	–10.76*	4.71*
<i>FS</i>	0.29	–0.31	–1.38	–0.67	–0.97	–2.42*	–1.59	–1.98*	–0.85	1.46
<i>FC</i>	0.53	–0.66	–1.93*	–0.99	–1.99*	–3.82*	–2.66*	–2.49*	–0.75	2.09*
<i>CON2</i>	–0.13	2.27*	4.26*	2.67*	2.27*	4.11*	2.62*	2.76*	0.29	3.10*

z-statistics are calculated as: $E(X) - E(Y) / [(Var(X)/N_x) + (VAR(Y)/N_y)]^{0.5}$

* indicates significance at the 10% level or better.

EVS = (Market Value-Book Value)/Sales.

GS = Geometric 5-year growth rate of Sales.

RISK = $\log(\text{High Price '91}/\text{Low Price '91})$.

AD = (AD Expenditure)/Sales.

FC = Number of foreign countries.

LTD = (Long Term Debt)/Total Assets.

CF = Cash Flow/Sales.

RD = (RD Expenditures)/Sales.

FS = Number of foreign subsidiaries.

CON2 = Percentage of for. subsidiaries in top two for. countries.

As expected, MNCs with high levels of both RD and AD intangibles (i.e., RD- and AD-intensive MNCs, (type IV)) have, on the average, the highest market values. The mean Type IV *EVS* is 0.662, which is significantly higher at the 10% level than all other MNC types, except for MNCs of Type II. This is consistent with the view that successful MNCs are firms with high levels of intangible assets. AD-intensive MNCs (Type II) appear to have the second highest market valuation (mean *EVS* = 0.588), indicating that capital markets tend to reward firms' advertising efforts more than their R&D efforts. Type IV MNCs also have the most widely dispersed networks of foreign operations as shown by the mean value of foreign countries (*FC* = 12.923). The comparison of the *FC* means among the different MNC types confirms that the network of RD-intensive MNCs is dispersed in more countries than that of AD-intensive MNCs. The mean value of the *FC* variable for RD-intensive MNCs is 9.758 compared with a mean *FC* of 6.875 for AD-intensive MNCs. The means difference test, as reported in Panel B of Table 3, indicates that the difference in the means of *FC* between RD- and AD-intensive MNCs is statistically significant (with z-value -1.99) at conventional levels.

Another interesting observation is that AD-intensive MNCs (Type II), based on the comparison of the mean values of the concentration ratio of foreign subsidiaries, *CON2*, as an alternative measure of geographic focus, indicates in Panel B that AD-intensive MNCs (mean *CON2* = 0.663) are characterized by more geographically focused multinational business networks than RD-intensive MNCs (mean *CON2* = 0.534). The difference in the means of *CON2* between RD-intensive and the AD-intensive groups is significant at the 5% level ($z = -2.27$). Hence, based on these two measures of MNCs network variables used in our analysis (i.e., *FC* and *CON2*), the evidence clearly suggests that RD-intensive MNCs maintain substantially more geographically diversified and less geographically focused operating networks than AD-intensive MNCs. Furthermore, consistent with the view that internal financing is preferred for proprietary information related projects such as R&D, RD-intensive MNCs have the highest levels of cash flows compared to the other types of MNCs in the sample. Finally, the results show that MNCs with low tangible assets (Type I) have the highest leverage. This result seems to be consistent with the view that corporate asset structures with few tangibles create less debt agency costs.

Estimates of the market value model for the four MNC types and the pooled sample are presented in Table 4 Panel A. As expected, the coefficients of the LTD and RISK control variables in the regression model display an inverse relation with *EVS*. This effect is significant for

Table 4.

Panel A: Coefficient estimates, for the pooled sample (*ALL*), and for the four MNC types obtained from the switching regression model with one cut-off point, ($RD^* = 0.008$, $AD^* = 0.006$). *I* (low RD and AD), *II* (AD -intensive MNCs), *III* (RD -intensive MNCs), *IV* (RD - and AD -intensive MNCs). Dependent variable is EVS .

