

# Identifying the Determinants of High-Tech Taiwanese Firms' Foreign Direct Investment Activities in the UK

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## *Abstract*

This paper considers the migration of Taiwanese high technology industry and applies Dunn's policy problem structuring model to ensure the achievement of this research study's goal, that the findings can be used as government policy-making reference on firm's investment abroad. This study begins by reviewing relevant literature and then returns to the practical background analysis. Regarding FDI theories, this paper concludes that their main characteristics are covered by competitive advantage, organization strategy, externality, and production cost. The main empirical methodology we suggest is the factor-logit model which combines factor analysis and Logit econometric model to construct a more detailed, specific, and formal mathematical representational model in the problem specification phase of this research. The results of empirical examination suggest that the motive factors, include EU advantage in marketing, UK-based overseas marketing, research and development (R&D) input, regional investment and production environment, as well as convergence of location and skill. The findings also confirm the importance of enterprise size, senior staff's experience, and financial capacity; this study suggests that the stability of policy investment environment is also backed by the dimensions of trade activity, industry category and market style. Then, the policy suggestions are also listed in the final section.

**Keywords:** *UK, Faktor-Logit Analysis, Taiwanese high tech firms.*

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## **Birleşik Krallık'a Doğrudan Yabancı Yatırım Yapan Yüksek Teknolojiye Sahip Tayvanlı Firmaların Eylemlerini Belirleyen Faktörlerin Tanımlanması**

### **Öz**

Bu makale yüksek teknolojiye sahip Tayvanlı firmaların Birleşik Krallık'ta yaptıkları yatırımları ele almayı ve Dunn'ın politika problemini belirleme modelini kullanarak yurt dışında yatırım yapacak firmalara rehberlik yapmayı hedeflemektedir. Çalışma kısa bir kaynak taramasından sonra, pratik çözümler önerecek analizle devam etmektedir. Doğrudan yabancı yatırım teorilerinin yer aldığı literatüre dayanarak, bu çalışma temel belirleyiciler olarak rekabet avantajını, kurumsal stratejiyi ve üretim maliyetlerinin olduğunu bulmuştur. Temel yöntem olarak daha detaylı, spesifik ve formel matematiksel modelleme tekniğini kullanan Logit Modelleme ile faktör analizini birleştiren Faktör-Logit Modelleme yöntemi kullanılmıştır. Ampirik çalışmanın sonuçları doğrulamıştır ki Birleşik Krallık'ta yatırım yapan Tayvanlı firmalar için önemli temel faktörler; pazarlamadaki Avrupa Topluluğu avantajı, UK temelli pazarlama, Ara-Gör girdileri, bölgesel yatırım ve üretim ortamı, lokasyon ve emektir. Bulgular aynı zamanda firmaların ölçeğinin, çalışanın deneyimli oluşunun, firmanın finansal kapasitesinin de önemli olduğunu göstermiştir. Yatırım ortamının dengesi ticaret faaliyetleri, endüstri kategorileri ve piyasa sitili tarafından desteklenmektedir.

**Anahtar kelimeler:** *Birleşik Krallık, Faktör-Logit Modelleme, Tayvanlı yüksek teknoloji firmaları.*

## 1. Introduction

With the fashion of industrial migration, the development of firms' foreign direct investment (FDI) has brought a strong influence to bear on economic development. Although the original economic system still retains the major role in economic development, the influence of FDI does significantly affect a regional or national economy. With the establishment of the EU, the influence of economic integration created an unknown situation for FDI. Although the policy of the Taiwanese government was justified and developed in varying economic situations and development stages, it has been in the debate on industrial migration policy, particular for FDI, because the style of policy-making remains focussed on the original experience and is lacking a sufficiently explanatory framework. In other words, in order to avoid making correct policy for solving the wrong problems,<sup>3</sup> problem structuring must happen prior to and is more necessary than problem solving before policy making.<sup>4</sup>

