TRANSNATIONALITY AND FINANCIAL PERFORMANCE IN THE ERA OF THE GLOBAL FACTORY

Peter J Buckley
Professor of International Business
Centre for International Business
University of Leeds
Maurice Keyworth Building
LS2 9JT, United Kingdom

&

Xiaowen Tian (corresponding author)
Professor of Management
School of Business and Governance
Murdoch University
90 South Street, Murdoch, WA 6150, Australia
Tel: 61-8-93606599
Email: x.tian@murdoch.edu.au

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ABSTRACT. Drawing on the core notions of knowledge augmentation and rational choice in internalization theory, the paper develops a theoretical framework to examine the relationship between transnationality and financial performance in the era of the global factory, and tests hypotheses against recent experience of leading transnational enterprises. The paper rejects a direct relationship between transnationality and financial performance, and supports a mediation model in which knowledge-based assets mediate the relationship between transnationality and financial performance conditional on R&D intensity. In making decisions on the transnationality of a firm, managers should not focus on whether it helps the firm achieve direct financial benefits because these are quickly offset by the costs in a competitive environment. Instead, they should focus on whether it helps the firm enhance knowledge-based assets and, through it, financial gains that can be long-lasting, and whether it is supported by R&D to augment such assets.

Key words: internalization theory, transnationality, performance, global factory

1. Introduction

Transnationality is defined as the extent to which a firm engages in value-creating activities across national borders. Faced with accelerated globalization, managers often make decisions to expand a firm's transnationality in order to enable the firm to effectively compete with rivals on a global scale. Increasing transnationality has become a prominent feature of the world's leading firms in recent years, as shown in the transnationality index of top 100 transnational enterprises (TNEs) published by the United Nations Conference on Trade and Development (UNCTAD 2014). Famous global brands, such as General Electric, Shell, Toyota, Exxon Mobil, and British Petrol, have been on the top of the transnationality index for years. The relationship between transnationality and financial performance (hereafter T-P relationship) thus became a focus of research.[1] The research reached, however, little consensus on the nature of the T-P relationship. Some found a positive T-P relationship (Grant 1987) while others found a negative T-P relationship (Siddharthan and Lall 1982; Kumar 1984). The findings were so divergent that many characterized them as "inconclusive" (Tallman and Li 1996: 180), "mixed" (Doukas and Lang 2003:154; Gomez-Mejia and Plich 1997: 310), "decidedly mixed"

[1] Some studies have used different terms for the T–P relationship, including the I–P relationship (internationalisation–performance relationship) and the M–P relationship (multinationality–performance relationship). These terms are often used interchangeably in the literature (Tallman and Pedersen 2012).

(Hitt, Hoskisson and Kim 1997: 772), "inconsistent" (Ruigrok and Wagner 2003: 65), "conflicting" (Annavarjula and Beldona 2000: 48), "contradictory" (Geringer, Tallman and Olsen 2000: 51), and "disappointing" (Hennart 2007:424). The confusing findings offer little guidance to managers who have to make decisions on the transnationality of a firm, and need to know whether and how the decisions may help enhance firm performance.

The present paper contends that a major problem in extant research lay in the focus on the direct financial benefits and costs of increasing the transnationality of a firm. The direct benefits were said to include reduction in financial risk due to geographic diversification of investment (Markowitz 1959; Shapiro 1978; Kim, Hwang and Burgers 1993), arbitrage of differentials in location-based endowments (Delios and Beamish 1999), profiting from linkage, leverage and learning in cross-border cooperations (Mathews 2002, 2006), and cost-savings through scale economies (Hitt, Hoskisson and Kim 1997). The direct costs were believed to include operation costs related to the liabilities of foreignness (Zaheer and Mosakowski 1997), learning costs associated to the liabilities of newness (Caves 1971), and coordination costs in managing dispersed value chain across the globe (Hitt, Hoskisson and Kim 1997; Bartlett and Ghoshal 1989; Sunderam and Balck 1992; Tomassen and Benito 2009; Richter 2014). In particular, Richter (2014) was among the first who have actually attempted to measure these costs. The focus on direct benefits and costs eventually led to the formulation of a "three-stage or S-shaped general theory" of the T-P relationship (Contractor 2007: 453; also see Contractor, Kumar and Kundu 2007; Contractor, Kundu and Hsu 2003; Lu and Beamish 2004; Thomas and Eden 2004; Contractor 2012). According to this theory, the T-P relationship changes with the incremental benefits and costs incurred to a firm at different stages of transnational expansion. The T-P relationship is negative at the early stage of transnational expansion, when substantial initial costs exceed benefits; positive at the mid stage of transnational expansion, when growth benefits surpass its costs; and then negative again at the late stage of transnational expansion, when increasing coordination costs outstrip the benefits. Guided by the theoretical focus on direct financial benefits and costs, extant research almost exclusively estimated the direct T-P relationship through regression analysis in which a firm's profitability was directly regressed on its transnationality index (Yang and Driffield 2012).

This paper argues that the T-P relationship is far more complex than envisaged in the direct benefit-cost approach. A third variable may influence the transnationality of a firm on the one hand and profitability of the firm on the other, and thereby has an impact on the T-P relationship. Hitt, Hoskisson and Kim (1997) noted,

for instance, that transnational expansion enhances a firm's innovation capabilities to augment knowledge. However, Hitt and colleagues did not go further to investigate the indirect financial gains from transnational expansion through knowledge augmentation. To distinguish indirect financial gains through knowledge augmentation from direct financial gains, it is necessary to develop a mediation framework to model the T-P relationship on a solid theoretical base and apply techniques of mediation analysis in empirical tests.

The lack of mediation analysis was recently noticed by a group of scholars who developed mediation models that take into account knowledge-based assets, also named firm-specific advantage or firm-specific assets. They maintained that knowledge-based assets such as proprietary technology and management know-how profoundly influence both transnationality and profitability, and the relationship between them. However, scholars in the group disagreed on which variable is the mediator in the mediation framework. Some proposed a 'T-mediator model', arguing that transnationality is the mediator between knowledge-based assets and profitability. Rugman and Verbeke (2008: 169) noted that transnationality is really "an intermediate variable, not an independent variable", and that "the true independent variable" that influences performance is knowledge-based assets. Kirca et al. (2011: 51) further postulated that transnationality "mediates the relationship" between knowledge-based assets and financial performance. Others proposed a 'K-mediator model', arguing that knowledge-based assets are the mediator between transnationality and financial performance. Verbeke and Forootan (2012: 335) proposed that knowledge-based assets "act as mediator", qualifying any observed linkage between transnationality and financial performance. Both sides believed that their mediation models were based on internalization theory. However, neither side explicated the difference in theoretical rationales between the two mediation models.

The present paper argues that the two mediation models represented alternative theoretical explanations about the relationship between transnationality and financial performance. The T-mediator model focused on the role of knowledge-based assets in determining transnationality and, through it, profitability. The K-mediator model focused on the role of transnationality in enhancing knowledge-based assets and, through it, profitability. Both mediation models need to be assessed against core notions of knowledge augmentation and rational choice in internalization theory in the light of the transition from vertically integrated TNE to "the global factory" (Buckley 2009: 229). Both models need to be subjected to empirical tests against recent experience of TNEs to see how well they help explain the new international business reality.

The contribution of the paper is threefold. It applies the notions of knowledge augmentation and rational choice to the new international business reality of the global factory, and develops a coherent internalization theory framework to examine the relationships between transnationality, knowledge-based assets, R&D, and profitability. Moreover, it tests the two mediation models against a dataset of leading TNEs from 2004 to 2011, provides robust evidence in support for a model in which knowledge-based assets mediate the relationship between transnationality and financial performance conditional on R&D, and helps resolve the T-P relationship puzzle in current discussion. Based on the findings, furthermore, it draws implications for managers in making decisions on transnational boundary and R&D to enhance knowledge-based assets and, through it, financial gains that can last long.

2. Theoretical Framework and Hypotheses

Since the pioneering work of Coase (1937), internalization theory has analysed firms in relation to imperfect markets, and become the theoretical foundation for research on TNEs. A number of scholars applied internalization theory to the transnationality of a firm, including Buckley and Casson (1976), Hennart (1982), Hymer (1976), McManus (1972), Swedenborg (1979), and Rugman (1981). Consequently, there were different interpretations, if not branches, of internalization theory in the research on TNEs. In the meantime, internalization theory has experienced substantial development in recent decades in integrating with theoretical perspectives from other disciplines in order to embrace the changing international business reality (Buckley and Casson 2009; Teece 2014). It is beyond the scope of the paper to trace the development of internalization theory as applied to TNEs in any detail. We primarily draw on the key ideas of internalization theory as explicated in Buckley and Casson's 1976 book and their subsequent writings to form the theoretical base of the paper.

Buckley and Casson (1976: 33) noted that firms maximize profit in a world of imperfect markets. When markets in intermediate products are imperfect, there is an incentive to bypass them by creating internal markets in a firm. Internalisation of markets in intermediate products across national boundaries generates TNEs. Buckley and Casson were particularly interested in internalization of markets for a particular kind of intermediate product – knowledge generated by R&D. They developed a special theory that internalization of the knowledge generated by R&D has characterized TNEs since World War II, and that the transnationality of a firm is a by-product of the internalization of markets in knowledge generated by R&D (Buckley and Casson 1976). As rational agents, meanwhile, managers make rational decisions on the transnationality of a firm to balance the benefits against the costs of internalizing markets for knowledge in order to maximize profit in

competition with rivals. Thus the transnationality of a firm is also an outcome of the rational choice of managers. Internalization theory thus has two critically important notions: 1) knowledge generated by R&D plays a major role in the formation and development of a TNE; and 2) managers make rational choice of the transnationality of a TNE to maximize profit. Any models of the T-P relationship should take into account knowledge augmentation and rational choice.