<i>Variable</i>	<i>I</i> <i>low RD and low</i> <i>AD MNCs</i>	<i>II</i> <i>AD-intensive</i> <i>MNCs</i>	<i>III</i> <i>RD-intensive</i> <i>MNCs</i>	<i>IV</i> <i>RD and AD-intensive</i> <i>MNCs</i>	<i>ALL</i> <i>Pooled MNC</i> <i>sample</i>
<i>Intercept</i>	-0.410984 -2.38**	-0.632087 -1.67*	-0.205278 -0.86	0.649564 1.87*	0.025097 0.17
<i>LTD</i>	0.044281 0.19	-2.960413 -4.05***	-0.144930 -0.38	-2.255791 -3.63***	-1.112986 -4.30***
<i>GS</i>	-0.262159 -0.92	0.592465 0.43	0.836870 1.85*	-0.171442 -0.24	0.250493 0.77
<i>CF</i>	2.459489 2.15***	7.145485 3.49***	2.652253 2.10**	2.542514 2.39**	2.755212 4.30***
<i>RISK</i>	-0.362509 -2.53**	-0.589431 -2.69**	-0.016773 -0.18	0.110599 0.50	-0.104955 -1.26
<i>GDIV</i>	0.078152 1.34	0.336839 3.77***	0.167228 2.68***	0.150615 1.72*	0.183837 4.46***
<i>GFOC</i>	0.155227 2.98***	0.489640 2.59**	0.062946 0.52	0.150615 0.12	0.104981 1.57
<i>N</i>	47	40	132	143	362
<i>F-Value</i>	2.086	8.548	2.870	5.862	12.172
<i>Prob . F</i>	0.1374	0.0001	0.0118	0.0001	0.0001
<i>adjusted R²</i>	0.1129	0.5373	0.0789	0.1704	0.1508

t-values are reported below the coefficient estimates.

*, **, and *** indicate significance at the 10%, 5%, and 1% levels respectively.

LTD = (Long Term Debt)/(Total Assets).

GS = Geometric 5-year growth rate of sales.

CF = (Operating Income before Depreciation – Interest Expense – Taxes – Dividends)/(Total Assets).

RISK = $\log(\text{High Price '91}/\text{Low Price '91})$.

GDIV = Geographic diversification measured as the $\ln(\text{Number of foreign countries where the MNC owns subsidiaries})$.

GFOC(= *CON2*) = Geographic focus measured as the $(\text{Number of subsidiaries in the two foreign countries with the highest number of subsidiaries})/(\text{Number of foreign subsidiaries})$.

Table 4. *Continued*

Panel B: Results of the test of significance in the difference of the coefficient estimates from the regressions in Panel A. The difference in the coefficients and the t-statistics are reported for the comparison of the Type II sample (AD-intensive MNCs) coefficients versus the Type III sample (RD-intensive MNCs) coefficients. MNC types were obtained from the switching regression model with one cut-off point, (RD* = 0.008, AD* = 0.006).

<i>Variable:</i>	<i>LTD</i>	<i>GS</i>	<i>CF</i>	<i>RISK</i>	<i>GDIV</i>	<i>GFOC</i>
<i>III—II:</i>	2.815483***	0.244405	-4.493231*	0.572658**	-0.169611	-0.426694*
Δ (coefficient) (t-value)	(3.11)	(0.15)	(-1.72)	(2.17)	(-1.44)	(-1.75)

Panel C: Coefficient estimates for the regression using the low RD and the high RD samples of MNC obtained by dividing the pooled sample around RD* = 0.008. High RD MNCs have RD > RD* and low RD MNCs have RD ≤ RD*. Dependent variable is EVS. Also reported is the differences between the coefficients obtained from the low RD and the high RD regression for each independent variable. t-values are in parentheses.