Therefore, this research adopted the process of problem structuring to identify the determinant factors of firm's direct investment by Taiwan in the UK and to focus on the observation of high-tech industrial migration activities; that is, this study's position was to put forward new policy-making. Briefly, to complete the task of providing suggestions before policy-making, problem structuring is used as the research framework of this study. Hsu and Chuan<sup>5</sup> focused on Taiwanese high-tech firms' data from 2003 to 2007 to investigate the impacts of international technology spillovers and firms' R&D activities on firms' innovation performance and adopted panel Ordinary Least Squares (OLS) with fixed-effect and random-effect models as well as System Generalized Method of Moments (GMM) model to estimate. The empirical findings indicated the innovation performance of high-tech firms is positively affected by their R&D efforts, export performance, and the presences of multinational corporations.

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<sup>3</sup> Howard Raiffa explained Type III error: In mathematics, a researcher has either to accept or accept or reject a so-called null hypothesis. The first principle of null hypothesis is to balance between making an error of the first kind (i.e. Rejecting the null hypothesis when it is true) and an error of the second kind (i.e. Accepting the null hypothesis when it is false). In reality, practitioners too often make errors of a third kind - solving the wrong problem. (W. N. Dunn, *Public Policy Analysis: An Introduction*. London: Prentice-Hall, 1994, p. 151)

<sup>4</sup> W. N. Dunn, *Public Policy Analysis: An Introduction*, London: Prentice-Hall, 2004.

<sup>5</sup> J. Hsu and Y. P. Chuan, "International technology spillovers and innovation: Evidence from Taiwanese high-tech firms", *The Journal of International Trade and Economic Development*, 23 (3), 2010, pp. 387-401.

Regarding research design, it is an essential process of framing research, De Vaus<sup>6</sup> argued 'the function of a research design is to ensure that the evidence obtained enables us to answer the initial question as unambiguously as possible'. To put it simply, research design is to ensure a research project can be carried out successfully.<sup>7</sup> In order to highlight the specific research issue – Taiwanese firms investing in the UK, the design of this research is a case study approach. Although the case-study research design has been used widely in different fields and developed into various different styles, the main common characteristics of case-study research design are widely accepted and used at present. In other words, it is like circle in that many academic studies reformulate or transform into newer different theories through reviewing or revising previous theories. The case study in this paper can be classified as an explanatory, theory building, multiple case, holistic, sequential, retrospective, case-study research design. In addition, this research has mainly adopted combinations of theoretical and empirical approaches with micro and macro economic points of view. Furthermore, in order to clarify the complicated network of economic reactions between FDI, UK and high technology industry, the philosophy of the research method regarding data collection and analysis was based on both qualitative and quantitative research to expand the method of data collection and analysis in methodology.

## **2. Model- Problem Structuring**

Dunn<sup>8</sup> suggested that problem structuring consists of four interdependent phases – problem sensing, problem searching, problem definition, and problem specification:

1) A prerequisite of problem structuring is problem sensing, i.e. the recognition or perceived existence of a problem situation.

2) At the stage between problem situation and meta-problem, the task is to discover the representatives of many multiple problems; namely, pick out a meta-problem – a problem behind problems - with problem searching.

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<sup>6</sup> D. A. De Vaus, *Research Design in Social Research*, London: SAGE, 2001.