Nevertheless, the global economy and international business have experienced profound changes in the decades since the publication of Buckley and Casson's book in 1976. A most significant change has been accelerated globalization and the rise of economies from the periphery of the world. The four newly industrialized economies of South Korea, Taiwan, Singapore and Hong Kong developed rapidly through integrating with the global market in the 1970 and 1980s. Many firms based in these economies, such as Foxconn and Flextronics, became major contract manufacturers, suppliers and distributors for western TNEs. Former closed or semi-closed economies in Asia, East Europe and Latin America opened up to the world market in the 1980s and 1990s, and attracted an increasing amount of foreign investment. Firms based in these emerging markets, particularly Brazil, Russia, India and China (BRIC), actively participated in the global production system through partnership with established TNEs in the upstream and downstream value chains, and engaged in "subcontracting production and service activities from the brand-owning TNEs" (Buckley, 2009: 229). These new participants in the global market from the periphery increased the pool of suppliers of external market transactions worldwide, and reduced the cost and price of external market transactions against internalized activities of TNEs (Buckley 2009; Liesch, Buckley, Simonin and Knight 2012). Meanwhile, development in digitalization, international technical standards, and intellectual property rights improved the performance of external markets relative to internal markets. All these changes have "led to a significant growth in international licensing, franchising, and subcontracting" (Buckley and Casson 2009: 1574). International businesses are no longer dominated by vertically integrated TNEs, but are characterized by a "differentiated network" or the "global factory" in which externalized and quasi-internalized activities increase in importance (Buckley 2009: 229). Therefore, the role knowledge augmentation and rational choice play in TNEs should be analysed against this significant change.

In the transition to the global factory, global orchestration know-how has become the cornerstone of knowledge-based assets of a TNE. Buckley (2009: 233) noted that "the use of increasingly complex structures involves both internalized and externalized activities, and requires that externalized activities be carefully

monitored (for quality control reasons for example) and integrated with those activities under the ownership of the global factory. 'Interface competence' – the ability to coordinate external organizations into the strategy of the focal firm, to liaise with external bodies and governments and to cohere these activities into a grand strategy – are at the heart of the skills necessary to organize a successful global factory" and are therefore the crux of the competitive advantage of a TNE. Managers can no longer manage simply by control and command, and have to learn and develop new skills in "orchestration and conducting" of all parts of the value chain in the global factory (Buckley 2011: 281). If internalization of knowledge influences, as internalization theory predicts, transnationality and profitability, then a TNE has to obtain certain knowledge-based assets in order to expand its boundaries across national borders, and has to enhance knowledge-based assets in order to achieve financial success in transnational expansion. To augment the knowledge-based assets, a TNE has to engage in R&D since "R&D represents any organized activity that converts ideas and experience into incremental innovations in the design, production, or marketing of the product range" (Buckley and Casson 2009: 1570). Knowledge-based assets are therefore likely to positively influence transnationality on the one hand and profitability on the other conditional on R&D intensity. We thus propose the following.

Hypothesis1a. Knowledge-based assets are positively related to transnationality conditional on R&D intensity.

Hypothesis 1b. Knowledge-based assets are positively related to profitability conditional on R&D intensity.

In the era of the global factory, a TNE may augment knowledge not only internally through R&D, but also externally through access to the know-how needed for managing differentiated networks in host countries. Internalization theory was recently extended to take into account the external market for knowledge. Buckley (2009: 226) noted that "the approach to innovation in the 1976 book is very much on the power of internal markets to integrate knowledge flows and so to create dynamic efficiencies in the firm by linking R&D with production and marketing. Later emphasis on accessing external markets in knowledge is a major factor leading to a more dispersed 'global factory' configuration in markets for knowledge". The access to external knowledge can be achieved through transnational expansion in the form of international acquisition, joint venture, and so on. We thus propose that a TNE can augment knowledge-based assets through accessing external knowledge in transnational expansion, and that transnationality has a positive effect on knowledge-based assets. However,

whether a TNE can fully utilize and absorb the external knowledge is conditional on R&D that drives knowledge augmentation.

In the era of the global factory, meanwhile, development of communication technology and the internet provides timely and abundant information for TNE managers to make decisions on transnational boundary based on analysis of the benefits and costs of internalization of markets against external market transactions. Managerial decisions on transnational boundary become increasingly rationalized to the extent that the transnationality of a firm is set "at the margin where the benefits of future internalization of markets are just offset by the costs" (Buckley and Casson 2009: 1564). Therefore, transnationality does not directly lead to high profitability because the benefits and costs of the hierarchical governance model in a TNE as opposed to the price governance model in the marketplace will be equalized in a competitive environment, leaving a TNE no advantage in direct financial gains as compared to a domestic firm (Buckley 2009; also see Hennart 2007). However, it might be argued that the prediction reflects an average trend, and that whether a TNE can achieve direct financial gains from transnationality may be contingent on R&D intensity. TNEs with higher levels of R&D intensity may be more likely to achieve direct financial gains from transnationality than TNEs with lower levels of R&D intensity. We formulate a hypothesis based on this argument. We acknowledge, however, that the reverse might be true. That is, R&D increases managers' knowledge and ability to make rational choice based on benefit-cost analysis so that the transnationality of a firm is still likely to be set at the margin.

Hypothesis 2a. Transnationality is positively related to knowledge-based assets conditional on R&D intensity.

Hypothesis 2b. Transnationality is positively related to profitability conditional on R&D intensity.

It is time to turn to empirical test of the two mediation models discussed in the last section in the light of the internalization theory. Any mediation model needs to illustrate 1) the direct effect of the independent variable on the dependent variable, and 2) the indirect effect of the independent variable on the dependent variable through the mediator variable. The indirect effect is referred to as the mediation effect, and is the focus of mediation analysis. Having discussed the relationships between major variables in both the T-mediator model and the K-mediator model against internalization theory, we can formulate hypotheses about the direct and indirect effects of the two mediation models moderated by R&D intensity.

For the T-mediator model, we draw on hypothesis 1b to posit that knowledge-based assets are likely to have a positive direct effect on profitability conditional on R&D intensity. Based on hypotheses 1a and 2b, meanwhile, we posit that knowledge-based assets are likely to have a positive indirect effect on profitability through transnationality conditional on R&D intensity. For the K-mediator model, similarly, we draw on hypothesis 2b to postulate that transnationality is likely to have a positive direct effect on profitability conditional on R&D intensity. Based on hypothesis 2a and 1b, meanwhile, we postulate that transnationality is likely to have a positive indirect effect on profitability through knowledge-based assets conditional on R&D intensity. We thus develop the following hypotheses.

Hypothesis 3a. Knowledge-based assets have a positive direct effect on profitability conditional on R&D intensity.

Hypothesis 3b. Knowledge-based assets have a positive indirect effect on profitability through transnationality conditional on R&D intensity.

Hypothesis 3c. Transnationality has a positive direct effect on profitability conditional on R&D intensity.

Hypothesis 3d. Transnationality has a positive indirect effect on profitability through knowledge-based assets conditional on R&D intensity.

3. Method

3.1 Sample

The annual World Investment Report, published by the United Nations' Conference on Trade and Development (hereafter UNCTAD), contains the data of top 100 nonfinancial TNEs in the world ranked by foreign assets. We combined the annual data from 2004 to 2011 to construct the sample. The data set included the value of total sales revenue and the value of sales revenue from foreign markets, the number of total employees and the number of employees in foreign affiliates, and the value of total assets and the value of assets in foreign affiliates.

However, the data set did not include profit, equity and R&D expenditure. We collected profit, equity, and R&D expenditure data from various sources, including the Fortune Global 500 company dataset, and the EU Industrial R&D Investment Report. We cross-checked the data in the three sources, and found that they were

largely consistent.[2] For TNEs which were included in UNCTAD dataset, but not in the Fortune Global 500 company dataset and the EU Industrial R&D Investment Report, we checked the annual report of these TNEs to find relevant information of these TNEs.

We deflated the value of profit, the value of equity, the value of R&D expenditure, the value of total sales revenue, the value of sales revenue from foreign market, the value of total assets, and the value of assets in foreign affiliates using the 2000 constant price indexes compiled by UNCTAD. After deleting cases with missing information, we obtained an unbalanced panel data set with 618 observations. The TNEs were located in 19 industries classified by UNCTAD, as shown in Table 6.

3.2 Variables

Profitability was measured by the return on asset ratio (ROA), i.e., the ratio of profit to assets. We industry-centred ROA according to the industry classification provided by UNCTAD so that the variable represented a firm's profitability relative to rivals in an industry. The relative measure indicated competitive advantage in financial performance as noted in extant studies (Sirmon, Hitt, Arregle and Campbell 2010). Alternative measures of profitability included the return on sales ratio (ROS) and the return on investment ratio (ROI), and they were used in supplementary tests.