<i>Variable:</i>	<i>Intercept</i>	<i>LTD</i>	<i>GS</i>	<i>CF</i>	<i>RISK</i>	<i>GDIV</i>	<i>GFOC</i>	
<i>Low RD</i>	-0.492315**	-0.946331**	-0.121911	5.730013***	-0.545978***	0.202094**	0.173195**	F = 7.407
(N = 87)	(-2.25)	(-2.77)	(-0.27)	(4.63)	(-3.69)	(3.54)	(2.26)	Adj-R ² = 0.309
<i>High RD</i>	0.114323	-1.110620***	0.382004	2.453730***	-0.024875	0.181364***	0.063287	F = 7.884
(N = 275)	(0.58)	(-3.12)	(0.91)	(3.27)	(-0.25)	(3.37)	(0.69)	ADJ-R ² = 0.131
<i>Low-High</i>								
Δ (coeff)	-0.606637*	0.164289	-0.503915	3.276283*	0.521103**	0.020730	0.109908	
(t-value)	(1.68)	(0.28)	(-0.68)	(1.73)	(2.26)	(0.22)	(0.79)	

*, **, and *** indicate significance at the 10%, 5%, and 1% levels respectively.

LTD = (Long Term Debt)/(Total Assets). *GS* = Geometric 5-year growth rate of sales. *CF* = (Operating Income before Depreciation – Interest Expense – Taxes – Dividends)/(Total Assets). *RISK* = log(High Price '91/Low Price '91). *GDIV* = Geographic diversification measured as the ln(Number of foreign countries where the MNC owns subsidiaries). *GFOC*(=CON2) = Geographic focus measured as the (Number of subsidiaries in the two foreign countries with the highest number of subsidiaries)/(Number of foreign subsidiaries).

high-AD MNCs (Types II and IV) in the case of *LTD*, and for low-RD MNCs (Types I and II) in the case of *RISK*. Consistent with Chauvin and Hirschey (1993), the *CF* variable has a positive and significant coefficient throughout the analysis, while the coefficient of the *GS* variable is significant only for the RD-intensive MNCs (Type III).

The geographic diversification variable (*GDIV*) has a positive and significant coefficient for the three MNC groups with significant levels of at least one type of intangibles (i.e., types II, III, and IV). Consistent with the evidence reported earlier, AD-intensive MNCs display a positive and significant coefficient for the *GFOC* variable as well, implying that geographic focused expansion is value increasing for this type of firms. The market seems to place a positive value to an increase in the geographic focus of the MNC's network for firms with marketing oriented intangible assets. The coefficient of *GFOC* is about 0.5, indicating that a 10% increase in the concentration ratio of foreign subsidiaries in the top two foreign countries of an advertising-intensive MNC would result in a 5% increase of its market value. This result also suggests that MNCs with advertising related advantages are likely to benefit from the increased geographic focus of their foreign operations because of the country-specific advantages of the host country and the nature of the MNC's intangible assets. RD-intensive MNCs, however, are likely to gain more through geographical diversification than focus of their foreign operations, as shown by the positive and significant relationship between firm value (*EVS*) and geographic diversification (*GDIV*). The coefficient of *GDIV* is about 0.17 which indicates that a 10% increase in the natural logarithm of the number of foreign countries an RD-intensive MNC operates in would result in a 1.7% increase of its market value. This is consistent with the notion that, because R&D advantages are easily transferable across borders, an expansion of the firm's network in new foreign markets (i.e., increasing the geographic diversification dimension of the MNC network) creates value.