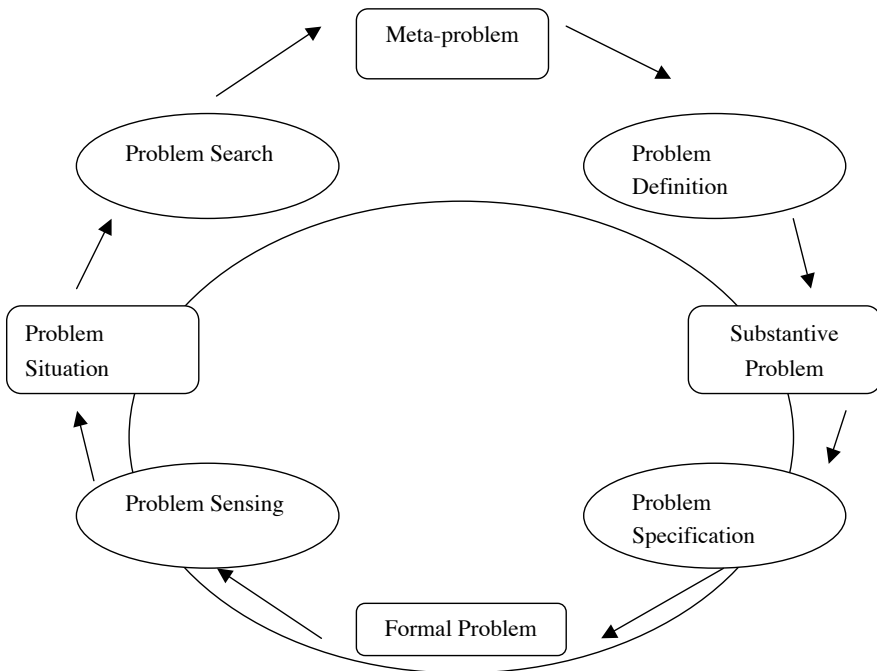
<sup>7</sup> C. Robson, *Real World Research: A Resource for Social Scientists and Practitioner-Researchers*, London: Blackwell Publishers, 2002.

<sup>8</sup> W. N. Dunn, *Public Policy Analysis: An Introduction*, London: Prentice-Hall, 1994.

3) The next phase is problem definition. The analyst is devoted to defining the problem in its most basic and general terms in this stage of moving from meta-problem to substantive problem.

4) Problem specification at the final stage is to construct a more detailed and specific formal problem from a substantive problem; normally, it involves the development of a formal mathematical representation (model) of the substantive problem.

**Figure 1: Phases of Problem Structuring**



**Source:** W. N. Dunn, *Public Policy Analysis: An Introduction*, London: Prentice-Hall, 1994.

The research process used in this study consisted of eleven steps with the four different stages of Dunn's problem structuring.

The first stage, in the main, reviews relevant literature and theories in order to collect what information would be considered in this study. The task of this stage is to sense or feel the existence of industrial migration from a broad view of academic theories and historical development.

2) Secondly, analysis of the present research's background discusses the development of research objects including FDI development and the high technology industry in the UK and Taiwan. The goal at the second stage is to construct representative problems (meta-problem) for setting up the initial problem at the next phase, meanwhile, it also served to narrow and clarify the complex scope of research area.

3) After the literature review, and analysis of present research background, in order to define the problem in its most basic and general terms, this study established the initial model. Then, based on this initial model, the questionnaire was designed at this stage. For reasons of reliability and validity, the questionnaire was pre-tested on a small number of respondents to check if it is designed well for respondents. Equally, to improve the quality of this questionnaire, the interviews with relevant people, as well as the pilot test of the original questionnaire, can complement each other in discovering ignored but important questions. In other words, by means of the interview and the pre-test of the questionnaire the reliability and validity of this questionnaire are strengthened. Briefly, the aim of this stage focuses on defining the research objects in basic and general terms to present the final version of the questionnaire

4) After problem definition, the main task is to construct a more detailed, specific and formal mathematical representation or model. The first task was to send out the questionnaires and to collect them. Then, the study carried out the empirical study to construct the representative model through mathematical analysis adopting factor analysis, Logit model, and multi-variance analysis. Next, this research established its explanatory model based on and modified by the results of empirical examination and the initial model presented at the previous research phase. To put it simply, the fourth phrase is the process of transferring from the representatives of substantive problems in the phase of problem definition to the specific formal problems in this stage.