Knowledge-based assets were proxied by total factor productivity (TFP). Total factor productivity has been widely used as a measure of aggregate technology and management know-how since the seminal work of Solow (1956, 1957), a Laureate of Nobel Prize in economics (Tian and Slocum 2015). This measure was particularly appropriate in the context of TNEs in which knowledge-based assets are increasingly characterized by the ability and skills to orchestrate internal and externalized activities in the entire value chain (Buckley 2009, 2011). The ability and skills are reflected in the improved productivity of all resources used in a TNE across the globe. TFP is not directly observable, but can be estimated using a production function as expressed in Equation 1.

$$G_{ijt} = P_{ijt} {S_{ijt}}^{\beta 1} {A_{ijt}}^{\beta 2}, \quad (1)$$

where $_i$ represented firm, $_j$ represented industry, and $_t$ represented year. G represented the value of total sales revenue, S represented the number of total staff, and A represented the value of total assets. $\beta 1$ and β_2

[2] We would like to thank an anonymous reviewer for advice on this point.

represented marginal productivity of workforce and assets, respectively. Both were constants determined by available technology. P represented TFP (Solow 1956, 1957).

Taking the natural logarithm of Equation 1 produced Equation 2:

$$LgG_{ijt} = a + \beta_1 LgS_{ijt} + \beta_2 LgA_{ijt} + \epsilon_{ijt} \quad (2)$$

The constant *a* and the error term ϵ_{ijt} represented TFP (P_{ijt}), which was calculated using Equation 3.

$$P_{ijt} = LgG_{ijt} - \beta_1 LgS_{ijt} - \beta_2 LgA_{ijt} \quad (3)$$

We needed to address the simultaneity bias and the selection bias in estimating labour coefficient (β_1) and capital coefficient (β_2) in Equation 2 (Yasar and Baciborski 2008). Olley and Pakes (1996) and Levinsohn and Petrin (2003), henceforth OP and LP, have developed two similar semi-parametric estimation procedures to overcome these biases using, respectively, investment and material costs as instruments for the unobservable productivity shocks. As data on material costs were not available, we followed the OP procedure, as illustrated by Yasar and Baciborski (2008), to use investment as the instrument for the unobservable productivity shock in calculating TFP.

We industry-centred TFP according to the industry classification provided by UNCTAD so that the variable represented a firm's knowledge-based assets relative to rivals in an industry. To minimize possible biases, we combined the UNCTAD data with the Fortune Global 500 company data to construct industry-level measure of TFP in industry-centring the variable.

Transnationality was measured by the transnationality index provided by UNCTAD. This index was an average of three ratios: foreign asset to total asset, foreign employment to total employment and foreign sales revenue to total sales revenue.

R&D intensity was measured by the ratio of R&D expenditure to total sales revenue. R&D is an important variable in the internalization theory because it affects transnationality on the one hand and knowledge-based assets on the other (Buckley and Casson 1976, 2009). We thus included R&D intensity as a moderator in the mediation models.

We included several *control variables***.** Large firms tend to act differently from small firms in transnational expansion, which may affect transnationality, knowledge-based assets, and profitability (Kirca et

al. 2011). We controlled for the effect of firm size using the logarithm of sales revenue of a firm, and named the variable firm size. Financial slack may also influence transnationality, knowledge-based assets, and profitability (Bourgeois 1981). Following Bourgeois (1981) and Chang and Rhee (2011), we operationalized financial slack using the leverage ratio (i.e., the ratio of liability to equity). A lower ratio indicated greater potential to raise additional fund and, thus, more financial slack. We also constructed industry dummy and country dummy variables to control for the impact of variation in industry and country of origin. These control variables were included in all regressions.

3.3 Estimation Strategy

We employed the bootstrapping approach to mediation analysis based on resampling the data 1000 times to produce not only a point estimate of the direct and indirect effects but also the standard errors and confidence intervals that were unbiased even if the error terms violated normal distribution. The bootstrapping approach is currently the most reliable approach to mediation test (Preacher, Rucker and Hayes 2007; Hayes, 2013). We used the mediation analysis software "Process" provided by Hayes (2013). All estimates were corrected for heteroskedasticity using White's heteroskedastic-consistent standard errors.

Before running the mediation analysis, we followed Sirmon and Hitt (2009) to use 2SLS to address the problem of endogeneity. In particular, transnationality and knowledge-based assets were likely to be endogenous. We therefore need find instruments which should not be related to the dependent variable predicted in the second stage, but should be related to the endogenous variables predicted in the first stage. The foreign input intensity ratio met these criteria. The ratio was the average of foreign asset to foreign sales revenue ratio and foreign employment to foreign sales revenue ratio. The intuitive argument was that some variation in transnationality and knowledge-based assets was due to the financial capacity to acquire input resources overseas, which should also shows up in the foreign input intensity ratio (Murray 2006). The instrumental variable was included in the first-stage regression, but not in the second-stage regression. The descriptive statistics and correlation matrix of major variables are presented in Table 1.

(Table 1 goes about here)

4. Results

All the hypotheses can be tested through moderated mediation analyses. However, we need to exclude the possibility that the direct T-P relationship was nonlinear as suggested in some studies. We included a quadratic

term and a cubic term of transnationality. The coefficient of the quadratic term was statistically indifferent from zero, as was the coefficient of the cubic term. The possibility of nonlinearity was rejected, so the quadratic and cubic terms were removed from mediation analyses. We ran moderated mediation analysis for the K-mediator model and the T-mediator model, respectively, including R&D intensity as a moderator as the internalization theory suggested (Buckley and Casson 1976, 2009).

4.1 Hypothesis Test

The result of regressions in the two moderated mediation models are reported in Table 2, while the results of test for direct and indirect effects in the moderated mediation models are reported in Table 3. Hypothesis 1a posits that knowledge-based assets are positively related to transnationality, and the positive effect is stronger in TNEs with a greater R&D intensity. As shown in column 3 of Table 2, the coefficient of knowledge-based assets on transnationality was positive though statistically insignificant, but the coefficient of interaction of knowledge-based assets with R&D intensity on transnationality was positive and statistically significant ($\beta = 0.81$, $p < 0.10$). The results indicated that knowledge-based assets had a positive effect on transnationality conditional on the level of R&D intensity. Specifically, a 1 per cent increase in R&D intensity would lead to a 0.81 per cent increase in the positive effect of knowledge-based assets on transnationality.

Hypothesis 1b posits that knowledge-based assets are positively related to profitability conditional on R&D intensity. As shown in column 2 of Table 2, the coefficient of knowledge-based assets on profitability was positive and statistically significant ($\beta = 0.023$, $p < 0.05$), as was the coefficient of interaction of knowledge-based assets with R&D intensity on profitability ($\beta = 0.312$, $p < 0.05$). The results supported hypothesis 1b, indicating that knowledge-based assets had a significantly positive effect on profitability conditional on R&D intensity. Specifically, a 1 per cent increase in R&D intensity would lead to a 0.312 per cent increase in the positive effect of knowledge-based assets on profitability. Hypothesis 1b gained support.

Hypothesis 2a posits that transnationality is positively related to knowledge-based assets conditional on R&D intensity. As shown in column 1 of Table 2, the coefficient of transnationality on knowledge-based assets was negative though statistically insignificant, but the coefficient of interaction of transnationality with R&D intensity on knowledge-based assets was positive and statistically significant ($\beta = 1.098$, $p < 0.05$). The results supported hypothesis 2a, indicating that transnationality had a positive effect on knowledge-based assets conditional on R&D intensity. Specifically, a 1 per cent increase in R&D intensity would lead to a 1.098 per cent increase in the effect of transnationality on knowledge-based assets.

Hypothesis 2b states that transnationality is positively related to profitability conditional on R&D intensity. As shown in column 2 of Table 2, the coefficient of transnationality on profitability was statistically indifferent from zero, as was the coefficient of interaction of transnationality with R&D intensity on profitability. The results rejected hypothesis 2b, indicating that transnationality did not have any significant effect on profitability regardless of the level of R&D intensity.

Coefficients obtained in the regression analyses were used to calculate the direct and indirect effects of the T-mediator model and the K-mediator model, and the formulae are shown in Appendices 1 and 2. For the T-mediator model, hypothesis 3a posits that knowledge-based assets have a positive direct effect on profitability conditional on R&D intensity. As shown in column 3 of Table 3, the direct effect of knowledge-based assets on profitability was positive though statistically insignificant at a low level of R&D intensity, but turned positive and statistically significant at an average level of R&D intensity ($\boldsymbol{\psi} = 0.0343$, $p < 0.01$) and a high level of R&D intensity ($\boldsymbol{\psi} = 0.0477$, $p < 0.01$). The positive direct effect strengthened with the increase in the level of R&D intensity. Specifically, a 1 per cent increase in knowledge-based assets directly led to a 0.0343 per cent and a 0.0477 per cent increase in profitability at an average level of R&D intensity and a high level of R&D intensity, respectively. Hypothesis 3a was supported. The results were consistent with the results of the test for hypothesis 1b.

Hypothesis 3b states that knowledge-based assets have a positive indirect effect on profitability through transnationality conditional on R&D intensity. As shown in column 4 of Table 3, the indirect effect of knowledge-based assets on profitability through transnationality was statistically indifferently from zero at all levels of R&D intensity. The results indicated that knowledge-based assets did not have any indirect effect on profitability through transnationality regardless of the level of R&D intensity. Hypothesis 3b was rejected. The rejection of hypothesis 3b was consistent with the rejection of hypotheses 2b in the regression analyses. A prime condition for any mediation effect to happen is the correlation between the mediator and the dependent variable (Preacher, Rucker, and Hayes 2007; Hayes, 2013). If transnationality as a mediator did not affect profitability conditional on R&D intensity, it was impossible that knowledge-based assets affected profitability through transnationality conditional on R&D intensity in mediation analysis no matter whether or not knowledge-based assets were positively related to transnationality conditional on R&D intensity.