These results, then, imply that RD-intensive MNCs are better off when they expand the geographical dimension of their foreign operations as opposed to trying to enhance the geographical focus of their foreign operations. Furthermore, for MNCs with high levels of marketing (AD) and technological know-how (RD) related intangible assets, geographic diversification of their foreign operations is likely to produce significant positive valuation effects. The same result is obtained when all firms are included in the analysis. While these results appear to be consistent with the predictions of the internalization of foreign investment activities of the firm, they also imply that firms with different intangible-asset intensities

are not likely to pursue the same course of foreign investment expansion. Finally, MNCs without significant levels of RD or AD related intangibles tend to benefit more from geographic-focused than geographic-diversified foreign business operations. The coefficient of the *GFOC* variable is positive and significant at the 1% level. It is noteworthy that this result remains essentially the same after we restrict the analysis to firms with zero RD and AD intensities. This result is not fully consistent with the internalization theory's prediction that a firm has to own substantial intangible assets in order to successfully expand its operations in foreign markets. This finding suggests that firms without a strong base of RD- and AD-related intangibles are able to benefit from international involvement, provided their foreign operations are geographically focused. This result also implies that this type of firm may be adding to its market value by its focused management of foreign based (i.e., country-specific) intangible assets. The evidence that country-specific advantages may create value for MNCs even in the absence of significant corporate intangibles, provides additional support for the multinational network hypothesis (see Doukas and Travlos, 1988; Doukas, 1995; Allen and Pantzalis, 1996) which postulates that foreign expansion is also motivated by the inherent advantages of the multinational structure of the firm.

To assess the relative impact of the network structure parameters on the market valuation of RD- and AD-intensive MNCs we test whether the difference among the regression coefficients, obtained in Table 4 Panel A for the two MNC Types, are statistically significant. These results are presented in Table 4 Panel B. The results reveal that the coefficients of *GFOC* are significantly different at the 10% level, while the coefficients of *GDIV* are not significantly different among the RD- and AD-intensive groups. In addition to that, the coefficients of *LTD* and *RISK* are significantly different among the two groups. These results are consistent with the notion that the market value varies significantly among MNCs with different types of intangible assets. In particular, the results in Table 4 Panel B indicate that the effect of geographic diversification of the MNC network on *EVS* is positive and not significantly different among RD- and AD-intensive MNCs. On the other hand, the sign and the magnitude of the effect of the degree of the geographic focus of the MNC network on *EVS* is significantly different between RD- and AD-intensive MNCs.

Finally, in Table 4 Panel C we provide the regression results using a dichotomous grouping of the pooled sample around RD* (i.e., high-RD and low-RD MNCs). This is done to examine whether a grouping based on a single intangible asset spans a new dimension. We also provide for

each variable the differences in the regression coefficients from the low-RD and the high-RD sample regressions. The results indicate that the effect of *CF* and *RISK* on *EVS*, differ significantly among the high-RD and the low-RD groups, while the effects of *GFOC* and *GDIV* on *EVS* are not significantly different among the two groups.

As shown in Table 4, the effect of *GDIV* and *GFOC* on *EVS* varies according to the level and type of intangibles possessed by MNCs. One would then expect to observe some differences in terms of firm characteristics between the four MNC groups. In particular, since some industries are more consumer oriented and others more technology oriented, one would expect the firms in the four different groups to be concentrated in few, different industries, rather than being evenly distributed across industries.

In Table 5, we present a breakdown of the number of firms in each MNC group by industry.¹⁵ AD-intensive (Type II) MNCs are firms that are

Table 5. *Distribution of MNCs in the pooled sample and the four groups by industry**

<i>Industry</i>	<i>I Low RD and AD MNCs</i>	<i>II AD- intensive MNCs</i>	<i>III RD- intensive MNCs</i>	<i>IV RD- and AD- intensive MNCs</i>	<i>ALL Pooled MNC sample</i>
<i>Mining</i>	4	1	5	0	10
<i>Construction</i>	0	0	1	0	1
<i>Food/Tobacco</i>	2	11	0	7	20
<i>Textiles</i>	0	5	2	0	7
<i>Lumber/Paper</i>	3	1	7	7	18
<i>Publishing</i>	2	1	1	0	4
<i>Chemicals</i>	2	1	18	31	52
<i>Petroleum/ Rubber/Plastic</i>	6	3	4	6	19
<i>Leather/Glass</i>	2	0	3	2	7
<i>Primary metal products</i>	4	0	8	0	12
<i>Metal products</i>	5	5	6	5	21
<i>Machinery</i>	9	4	23	34	70
<i>Electric equipment</i>	2	0	21	23	46
<i>Transportation</i>	2	3	16	4	25
<i>Miscellaneous manufact.</i>	4	5	17	24	48
<i>Total</i>	47	40	132	143	362