### **3. Problem Sensing**

At the first stage of the research process, the main goal is to understand the problem situation by means of sensing problems. In order to sense or recognize the existence of industrial migration throughout firm's direct investment, it was necessary to carry out a review of relevant literature and theories for this study. As far as the phases of problem sensing and problem searching, the data were collected from studying academic reports, gov-

ernment publications, theses and journal articles, the relevant arguments and various different responses to the topic of this study were selected. In terms of location, Lei and Chen<sup>9</sup> investigates the location choice behaviour of firms originating in newly industrialized economies (Taiwanese firms) investing in emerging countries (China and Vietnam), and used logit analysis. They study found that: (1) firms with stronger ownership advantages prefer to invest in more developed than less developed regions; (2) firms occupying favourable positions in their network prefer to invest in more developed than less developed regions; (3) firms with a high degree of networking prefer to invest in less developed than more developed regions; (4) firms choose to invest in more developed than less developed regions to gain access to a large market; (5) firms with strong resource-seeking motives prefer to invest in more developed than less developed regions to access their resources.

These data were used to review the theoretical development of FDI and policy interaction as well as to analyse the development of FDI and high technology industrial migration from Taiwan to UK. Ganotakis and Love<sup>10</sup> also examined the relationship between R&D, product innovation, and exporting for a sample of new technology based Taiwanese firms (NTBFs) in the UK, and found strong evidence of the importance of internal R&D and of supply-chain collaborations in fostering innovation, and that formal commercial collaborations can be important in overcoming the (information) sunk costs of entering export markets. Owing to the close linkage between policy interaction and FDI development, the study, in this phase, began with related literature of on policy interaction and FDI theories.

First, on policy interaction, from classical economics, neo-classical economics to modern economics, it can be seen that commonly a close linkage between national policy and international policy on trade has existed explicitly. Furthermore, many empirical studies, such as<sup>11</sup> and others offer sufficient evidence to support the viewpoint that a national economic

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<sup>9</sup> H. S. Lei and Y. S. Chen, "The right tree for the right bird: Location choice decision of Taiwanese firms' FDI in China and Vietnam", *International Business Review*, 20 (3), 2011, pp. 338-352.

<sup>10</sup> L. Ganotakis and J. H. Love, "R&D, product innovation, and exporting: evidence from UK new technology based firms", *Oxford Economic Papers*, 63 (2), 2011, pp. 279-306.

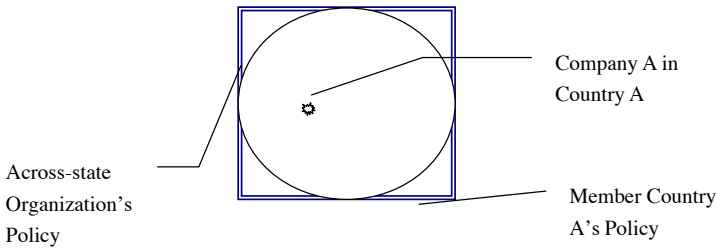
<sup>11</sup> R. A. W. Rhodes, *The National World of Local Government*, London: Allen & Unwin, 1986; J. Marks, *Into the Single Market: A MEED Practical Guide to Business in the New Europe*, London: Middle East. Economic Digest, 1993; R. Leonardi and R. Nanetti, *The Regions and European Integration: The Case of Emilia-Romagna*, London: Pinter, 1990.

policy, is influenced and adjusted by national and economic across-state organizations or authorities.

Of economic models involved in across-state policy interaction, the gravity model is the most widely adopted and examined by researchers<sup>12</sup>. To reflect the importance of policy interaction in dynamic economic development, the modified gravity model (see Equation 2.8) presented by this study can clarify this core problem through considering the growth of high technology.

After discussing policy interaction between participants through reviewing literature, this study went on to establish the framework - one ball one box - to conceptualize the process of policy interaction; the framework presents three dimensions (trade activity, industry category and market style) and one restriction (stability of policy system).