For the K-mediator model, hypothesis 3c posits that transnationality has a positive direct effect on profitability conditional on R&D intensity. As shown in column 1 of Table 3, the direct effect of transnationality on profitability was statistically indifferent from zero at all levels of R&D intensity. The results indicated that

transnationality did not have any direct effect on profitability regardless of the level of R&D intensity. Hypothesis 3c was rejected. The rejection of hypothesis 3c was consistent with the rejection of hypothesis 2b in the regression analyses.

Hypothesis 3d states that transnationality has a positive indirect effect on profitability through knowledge-based assets conditional on R&D intensity. As shown in column 2 of Table 3, the indirect effect of transnationality on profitability through knowledge-based assets was statistically indifferent from zero at a low level of R&D intensity, but turned positive and statistically significant at an average level of R&D intensity (θ = 0.006; LCI = 0.0004; UCI = 0.0126) and a high level of R&D intensity (θ = 0.0105; LCI = 0.0006; UCI = 0.0238). The results indicated that transnationality had a positive indirect effect on profitability through knowledge-based assets conditional on R&D intensity. Specifically, a 1 per cent increase in transnationality led to a zero per cent, a 0.0006 per cent, and a 0.0105 per cent increase in profitability through knowledge-based assets at a low, an average, and a high level of R&D intensity, respectively. Hypothesis 3d gained support.

4.2 Supplementary Test

It might be argued that different measures of profitability may influence the results, and that it might take some time for knowledge-based assets and R&D intensity to generate an effect on the different measures of profitability.[3] To address this concern, we used one-year lagged knowledge-based assets and R&D intensity to rerun the two moderated mediation models using three different measures of profitability: ROA, ROI, and ROS. We reported the regression results in Table 4, and the results of the estimated direct and indirect effects in Table 5. The results were very similar to those presented in Tables 2 and 3, though the magnitude of the positive indirect effect in the K-mediator model and the magnitude of the positive direct effect in the T-mediator model were larger than those presented in the hypothesis test. The supplementary test indicated that the results were not sensitive to which of the three profitability measure was used, and that knowledge-based assets and R&D intensity indeed had a lagged effect on the T-P relationship.

(Tables 4 and 5 go about here)

It might be further argued that industry variation in R&D intensity may affect the T-P relationship. To address this concern, we broke the sample into two subsamples: one included firms in high R&D-intensive industries, and the other included firms in low R&D-intensive industries. We obtain industry-level R&D intensity data from the EU Industrial R&D Investment Report compiled by the European Commission from 2004 to 2011. The industry-level R&D data were based on both EU firms and non-EU firms. In this study, as

[3] We would like to thank an anonymous reviewer for advice on this point.

shown in Table 6, we classified industries with an average ratio of R&D expenditure to total sales greater than 2% as high R&D-intensive industries, and industries with an average ratio of R&D expenditure to total sales smaller than 2% as low R&D-intensive industries. 2% was chosen as the threshold because it represented a big jump from the next level of R&D ratio.

(Table 6 goes about here)

We reran the moderated mediation models for the two subsamples, respectively. We reported the regression results in Table 7, and the results of the estimated direct and indirect effects in Table 8. The results were very similar to those in the hypothesis test. However, the positive moderating effect of firm-level R&D intensity was apparently stronger in the high R&D-intensive industries than in the low R&D-intensive industries. The finding was consistent with the prediction of the internalization theory (Buckley 1976). To address the structural similarities issues across the industry groupings, we regrouped the two subsamples according to different R&D intensity thresholds, 1.12, 3.3, and also tried to remove the highest two R&D-intensive industries and the lowest two R&D-intensive industries. We then reran the mediation models, and found that the results remained virtually unchanged.[4] Interested readers may contact the authors for the results of the additional supplementary tests.

(Tables 7 and 8 go about here)

4.3 Control Variables

[4] We would like to thank an anonymous reviewer for advice on this point.

The coefficient of firm size on knowledge-based assets was positive and statistically significant in all regressions, indicating that firm size was positively related to knowledge-based assets. This might be attributed to scale efficiency. That is, as firms increase production, the fixed costs are spread to an increasing number of products. The unit costs decrease, as do the total input resources needed to produce the same number of products.

The coefficient of firm size on transnationality was statistically indifferent from zero in all regressions, as was the coefficient of firm size on profitability. The results indicated that the size of a firm was related to neither the transnationality of the firm nor the profitability of the firm. A possible interpretation is that the size of a firm, similar to the transnationality of a firm, indicates the extent to which a firm internalizes activities as opposed to the market. According to the rational choice notion of the internalization theory, as discussed in the next section, managers make the decision on internalization at the margin where the benefits and costs are just offset. Therefore, neither the size of a firm nor the transnationality of a firm has a direct relationship with profitability. As the decisions on firm size and firm transnationality are correlated, there should be no direct relationship between the two. This argument was supported by the insignificant correlation coefficients between the three variables, as shown in Table 1.

The coefficient of financial slack on knowledge-based assets was negative and statistically significant, as was the coefficient of financial slack on profitability. This was consistent with studies on the effect of financial slack on knowledge augmentation and profitability (Chang and Rhee 2011; Nohria and Gulati 1996; Voss, Sideshmukh, and Voss 2008). This is because the lower the level of debt, the less interest payment a firm has to make, and the more resources the firm can use in innovation (Bourgeois 1981). The coefficient of financial slack on transnationality was negative though statistically insignificant in all regressions, indicating that financial slack did not have any effect on transnationality. A possible explanation is that firms make decisions on transnationality primarily based on consideration of the long-term potential benefits and costs, rather than the current level of debt. Therefore, the debt level of a firm is not related to the transnationality of the firm. Although these variables were not the focus of the study, interested readers may further investigate how firm size and financial slack impact on the T-P relationship in greater detail in future research.

5. Discussion

5.1 Theoretical Contributions

A TNE results from the rational effort of managers to internalize markets in knowledge, augmented from both internal and external sources, across national borders in order to maximize profit in competition with rivals. Knowledge augmentation and rational choice should be taken into account in any models that explain how

managers make decisions on the transnationality of a firm and how the decisions affect firm performance (Buckley and Casson 1976; 2009). This core tenet of internalization theory was largely overlooked in extant research on the T-P relationship. This paper invokes this core tenet to investigate the T-P relationship in the light of the new international business realty of the global factory, and fills a research gap.

The paper finds that transnationality is positively related to knowledge-based assets which, in turn, are positively related to profitability, and that the positive relationships strengthen with the increase in R&D. This finding is consistent with the notion of knowledge augmentation through transnational expansion in the era of the global factory, and lends support to a mediation model in which knowledge-based assets mediate the relationship between transnationality and profitability conditional on R&D intensity. However, transnationality does not have any direct effect on profitability regardless of the degree of R&D intensity. This finding is in line with the notion of rational choice, and leads to rejection of a mediation model in which transnationality mediates the relationship between knowledge-based assets and profitability conditional on R&D intensity.

The paper thus suggests that knowledge augmentation indeed plays a vital role, as internalization theory predicts, in influencing transnationality and financial performance in the era of the global factory. However, this role should not be overstated and simplified, and should be assessed against the limit set by rational choice. The core notions of knowledge augmentation and rational choice are coherent components of internalization theory, and need to be taken into account simultaneously. From the coherent internalization theory perspective, we can see clearly the theoretical problems with the two mediation models in the extant literature. The K-mediator model is consistent with the rational choice notion of internalization theory, but overlooks the knowledge augmentation notion of internalization theory. Once adjusted for knowledge augmentation, it serves well in explaining international business reality. The T-mediator model violates not only the rational choice notion of internalization theory, but also the knowledge augmentation notion of internalization theory. It fails to explain international business reality even after it is adjusted for knowledge augmentation. The coherent internalization framework developed in the paper thus helps clarify the confusion in extant studies on the T-P relationship. This is a significant contribution to the literature.

5.2 Managerial Implications

In the era of the global factory, managers are often encouraged to believe that there is a direct association between transnationality and profitability, and are often advised to make decisions to expand firm boundaries across national borders in order to gain direct financial benefits. As Contractor (2007: 454) noted, the

international business community "rests upon the meta-hypothesis" that transnational expansion will generally augment company profits, and has focused on examining the direct link between transnationality and profitability. The present study shows that there is no direct link between transnationality and profitability, but an indirect link between the two through knowledge-based assets conditional on R&D. The paper thus calls for managers to rethink transnational expansion strategy.

In expanding the boundary of a firm across national borders, managers should not focus on direct financial benefits that are quickly offset by direct costs in a competitive environment no matter how much R&D is invested. Instead, they should focus on indirect financial benefits through knowledge-based assets. Managers should take transnational expansion as a strategy to learn the skills needed to integrate externalized activities with internalized activities in the entire global value chain. Because the skills to orchestrate activities in the entire global value chain of differentiated networks are difficult for rivals to imitate, financial gains based on global orchestration know-how can be long-lasting (Buckley 2011: 281). This observation is, as Teece (2014:8) noted, in line with capability-based theory in strategic management which is a "prong" of internalization theory.