*A chi-square test rejects the hypothesis that the industry distributions are identical across the four groups of MNCs.

active primarily in the Food and Tobacco industry. The Food and Tobacco industry group makes up 27.5% (or 11 out of 40) of all Type II firms. The next largest groups of AD-intensive MNCs are in the Textiles and the Metal Products industries (with 5 MNCs each, out of a total of 40 Type II firms). The 132 RD-intensive MNCs are mainly to be found in industries like Machinery (23 Type III firms), Electric Equipment (21 Type III firms), Chemicals (18 Type III firms), Transportation (16 Type III firms), and Miscellaneous Manufacturing (17 Type III firms). Type IV firms, which are RD- and AD-intensive MNCs, are heavily represented in the same industries where the bulk of Type III firms is, with the exception of the Transportation industry. Indeed, Type IV MNCs are more concentrated than Type III firms in few industries. Finally, the largest group of Type I firms is in the Machinery industry (9 MNCs out of a total of 47 Type I firms), followed by the Petroleum/Rubber/Plastic and the Metal Products industries (with 6 Type I MNCs in each). Thus, not surprisingly, AD-intensive MNCs are mostly firms that operate in consumer oriented industries, such as the food and tobacco industries, while RD-intensive MNCs are firms that mainly operate in technology-oriented industries such as the chemicals, machinery, and electric equipment industries.¹⁶

It appears that AD-intensive MNCs' intangibles, being of a more country-specific nature, fit better with local foreign country intangible assets, inducing MNCs to focus more in local foreign markets by expanding their multinational network vertically in each foreign country. Expanding across countries does not seem to favor the stockholders of AD-intensive MNCs because transactions costs of organizing internal markets for AD-related intangibles outweigh the benefits derived from such markets. On the other hand, RD-intensive MNCs possess intangibles that seem to be not well tied with advantages of the hosting foreign country. Thus, RD-intensive MNCs seem to benefit from spreading their multinational network across countries where the benefit of superior product development and production efficiency outweigh the transactions costs of transferring RD intangibles within their network.

Overall, the empirical results provide strong support to the notion that investors recognize the significance of the interaction of multinational network structure with the MNCs' investments in different types of intangibles, and assign market values accordingly. However, contrary to the internalization hypothesis, MNCs without significant levels of intangibles are found to benefit from foreign expansion, provided this is done by means of increasing the geographic focus of the MNC's foreign subsidiary network.

V. Conclusion

We identify interactive effects between the level and type of intangibles and the network structure of the MNCs that cannot be captured if one does not separate MNCs into groups according to their emphasis on different types of intangibles (R&D related and advertising related). Because of the different nature of these intangible assets, the MNC's value maximizing foreign expansion path depends on whether it has R&D- or advertising-related comparative advantages.

The results indicate that investors assign higher values to RD-intensive MNCs when they expand the geographic diversification of their foreign subsidiaries' network. This result implies that investors recognize the company-specific nature of RD-related advantages, which allows such advantages to be easily transferred across borders. Moreover, the market rewards the geographic focused expansion of the MNC network (i.e., by increasing the concentration of foreign subsidiaries) if the MNC is an AD-intensive firm. This indicates that investors recognize the country-specific nature of the know-how related to AD advantages and assign higher market values to those AD-intensive MNCs that increase their network in countries where they have already established operations.

These findings support the view that investors are aware of the interplay between multinationality and intangibles, and seem to assign market values accordingly. We provide insight about the optimal expansion path of MNCs of different kinds (consumer- or technology-oriented MNCs), a finding that is of value not only to investors, but to regulators and researchers in other disciplines as well. In addition, this empirical study provides evidence consistent with the multinational network hypothesis in the sense that expansion of foreign operations is found to be value increasing even for MNCs that do not possess significant levels of intangible levels. This is also consistent with the general perception that foreign operations are associated with greater growth opportunities because of host-country related comparative advantages that can only be captured by spreading the firm's activities internationally.