**Figure 2: One Ball in One Box – Stability of Policy Investment Environment**



For example (see Figure 2), member Country A (eg. UK) makes and implements its policy on the basis of the three dimensions (market style, industry tendency and trade activity) under the policy by an economic across-state organization (eg. EU's policy). The character of Company A (eg. Taiwanese firm) in Country A reflecting on policy interaction is high-level overseas market, labour-intensive industry, and import over export. When the UK faces the new policy from the EU or itself is over the scope of

<sup>12</sup> J. Tinbergen, *Shaping The World Economy: Suggestion for an International Economic Policy*, New York: The Twentieth Century Fund, 1962; A. Giovannini and F. Giavazzi, "Monetary Policy Interactions Under Managed Exchange Rates", *Economica*, 56: 222, 1989, pp. 199-221; C. Allen and D. Currie, "Policy Interaction between the OECD Countries and Latin America in the 1980s", *The Manchester School of Economic and Social Studies*, Vol. 60, 1982, pp. 1-10; V. Nitsch, "National borders and international trade: Evidence from the European Union", *The Canadian Journal of Economics*, 33:4, 2000, pp. 1091-1105.



the EU policy stability (Box), the UK has to adjust its policy to maximize its benefit under the requirements of policy interaction; in other words, it will be automatically adjusted without non-economic intervention.

Regarding relevant FDI theories, before the 1960's, the studies in this field belonged to a part of international trade and received little attention from scholars. International trade theory includes the Heckscher-Ohlin Theorem,<sup>13</sup> the Stolper-Samuelson Theorem<sup>14</sup> and factor price equalization theory in 1949. The spirit of international trade theory is around comparative advantage and the life cycle of products.

Since Hymer<sup>15</sup> presented the industrial organization theory, the issue of direct investment has gradually become another study area of international economics. Of these doctrines, Coase's transaction cost theory was broadly applied and developed by researchers, such as Williamson's<sup>16</sup> pre- and post-cost and efficient governance, Hennart's<sup>17</sup> existence of international enterprise, as well as Teece and Griffin's<sup>18</sup> connection of affiliates, joint ventures and licensing. The common trait of these is that instability, asset ownership and asymmetry of information cause cost for both of buyer and seller.

In fact, firm theory and internalization theory are also developed from the nature of Coase's transaction cost. Regarding firm theory, Buckley and Casson<sup>19</sup> presented an interpretation of how a firm develops a multi-national enterprise by means of FDI in order to obtain advantage; it was developed on the basis of the Coasian approach. Moreover, on internalization theory, Buckley and Casson<sup>20</sup> believe that because markets are imperfect firms take the approach of internalization to reduce their expenditure.

<sup>13</sup> E. Heckscher, "The Effect of Foreign Trade on the Distribution of Income", *Ekonomisk Tidskrift*, 21, 1919, pp. 497-512; Reprinted in H. S. Ellis and L. A. Metzler (eds.), *Readings in the Theory of International Trade*, New York: Blakiston, 1949.

<sup>14</sup> W. F. Stolper and P. A. Samuelson, "Protection and real wages", *Review of Economic Studies*, 1, 1941, pp. 58-73.

<sup>15</sup> S. Hymer, *The International Operations of National Firms: A Study of Direct Investment*, Ph. D. Thesis, 1960, MIT: Published by MIT Press under Same Title in 1976.

<sup>16</sup> O. E. Williamson, *Markets and Hierarchies: Analysis and Antitrust Implications*, New York: Macmillan Publishing Co. Inc., 1975.

<sup>17</sup> J. F. Hennart, "Can the "New forms of investment" substitute for the old form", *Journal of International Business Studies*, 20: 2, 1989, pp. 211-35.

<sup>18</sup> D. J. Teece and J. M. Griffin, *OPEC Behavior and World Oil Prices*, London: Allen & Unwin, 1982.

<sup>19</sup> P. J. Buckley and M. Casson, *The Future of the Multinational Enterprise*, London: Mcmillan, 1976.

<sup>20</sup> Ibid; 25<sup>th</sup> Anniversary Edition. Hampshire: Palgrave Macmillan, 2002.