To develop knowledge-based assets, managers should invest in R&D to augment global orchestration know-how in the process of transnational expansion. The paper finds that both the positive effect of transnationality on knowledge-based assets and the positive effect of knowledge-based assets on profitability are conditional on R&D intensity, as is the indirect effect of transnationality on profitability through knowledge-based assets. R&D is the key to enhancing knowledge-based assets and, through it, sustainable financial performance, and should be taken into account in making decisions on transnationality.

5.3 Limitations and Future Directions of Research

Location is an important consideration in international business theories, including internalization theory (Buckley and Casson 1976; 2009). Unfortunately, we do not have information on where the transnational activities were undertaken by each of the TNEs in our sample, and therefore did not take into account the possible impact of location choice on the T-P relationship in our study. In addition, we did not have sufficient and comparable information on TNEs from emerging markets, and could not compare TNEs from emerging markets with TNEs from advanced markets in the T-P relationship in our study. Future research may overcome the limitations when data become available.

The sample in the study includes only the leading TNEs due to data constraints. It is not clear whether the findings apply to small and medium-sized TNEs. In addition, recent research has argued that institutions, industry-level competition, firm age, and product diversification may influence the T-P relationship (Bausch and Krist 2007; Kirca et al. 2011). These variables are not included in the study due to data constraints. When data become available, future research might examine how institutions, industrial structure, firm age, and product diversification influence the effect of transnationality on knowledge-based assets and, through it, profitability conditional on R&D intensity in large, small, and medium-sized TNEs.

5.4 Conclusion

Applying internalization theory to the new international business reality of the global factory, the paper develops a coherent framework to examine the T-P relationship, and tests hypotheses against recent experience of major transnational enterprises. The paper rejects a direct effect of transnationality on financial performance, and supports an indirect effect of transnationality on financial performance through knowledge-based assets conditional on R&D intensity. In making decisions on expanding the transnationality of a firm, managers should not focus on whether it helps the firm achieve short-lived direct financial gains, but on whether it is supported by R&D to enhance the firm's knowledge-based assets and, through it, financial gains that can be long-lasting.

Tables and Figures

Table 1 Descriptive Statistics and Correlation Matrix of Major Variables [a, b]

Variable	Mean	SD	1	2	3	4	5
1.Knowledge-based assets	0.66	0.47					
2.Transnationality	0.52	0.23	0.04**				
3.Profitability	0.05	0.07	0.14**	0.01			
4. Firm size	9.24	1.60	0.27**	-0.02	-0.03		
5. Financial slack	0.32	0.13	-0.04*	-0.05*	-0.09**	0.08**	
6. R&D intensity	0.04	0.04	0.06	0.08*	0.15*	-0.07	-0.02

[a] For knowledge-based assets, the statistics and correlation coefficients were based on industry-centred values except for means.
[b] * if $p < 0.05$; ** if $p < 0.01$.

Table 2 Results of Regressions in the Hypothesis Test [a,b,c]

Variable	Moderated K-mediator model		Moderated T-mediator model	
	Knowledge-based assets	Profitability	Transnationality	Profitability
	(1)	(2)	(3)	(4)
Intercept	-0.018	0.004	0.04***	0.004
	(0.017)	(0.03)	(0.01)	(0.03)
Firm size	0.11***	-0.01	-0.02	-0.01
	(0.02)	(0.01)	(0.02)	(0.01)
Financial slack	-0.11*	-0.02*	-0.03	-0.02*
	(0.05)	(0.01)	(0.03)	(0.01)
Knowledge-based assets		0.023**	0.017	0.023**
		(0.007)	(0.02)	(0.07)
Transnationality	0.135	-0.008		-0.008
	(0.09)	(0.01)		(0.01)
R&D intensity	-0.056	-0.003	-0.28	-0.003
	(0.27)	(0.039)	(0.17)	(0.039)
Transnationality × R&D intensity	1.098*	0.141		0.141
	(0.52)	(0.26)		(0.26)
Knowledge-based assets × R&D intensity		0.312*	0.81†	0.312*
		(0.14)	(0.41)	(0.14)
Adjusted R^2	0.18	0.18	0.13	0.18

[a] Coefficients obtained from the regressions serve as the basis for calculating the direct and indirect effects of the moderated K-mediator model and the moderated T-mediator model as reported in Table 3 and illustrated in Appendices 1 and 2.

[b] † if $p < 0.10$; * if $p < 0.05$; ** if $p < 0.01$; *** if $p < 0.001$.

[c] All regressions included industry dummies and country dummies. The coefficients of these dummy variables were not reported to save space.

Table 3. Hypothesis Test for Direct and Indirect Effects in Moderated K-mediator Model and Moderated T-mediator Model [a]

R&D intensity [b]	Moderated K-mediator model		Moderated T-mediator model	
	Direct Effect (ψ) [c]	Indirect Effect (θ) [d]	Direct Effect (ψ) [c]	Indirect Effect (θ) [d]
Low (-0.0069)	-0.0092 (0.0144)	0.0027 (-0.0019/0.0088)	0.0210 (0.0126)	-0.0001 (-0.0011/0.0008)
Mean (0.0359)	-0.0032 (0.0106)	0.0060♯ (0.0004/0.0126)	0.0343*** (0.0053)	-0.0001 (-0.0014/0.0011)
High (0.0786)	0.0029 (0.0160)	0.0105♯ (0.0006/0.0238)	0.0477*** (0.0086)	0.0002 (-0.0034/0.0042)

[a] The direct and indirect effects are calculated using coefficients reported in Table 2 as illustrated in Appendices 1 and 2.
[b] Mean denotes the mean value; Low denotes one standard deviation below the mean value; High denotes one standard deviation above the mean value.
[c] For the direct effect (ψ), † if $p < 0.10$; * if $p < 0.05$; ** if $p < 0.01$; *** if $p < 0.001$. Statistic in the bracket is standard error.
[d] For the indirect effect (θ), ♯ indicates statistical significance at the 95% confidence interval. The lower confidence interval (LCI) statistic is before the slash and the upper confidence interval (UCI) statistic is after the slash in the bracket.

Table 4 Results of Regressions in Supplementary Test (ROA, ROI and ROS with One-year Lagged Knowledge-based assets and R&D Intensity) [a,b,c]

Variable	ROA				ROI				ROS			
	Moderated K-mediator model		Moderated T-mediator model		Moderated K-mediator model		Moderated T-mediator model		Moderated K-mediator model		Moderated T-mediator model	
	Knowledge-based assets	Profitability	Transnationality	Profitability	Knowledge-based assets	Profitability	Transnationality	Profitability	Knowledge-based assets	Profitability	Transnationality	Profitability
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Intercept	-0.0097	0.003	0.03***	0.003	0.16***	0.014**	-0.09***	0.014**	0.049***	-0.00	0.029***	-0.00
	(0.017)	(0.03)	(0.01)	(0.03)	(0.03)	(0.005)	(0.02)	(0.005)	(0.016)	(0.00)	(0.01)	(0.00)
Firm size	0.12***	-0.03	-0.02	-0.03	0.14***	-0.04	-0.03	-0.04	0.11***	0.01	-0.07	0.01
	(0.03)	(0.02)	(0.02)	(0.02)	(0.04)	(0.03)	(0.02)	(0.03)	(0.02)	(0.01)	(0.06)	(0.00)
Financial slack	-0.13*	-0.04*	-0.04	-0.02*	-0.14*	-0.04*	-0.05	-0.04*	-0.09**	-0.07*	-0.02	-0.07*
	(0.06)	(0.02)	(0.03)	(0.01)	(0.06)	(0.02)	(0.04)	(0.02)	(0.04)	(0.03)	(0.02)	(0.03)
Knowledge-based assets		0.02***	0.047*	0.02***		0.016*	0.087*	0.016*		0.017*	0.043*	0.017*
		(0.007)	(0.023)	(0.007)		(0.007)	(0.02)	(0.007)		(0.007)	(0.022)	(0.007)
Transnationality	0.208*	0.006		0.006	0.41***	0.021		0.021	0.195*	0.008		0.008
	(0.097)	(0.01)		(0.01)	(0.10)	(0.015)		(0.015)	(0.10)	(0.014)		(0.014)
R&D intensity	-0.21	0.034	-0.27	0.034	0.19	0.061	-0.49	0.061	-0.53	0.062	-0.245	0.062
	(0.28)	(0.04)	(0.18)	(0.04)	(0.27)	(0.04)	(0.28)	(0.04)	(0.31)	(0.41)	(0.17)	(0.41)
Transnationality × R&D intensity	1.45*	-0.28		-0.28	1.16*	-0.30		-0.30	1.69*	-0.26		-0.26
	(0.72)	(0.28)		(0.28)	(0.57)	(0.29)		(0.29)	(0.85)	(0.28)		(0.28)
Knowledge-based assets × R&D intensity		0.49***	0.54*	0.49***		0.50***	0.41*	0.50***		0.44**	0.49*	0.44**
		(0.15)	(0.27)	(0.15)		(0.16)	(0.21)	(0.16)		(0.15)	(0.25)	(0.15)
Adjusted R^2	0.18	0.18	0.13	0.18	0.18	0.18	0.13	0.18	0.19	0.30	0.10	0.30

[a] Coefficients obtained from the regressions serve as the basis for calculating the direct and indirect effects of the moderated K-mediator model and the moderated T-mediator model as reported in Table 5 and illustrated in Appendices 1 and 2.