Notes

1. The origins of the theory of internalization can be traced to Coase (1937) and Hymer (1976). For further discussion and analysis refer to Buckley and Casson (1976), Rugman (1981), Teece (1981) and (1985), Caves (1982), Hennart (1986) and Buckley (1988).

2. Other related studies include Errunza and Senbet (1981, 1984), Kim and Lyn (1986) and Morck and Yeung (1992).

3. Product differentiation achieved from RD intangibles is one of an objective nature. It stems from improved "lead time" of production (i.e., time elapsed from the inception of the product until its introduction to the market), better product features, higher product quality and performance. On the other hand, product differentiation associated with superior marketing ability reflects the ability to better communicate to the market the superior features of the product and the higher consumer awareness of the product's quality. Consequently it has a more subjective nature.

4. These are the costs of bringing the two parties together, the costs of negotiating, the costs of contracting and the costs of overseeing contractual terms.

5. The MNC network provides a collection of links between different product markets. As described in Galbraith and Kay (1986), every link is a potential synergy source, hence maintaining the optimal number and mix of links maximizes value. Technological links provide conduits for RD-driven synergies while marketing links offer opportunities for AD-driven synergies.

6. Namely the difference in the easiness with which information is transferred across foreign countries and within a foreign country.

7. A MNC is defined here as a firm with at least one foreign subsidiary.

8. The SR model used here is the one developed by Goldfeld and Quandt (1973). It maximizes the log-likelihood function value for all possible (RD, AD) combinations that create different groups, i , of MNCs ($i = \{I, II, III, IV\}$). The cut-off point that maximizes the log-likelihood function value (RD^*, AD^*) is chosen as the critical point around which the four MNC groups are defined. We are thankful to an anonymous referee for pointing out that our hypotheses could alternatively be tested using the Morck and Yeung (1991) OLS regression model on the pooled sample. The Morck and Yeung (1991) model is $q = mn(Y_0 + Y_1RD + Y_2ADV) + \text{control variables}$, where q is the market value measure, and mn are the multinational network variables. We have used the SR approach instead, because of its intuitive appeal and its ability to control for the possible non-linear effects between Y_1 , Y_2 and the intangibles variables (RD and ADV , respectively).

9. *EVS* was developed by Thomadakis (1977). *EVS* was shown by Hirschey and Wichern (1984) to be highly correlated with Tobin's q . Both market value measures (Tobin's q and Thomadakis' *EVS*) are subject to accounting measurement errors and bias, but are still appropriate in a cross-sectional study of this nature.

10. This measure has been utilized in a market value study by Chauvin and Hirschey (1993) and it is proportional to the "ideal" volatility estimator of Garman and Klaas (1980).

11. The *GDIV* and *GFOC* measures are similar to the measures of "breadth" and "depth" of a multinational network used in Allen and Pantzalis (1996).

12. The number of foreign subsidiaries that the MNC maintains in the two countries of its network with the most subsidiaries has also been considered as an alternative measure of the geographic focus. The use of this geographic focus variable in the analysis does not materially alter the results reported here.

13. In addition to the cut-off points determined using the SR methodology, we repeated this study using the median RD and AD values to separate the pooled sample into the four MNC groups. The results of the study based on these groups are not substantially different from the ones presented here. Furthermore, the SR procedure was repeated to investigate the possible presence of additional cut-off points for each switch variable. Additional cut-off points were not found to be significant.

14. Chauvin and Hirschey (1993) show that for RD and AD to become effective, they have to be above certain "thresholds".

15. This 15 major industries classification was performed based on each firm's primary 2-digit SIC code industry.

16. This is confirmed by testing the industry distributional differences in our sample. A chi-square test rejected the hypothesis that the industry distributions are identical across the four groups of MNCs.

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