The theory of the international product cycle presented by Well and Louis<sup>21</sup> as well as Vernon<sup>22</sup> is also concerned with FDI; it covers Chen and Bolon's<sup>23</sup> argument of innovation ability and Porter's<sup>24</sup> competitive advantage of nations. It is mainly used to explain why international investment takes place from the angle of the product market cycle. The theory of market power based upon Hymer's international organization theory is developed by Kinckerbocker<sup>25</sup> to explain that FDI is an oligopoly reaction for markets because firm specific and industry specific factors in imperfect markets affect the strategy of firms. Further, for the application of location theory in FDI, Porter<sup>26</sup> argues that FDI firms prefer to invest directly in areas of plentiful resources in order to get lower costs.

Actually, Dunning's Eclectic Theory<sup>27</sup> of the investment development path (IDP) offers a more explicit position for FDI and argues that the determinants of FDI are ownership specific, location and internalization incentive advantages. At recent times, many researchers, such as; Itaki,<sup>28</sup> Brewer,<sup>29</sup> Rivoli and Salorio<sup>30</sup> have also adopted Dunn's approach.

#### 4. Problem Searching

After the phase of sensing the problem, the existence of firm's direct investment in industrial migration is recognized by this study. The next step was to carry out analysis of our research background (problem searching) in order to discover the real representative of background (meta-prob-

<sup>21</sup> J. Well and T. Louis, "A product life cycle for international trade", *Journal of Marketing*, 32: 3, 1968, pp. 1-6.

<sup>22</sup> R. Vernon, *The Economic and Political Consequences of Multinational Enterprise: An Anthology*, Boston: Harvard University, 1972; R. Vernon, "The Product Cycle Hypothesis in a New Environment", *Oxford Bulletin of Economics & Statistics*, 41: 4, 1979, pp. 255-267.

<sup>23</sup> J. L. Cheng and D. S. Bolon, "The Management of Multinational R&D: A Neglected Topic in International Business Research", *Journal of International Business Studies*, 24, 1995, pp. 1-18.

<sup>24</sup> M. E. Porter, *The Competitive Advantage of Nations*, London: Macmillan Press, 1998.

<sup>25</sup> F. T. Kinckerbocker, "Oligopolistic reaction and multinational enterprise", *Tunderbird International Business Review*, 15 (2), 1973, pp.7-9.

<sup>26</sup> M. E. Porter, *The Competitive Advantage of Nations*, London: Macmillan Press, 1988.

<sup>27</sup> J. H. Dunning, "Trade, Location of Economic Activity and the MNE: A Search for an Eclectic Approach", in *The International Allocation of Economic Activity: Proceedings of A Nobel Symposium Held at Stockholm*, B. Ohlin, P. O. Hesselborn, and P. M. Wijkman, (eds.), London: Macmillan, 1977; J. H. Dunning, *International Production and Multinational Enterprise*, London: Allen & Unwin, 1981.

<sup>28</sup> M. Itaki, "A Critical Assessment of the Eclectic Theory of the Multinational", *Journal of International Business Studies*, 22: 3, 1991, pp. 445-61.

<sup>29</sup> T. L. Brewer, "Government Policy, Market Imperfections, and Foreign Direct Investment", *Journal of International Business Studies*, 24: 1, 1993, pp.101-31.

<sup>30</sup> *Ibid*, 27: 2, 1996, pp. 335-57.

lem). This study, then, takes FDI by Taiwanese high-tech companies in the UK as its case study. The research background is mainly made up by FDI growth in the UK and Taiwan as well as high technology industry in both countries.