[b] † if $p < 0.10$; * if $p < 0.05$; ** if $p < 0.01$; *** if $p < 0.001$.

[c] All regressions included industry dummies and country dummies. The coefficients of these dummy variables were not reported to save space.

Table 5 Supplementary Test for the Direct and Indirect Effects in Moderated K-mediator Model and Moderated T-mediator Model (ROA, ROI and ROS with One-year Lagged Knowledge-based assets and R&D Intensity) [a]

R&D intensity [b]	Moderated K-mediator model		Moderated T-mediator model	
	Direct Effect (ψ) [c]	Indirect Effect (θ) [d]	Direct Effect (ψ) [c]	Indirect Effect (θ) [d]
ROA				
Low (-0.0062)	0.0077	0.0035	0.0175	0.0003
	(0.0155)	(-0.0005/0.0094)	(0.0098)	(-0.0011/0.0021)
Mean (0.0371)	-0.0044	0.0102♯	0.0388***	-0.0003
	(0.0110)	(0.0037/0.0169)	(0.0055)	(-0.0021/0.0014)
High (0.0804)	-0.0166	0.0196♯	0.0602***	-0.0015
	(0.0172)	(0.0073/0.0326)	(0.0094)	(-0.0066/0.0025)
ROI				
Low (-0.0062)	0.0225	0.0050	0.0126	0.0019
	(0.0161)	(-0.0003/0.0129)	(0.0078)	(-0.0005/0.0050)
Mean (0.0371)	0.0096	0.0153♯	0.0343***	0.0010
	(0.0118)	(0.0077/0.0238)	(0.0057)	(-0.0018/0.0039)
High (0.0804)	-0.0033	0.0279♯	0.0560***	-0.0004
	(0.0176)	(0.0132/0.0435)	(0.0094)	(-0.0055/0.0059)
ROS				
Low (-0.0062)	0.0092	0.0026	0.0139	0.0004
	(0.0157)	(-0.0006/0.0079)	(0.0087)	(-0.0010/0.0020)
Mean (0.0371)	-0.0022	0.0085♯	0.0329***	-0.0001
	(0.0111)	(0.0029/0.0153)	(0.0054)	(-0.0018/0.0017)
High (0.0804)	-0.0137	0.0172♯	0.0520***	-0.0011
	(0.0172)	(0.0061/0.0295)	(0.0093)	(-0.0053/0.0026)

[a] The direct and indirect effects are calculated using coefficients reported in Table 4 as illustrated in Appendices 1 and 2

[b] Mean denotes the mean value; Low denotes one standard deviation below the mean value; High denotes one standard deviation above the mean value.

[c] For the direct effect (ψ), † if $p < 0.10$; * if $p < 0.05$; ** if $p < 0.01$; *** if $p < 0.001$. Statistic in the bracket is standard error.

[d] For the indirect effect (θ), ♯ indicates statistical significance at the 95% confidence interval. The lower confidence interval (LCI) statistic is before the slash and the upper confidence interval (UCI) statistic is after the slash in the bracket.

Table 6 R&D Intensity of 19 Industries [a]

Industry	R&D to Sales Ratio (%)	No. of Firms/Year Observations
Low R&D-intensive Industries		
Wholesale and retail	0.3	37
Transportation	0.3	12
Mining & quarrying	0.4	29
Entertainments, hotel and restaurants	0.4	10
Food, beverages and tobacco	0.5	47
Utilities and energy	0.5	56
Non-metalic mineral, wood, paper and building material	0.6	30
Construction	0.6	6
Metal and metal products	0.7	19
Petroleum expl./ref./distr.	0.8	51
Other	1.12	21
Subtotal		318
High R&D-intensive Industries		
Trading and diversified	2.22	26
Machinery and equipment	2.8	26
Chemical	3.3	28
Computer and related office equipment	3.3	26
Motor vehicles and parts	5.5	63
Electrical & electronic equipment	6.5	40
Telecommunication	13.3	46
Pharmaceuticals	14.2	45
Subtotal		300
Total		618

[a] Data on industry-level R&D intensity came from the EU Industrial R&D Investment Report compiled by the European Commission from 2004 to 2011. The industry-level R&D data were based on both EU firms and non-EU firms.

Table 7 Results of Regressions in Supplementary Test (High R&D-intensive v.s. Low R&D-intensive Industries) [a,b,c]

Variable	High R&D-intensive Industries				Low R&D-intensive Industries			
	Moderated K-mediator model		Moderated T-mediator model		Moderated K-mediator model		Moderated T-mediator model	
	Knowledge-based assets	Profitability	Transnationality	Profitability	Knowledge-based assets	Profitability	Transnationality	Profitability
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Intercept	-0.66***	0.17***	0.69***	0.17***	-1.37***	0.00	1.23***	0.00
	(0.18)	(0.03)	(0.08)	(0.03)	(0.26)	(0.03)	(0.15)	(0.03)
Firm size	0.05***	0.01	-0.06	0.01	0.18***	-0.02	-0.04	-0.02
	(0.01)	(0.01)	(0.05)	(0.01)	(0.05)	(0.02)	(0.03)	(0.00)
Financial slack	-0.08*	-0.01*	-0.03	-0.01*	-1.17***	-0.31***	-0.52	-0.31***
	(0.04)	(0.00)	(0.02)	(0.00)	(0.35)	(0.08)	(0.34.)	(0.08)
Knowledge-based assets		-0.00	-0.053	-0.00		0.016	0.12	0.016
		(0.01)	(0.05)	(0.01)		(0.011)	(0.09)	(0.011)
Transnationality	0.21	0.011		0.011	0.044	-0.024		-0.024
	(0.16)	(0.02)		(0.02)	(0.09)	(0.023)		(0.023)
R&D intensity	-3.54***	0.61***	0.68***	0.61***	3.31	-1.29*	0.89	-1.29*
	(1.28)	(0.21)	(0.14)	(0.21)	(3.38)	(0.59)	(1.32)	(0.59)
Transnationality × R&D intensity	5.27***	-0.38		-0.38	4.28	2.08		2.08
	(1.87)	(0.32)		(0.32)	(2.75)	(1.42)		(1.42)
Knowledge-based assets × R&D intensity		0.93***	1.46**	0.93***		0.54*	-4.95	0.54*
		(0.31)	(0.52)	(0.31)		(0.26)	(2.64)	(0.26)
Adjusted R^2	0.19	0.20	0.18	0.20	0.20	0.30	0.11	0.30

[a] Coefficients obtained from the regressions serve as the basis for calculating the direct and indirect effects of the moderated K-mediator model and the moderated T-mediator model as reported in Table 8 and illustrated in Appendices 1 and 2.

[b] † if $p < 0.10$; * if $p < 0.05$; ** if $p < 0.01$; *** if $p < 0.001$.

[c] All regressions included industry dummies and country dummies. The coefficients of these dummy variables were not reported to save space.

Table 8 Supplementary Test for Direct and Indirect Effects in Moderated K-mediator Model and Moderated T-mediator Model (High R&D-intensive v.s. Low R&D-intensive Industries) [a]

R&D intensity [b]	Moderated K-mediator model		Moderated T-mediator model	
	Direct Effect (ψ) [c]	Indirect Effect (θ) [d]	Direct Effect (ψ) [c]	Indirect Effect (θ) [d]
R&D-intensive Industries				
Low (0.0068)	-0.0025	0.0002	0.0063	-0.0001
	(0.0198)	(-0.0036/0.0028)	(0.0098)	(-0.0034/0.0021)
Mean (0.0528)	-0.0195	0.0142♯	0.0491***	-0.0014
	(0.0175)	(0.0035/0.0268)	(0.0082)	(-0.0035/0.0016)
High (0.0987)	-0.0364	0.0496♯	0.0918***	-0.0051
	(0.0284)	(0.0048/0.0502)	(0.0147)	(-0.0087/0.0035)
Non R&D-intensive Industries				
Low (-0.0058)	-0.0119	0.0001	-0.0032	-0.0003
	(0.0285)	(-0.0056/0.0072)	(0.0045)	(-0.0035/0.0004)
Mean (0.0092)	0.0189	0.0002♯	0.0051***	-0.0008
	(0.0124)	(0.0001/0.0121)	(0.0014)	(-0.0024/0.0007)
High (0.0243)	0.0500	0.0014♯	0.0135***	-0.0059
	(0.0301)	(0.0009/0.0204)	(0.0048)	(-0.0084/0.0078)

[a] The direct and indirect effects are calculated using coefficients reported in Table 7 as illustrated in Appendices 1 and 2

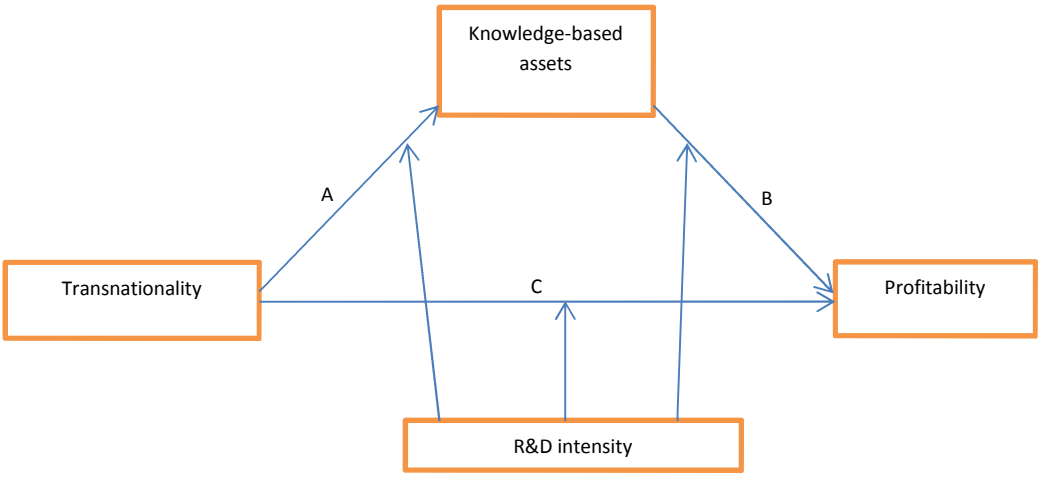
[b] Mean denotes the mean value; Low denotes one standard deviation below the mean value; High denotes one standard deviation above the mean value.

[c] For the direct effect (ψ), † if $p < 0.10$; * if $p < 0.05$; ** if $p < 0.01$; *** if $p < 0.001$. Statistic in the bracket is standard error.

[d] For the indirect effect (θ), ♯ indicates statistical significance at the 95% confidence interval. The lower confidence interval (LCI) statistic is before the slash and the upper confidence interval (UCI) statistic is after the slash in the bracket.

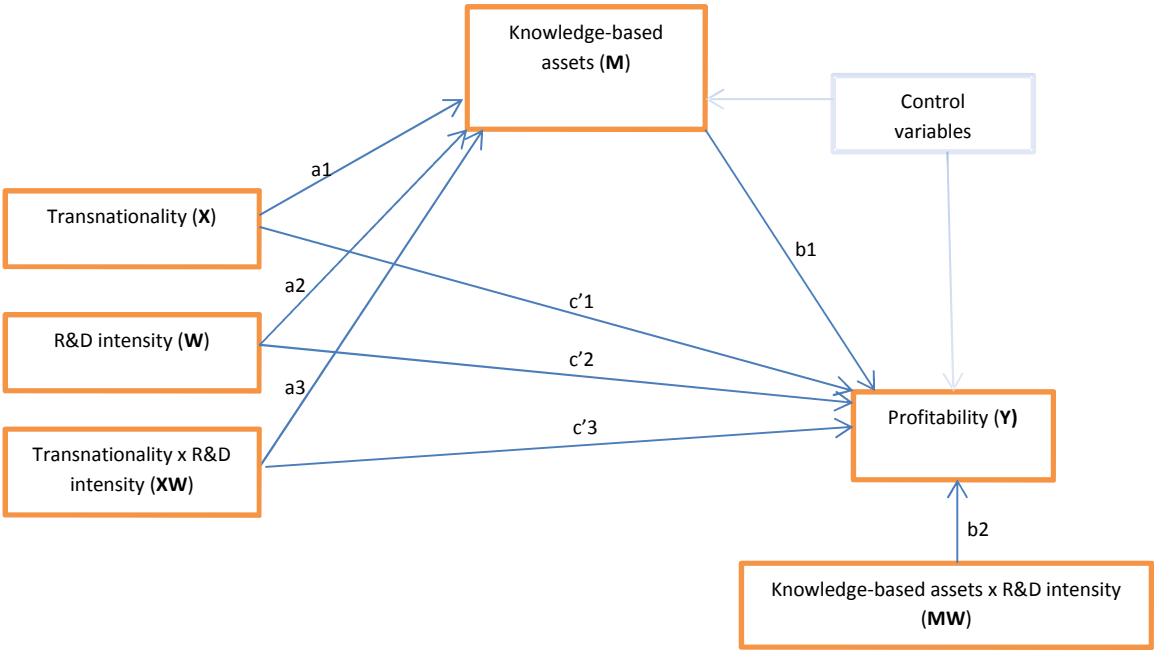
Appendix 1 Conceptual and Statistical K-mediator Model Moderated by R&D [a, b, c]

A. Conceptual Model



Note: AB represents the indirect effect and C represents the direct effect of transnationality on profitability.

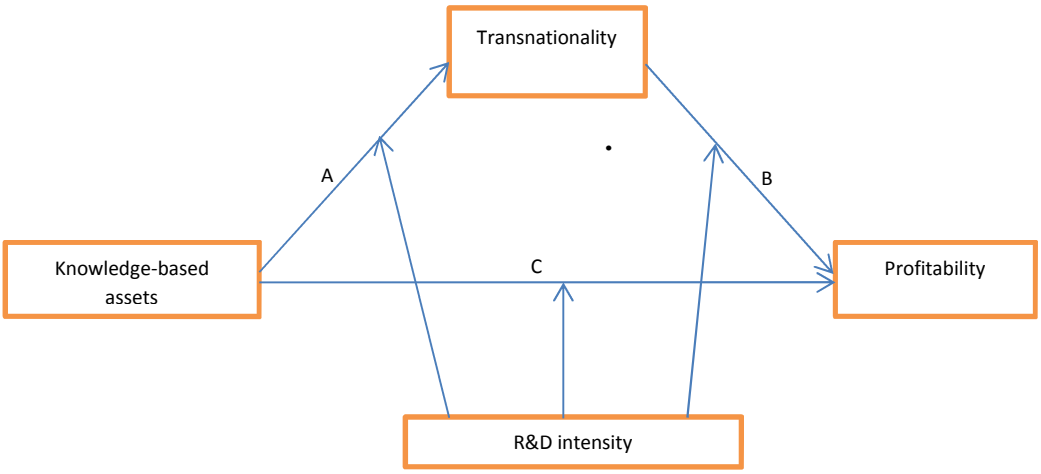
B. Statistical Model



[a] Conditional indirect effect of transnationality (X) on profitability (Y) through knowledge-based assets (M)= $(a1 + a3W)(b1 + b2W)$.
[b] Conditional direct effect of transnationality (X) on profitability (Y) = $c'1 + c'3W$
[c] Source: Hayes (2013).

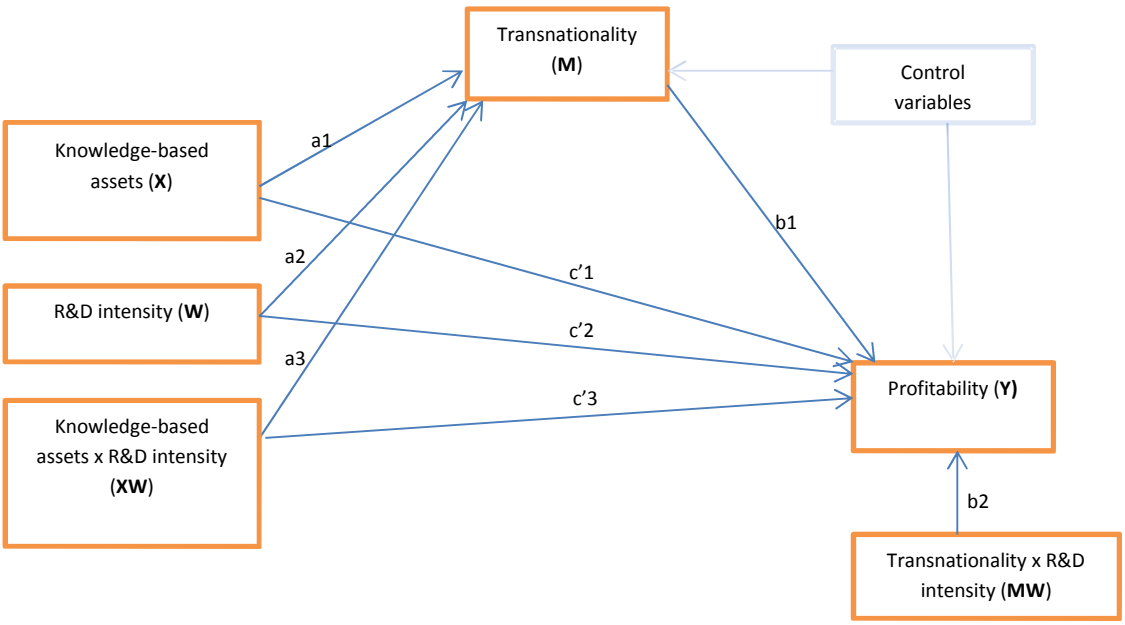
Appendix 2 Conceptual and Statistical T-mediator Model Moderated by R&D [a, b, c]

A. Conceptual Model



Note: AB represents the indirect effect and C represents the direct effect of knowledge-based assets on profitability.

B. Statistical Model



[a] Conditional indirect effect of knowledge-based assets (X) on profitability (Y) through transnationality (M)= $(a1 + a3W)(b1 + b2W)$.
[b] Conditional direct effect of knowledge-based assets (X) on profitability (Y) = $c'1 + c'3W$
[c] Source: Hayes (2013).

References

Annavarjula, M., & Beldona, S. (2000). Multinationality-performance relationship: a review and reconceptualization. *The International Journal of Organizational Analysis*, 8 (1), 48-67.

Bartlett, C., & Ghoshal, S. (1989). *Managing across borders: The transnational solution*. Boston: Harvard Business School Press.

Bausch, A., & Krist, M. (2007). The effect of context related moderators on the internationalization-performance relationship: Evidence from meta-analysis. *Management International Review*, 47 (3), 1-29.

Bourgeois, L. (1981). On the measurement of organizational slack. *Academy of Management Review*, 6: 29-39.