British economic development is a strongly related to FDI, particularly after 1990. In the 1990s, the average annual growth of FDI into the UK was nearly 26 per cent;<sup>31</sup> the inward FDI stock of GDP increased dramatically from 12 per cent in 1980 to 31 per cent in 2000,<sup>32</sup> higher than that of the EU, US and other major economic countries. In fact, until 2001, the UK was ranked as the second biggest host country for FDI inflow.<sup>33</sup>

The government's policy on FDI has adjusted in response to different economic situations. Before the Second World War, Britain adopted a *laissez-fair* attitude on FDI policy and there were few regulations and little assistance for investors. However, this type of policy was changed and revised; the government started making efforts to attract FDI, particular after the establishment of the IBB in 1977. The British FDI policy-making decision related to foreign investors is based on the details of the investors' motivation. These determinants can be said to have three dimensions: market environment, national and international constraints.

Regarding its high technology industrial environment, compared with the EU, the weakness on the supply side of high-tech industry is its lack of application of high technology from higher level R&D input despite of having high quality science. However, the greatly increasing consumer market in high technology created a more mature investment environment than in the other EU areas for investors. In addition, the UK has had a leading role in policy-reform in high technology industry, in particular the privatization of telecommunications, inspired competition policy in the EU. As a result, the UK offers a well-structured environment for firms to invest in high technology industry.

Along with economic development, the momentum of FDI was enhanced and policy has been continuously adjusted to the different stages of Taiwan's economic development. Before 1963, the amount of FDI was very small, the majority of FDI was from the US; the Taiwanese economic environment was lacking in incentives for investors and domestic firms

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<sup>31</sup> Calculated from the data of FDI inflows, 1991-2001(UNCTD, 2003).

<sup>32</sup> Ibid.

<sup>33</sup> Its stock of inward FDI had accumulated to about 497 billion, taking nearly 7.26 per cent of all world inward FDI (UNCTD, 2003).

were not able to implement their own investment. From 1963 to 1980, FDI policy concentrated on attracting and regulating inward FDI. However, since the rise of globalisation and liberalization in the 1980s, the FDI policy of Taiwan's government has adjusted to be more open and flexible. That resulted in Taiwan's outward FDI expanding rapidly when Taiwan entered the stage of mature economy with rich economic resources. Taiwanese FDI is mainly distributed among EU nations, US, Southeast Asia, and China. The first two areas provide Taiwanese firms with secure high technology and large markets; Southeast Asia and China offer low production costs, especially a cheap workforce and land for Taiwanese firms.

As far as Taiwanese firms in the UK are concerned, the rapid growth of investment inflow goes with the high trade activities since 1990. Between 1952 and 2002, the UK attracted almost 46 per cent of Taiwanese firms' investment in Europe and became the biggest host country for Taiwanese investors.<sup>34</sup> In particular, from 1992 to 2002, the inflow of Taiwanese FDI into the UK was 13.64 times greater than the accumulated investment in the previous forty years from 1952-1991.<sup>35</sup> The majority of direct investment was concentrated on high technology industry,<sup>36</sup> especially on computers, computer peripherals, TV tuners, picture tube components, monitors, PC motherboards, power supplies and notebook computers. Their investment motives can be seen as the advantage of English, EU market access, the comparatively low production cost from the workforce and tax, as well as policy incentives for the high technology sector.

The process of this stage also enabled this study to clarify the complex research area and to identify the specific questions (meta-problems) for the following phase of problem definition.

## **5. Problem Definition**

This phase is to define the problem in its most basic and general terms (the substantive problem) after discovering meta-problem. The first task of problem definition is to establish the initial model for this research. The initial model based on the findings of preceding phases (problem sensing and problem searching) contains three dimensions – the firm's internal condition, motive factors and policy environment. The dimension of the firm's internal condition includes the scale of the enterprise, the experience

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<sup>34</sup> Calculated from the data of the investment commission, Taiwan Investment Commission (2002).