Buckley, P.J. (2009). Internalization thinking: From the multinational enterprise to the global factory. *International Business Review*, 18, 224-235.

Buckley, P.J. (2011). International integration and coordination in the global factory. *Management International Review*, 51, 269-283.

Buckley, P.J., & Casson, M.C. (1976). *The future of the multinational enterprises*. London: Macmillan.

Buckley, P.J., & Casson, M.C. (2009). The internalisation theory of the multinational enterprise: A review of the progress of a research agenda after 30 years. *Journal of International Business Studies*, 40, 1563-1580.

Caves, R. (1971). International corporations: The industrial economics of foreign investment. *Economica*, 38 (149), 1-27.

Chang, S.J., & Rhee, J.H. (2011). Rapid FDI expansion and firm performance. *Journal of International Business Studies*, 42, 979-994.

Coase, R.H. (1937). The nature of the firm. *Economica*, 4 (16), 386-405.

Contractor, F. J. (2007). Is international business good for companies? The evolutionary or multi-stage theory of internationalization vs. the transaction cost perspective. *Management International Review*, 47(3), 453-475.

Contractor, F. J. (2012). Why do multinational firms exist? A theory note about the effect of multinational expansion on performance and recent methodological critiques. *Global Strategy Journal*, 2, 318-333.

Contractor, F., Kumar, V., & Kundu, S. (2007). Nature of the relationship between international expansion and performance: The case of emerging market firms. *Journal of World Business*, 42, 401-417.

Contractor, F. Kundu, S., & Hsu, C. (2003). A three-stage theory of international expansion: the link between multinationality and performance in the service sector. *Journal of International Business Studies*, 34 (1), 5-18.

Delios, A., & Beamish, P.W. (1999). Geographic scope, product diversification, and the corporate performance of Janpanese firms. *Strategic Management Journal*, 20 (8), 711-728.

Doukas, J.A., & Lang, L.H.P. (2003). Foreign direct investment, diversification and firm performance. *Journal of International Business Studies*, 34 (2), 153-172.

Geringer, J.M., Tallman, S., & Olsen, D.M. (2000). Product and international diversification among Japanese multinational firms. *Strategic Management Journal*, 21 (1), 51-80.

Gomez-Mejia, L.R., & Palich, L.E. (1997). Cultural diversity and the performance of multinational firms. *Journal of International Business Studies*, 28 (2), 309-335.

Grant, R.M.(1987). Multinationiality and performance among British manufacturing companies. *Journal of International Business Studies*, 18 (3), 79-89.

Hayes, A.F. (2013). *An introduction to mediation, moderation, and conditional process analysis: A regression-based approach*. New York: Guilford Press.

Hennart, J.F. (1982). *A theory of multinational enterprise*. Ann Arbour: University of Michigan Press.

Hennart, J.F. (2007). The theoretical rationale for a multinational-performance relationship. *Management International Review*, 47 (3), 423-452.

Hitt, M.A., Hoskisson, R.E., & Kim, H. (1997). International diversification: effects on innovation and firm performance in product-diversified firms. *Academy of Management Journal*, 40 (4), 767-798.

Hymer, S. (1976). *The international operations of national firms. A study of direct investment*. Cambridge, MA: MIT Press.

Kim, W.C., Hwang, P., & Burgers, W. (1993). Multinationals' diversification and the risk-return trade-off. *Strategic Management Journal*, 14 (4), 275-286.

Kirca, A. H., Hult, G.T.M., Roth, K.,Cavusgil, S. T., Perryy, M.Z., Akdeniz, M.B. et al. (2011). Firm-specific assets, multinationality and financial performance: A meta-analytic review and theoretical integration. *Academy of Management Journal*, 54(1), 47-72.

Kumar, A. (1984). Comparative analysis of U.K. domestic and international firms. In A.R. Rugman (Ed.), *New theories of the multinational enterprise* (pp.18-29). New York: St. Martin's Press.

Levinsohn, J., & Petrin, A. (2003). Estimating production functions using inputs to control for unobservables. *Review of Economic Studies*, 70, 317-342.

Liesch, P.W., Buckley, P.J., Simonin, B.L, & Knight, G. (2012). Organizing the worldwide market for market transactions. *Management International Review*, 52, 3-21.

Lu, J. W., & Beamish, P. W. (2004). International diversification and firm performance: The S-curve hypothesis. *Academy of Management Journal*, 47(4), 598-609.

Markowitz, H. (1959). *Portfolio selection: Efficient diversification of investments.* New York: Wiley.

Mathews, J.A. (2002). *Dragon multinationals: A new model of global growth*. New York: Oxford University Press.

Mathews, J.A. (2006). Dragon multinationals: New players in 21st century globalization. *Asia Pacific Journal of Management*, 23, 5-27.

McManus, J.C. (1972). The theory of the multinational firm. In G.Paquet (Ed.), *The multinational firm and the national state* (167-182). Toronto: Collier Macmillan.

Murray, M.P. (2006). Avoiding invalid instruments and coping with weak instruments. *Journal of Economic Perspectives*, 20 (4), 111-132.

Nohria, N., & Gulati, R. (1996). Is slack good or bad for innovation? *Academy of Management Journal*, 39 (5), 1245-1264.

Olley, G.S., & Pakes, A. (1996). The dynamics of productivity in the telecommunications equipment industry. *Econometrica*, 64, 1263-1297.

Preacher, K, J., Rucker, D.D., & Hayes, A.F. (2007). Assessing moderated mediation hypotheses: Theory, methods and prescriptions. *Multivariate Behavioural Research*, 42, 185-227.

Powell, K.S. (2014). From M-P to MA-P: multinationality alignment and performance. *Journal of International Business Studies*, 45, 211-226.

Richter, N.F. (2014). Information costs in international business: Analyzing the effects of economies of scale, cultural diversity and decentralization. *Management International Review*, 54, 171-193.

Rugman, A. (1981). *Inside the multinationals: The economics of internal markets*. New York: Columbia University Press.

Rugman, A., & Verbeke. A. (2008). Internalisation theory and its impact on the field of international business. International Business Scholarship. *AIB Fellows on the First 50 years and Beyond Research in Global Strategic Management*, Volume 14. Emerald Group Publishing Limited: UK; 155-174.

Ruigrok, W., & Wagner, H. (2003). Internationalization and performance: an organizational learning perspective. *Management International Review*, 43 (1), 63-83.

Shapiro, A. (1978). Financial structure and the cost of capital in the multinational corporation. *Journal of Financial and Quantitative Analysis*, 13 (2), 211-266.

Siddharthan, N. S., & Lall, S. (1982). Recent Growth of the Largest U.S. Multinationals. *Oxford Bulletin of Economics and Statistics*, 44(1), 1-13.

Sirmon, D. G., & Hitt, M. A. (2009). Contingencies within dynamic managerial capabilities: Interdependent effects of resource investment and deployment on firm performance. *Strategic Management Journal*, 30, 1375-1394.

Sirmon, D. G., Hitt, M. A., Arregle, J.-L., & Campbell, J. T. (2010). The dynamic interplay of capability strengths and weaknesses: Investigating the bases of temporary competitive advantage. *Strategic Management Journal*, 31(13), 1386-1409.

Solow, R. M. (1956). A contribution to the theory of economic growth. *Quarterly Journal of Economics*, 70, 65-94.

Solow, R. M. (1957). Technical change and the aggregate production function. *Review of Economics and Statistics*, 39, 312-320.

Sundaram, A. K., & Black, S. J. (1992). The environment and internal organization of multinational Enterprises. *Academy of Management Review*, 17 (4), 729-757.

Swedenborg, B. (1979). *Multinational operations of Swedish firms*. Stockholm: Almquist and Wiskell.

Tallman, S., & Li, J. (1996). Effects of international diversity and product diversity on the performance of multinational firms. *Academy of Management Journal*, 39 (1), 179-196.

Tallman, S. & Pedersen, T. (2012). Editors' comment on research platforms: point-counterpoint on multinationalization and performance. *Global Strategy Journal*, 2, 313-317.

Teece, D. J., (2014). A dynamic capabilities-based entrepreneurial theory of the multinational enterprise. *Journal of International Business Studies*, 45 (1), 8-37.

Tian, X. & Slocum, J. (2015). The decline of global market leaders. *Journal of World Business*, 51, 15-25.

Thomas, D., & Eden, L. (2004). What is the shape of the multinationality-performance relationship? *Multinational Business Review*, 12(1), 89-110.

Tomassen, S. & Benito, G.R.G. (2009). The costs of governance in international companies. *International Business Review*, 18, 292-304.

UNCTAD. (2014). *World Investment Report*. New York: United Nations.

Verbeke, A., & Forootan, M. Z. (2012). How good are multinationality-performance (M-P) empirical studies? *Global Strategy Journal*, 2, 332-344.

Voss, G., Sideshmukh, D., & Voss, Z. (2008). The effects of slack resources and environmental threat on product exploration and exploitation. *Academy of Management Journal*, 51 (1), 147-164.

Yasar, M., & Raciborski, R. (2008). Production function estimation in Stata using the Olley and Pakes method. *The Stata Journal*, 8 (2), 221-231.

Yang, Y. & Driffield, N. (2012). Multinationality-performance relationship: A meta-analysis. *Management International Review*, 52, 23-47.

Zaheer, S., & Mosakowski, E. (1997). The dynamics of the liability of foreignness: a global study of survival in financial services. *Strategic Management Journal*, 18 (6), 439-464.