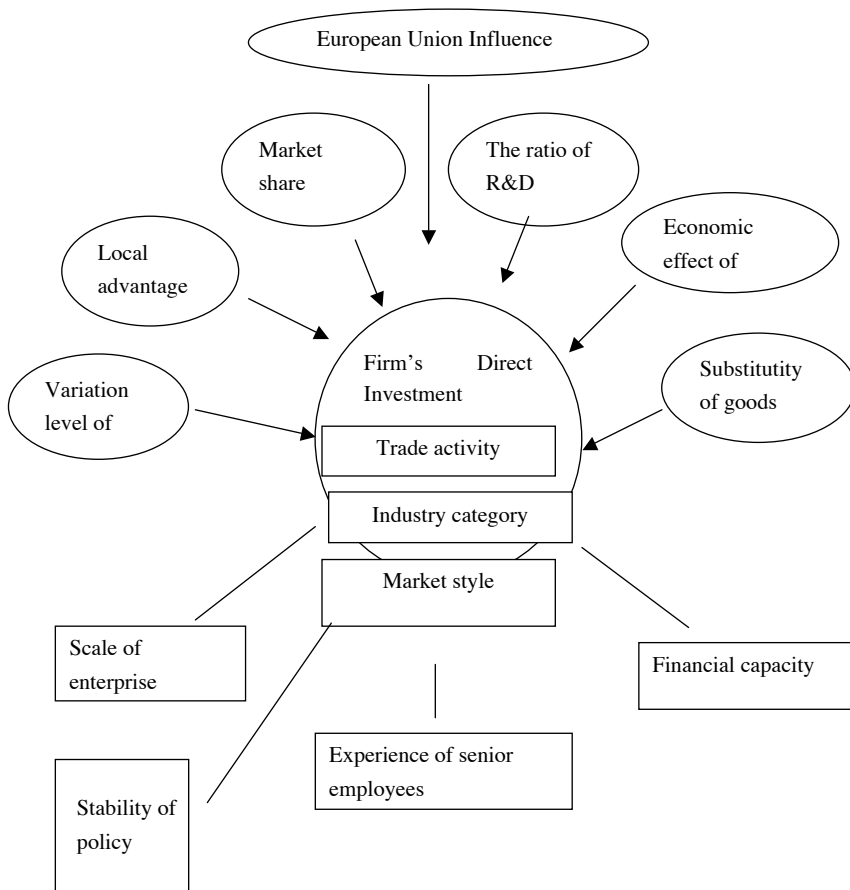
<sup>35</sup> Ibid.

<sup>36</sup> 89 of 149 formally registered in the UK belong to the sector of high technology (Taiwan Trade Center in London, 2003).

of its senior employees and its financial capacity. Motive factors include variation of production, local advantage, market share, R&D, substitutability of goods, economic effect of location, and EU influence. Finally, trade activity, industry category, and market style are measures of the stability of the policy environment.<sup>37</sup>

The study proceeds to construct the questionnaire based on the framework of the initial model. Next, to improve the reliability and validity of this questionnaire, the research refined the questionnaire by means of interviews and a pre-test of questionnaire (pilot test).

**Figure 3: The Initial Model**



<sup>37</sup> D. A. De Vaus, *Research Design in Social Research*, London: SAGE, 2001.

In addition, in this phase, after establishing this initial model we were able to set up the examination hypotheses. That also provides this study with the examination objects to carry out the empirical study in the problem specification phase.

Hypothesis 1:  $H_0$ : No specific motive factor affects the firm's direct investment in the UK, particularly after 1992.

Hypothesis 2:  $H_0$ : Firm internal condition does not affect the entry time of its investment into the UK.

Hypothesis 3:  $H_0$ : Stability of policy investment environment does not exist for the entry time of firm's direct investment into the UK.

## **6. Problem Specification**

In this stage, the main task was to set up a formal mathematical model containing more detailed and specific formal problems. Namely, problem specification is the process of transferring from representatives of substantive problems in the problem definition phase to specific formal problems. The approach in this stage was to use empirical study to examine the initial model; the sources of data include a questionnaire to Taiwanese high-tech firms in the UK and an interview with senior employees in firms for the pilot test of the questionnaire. The methods adopted in the empirical study were descriptive statistics, factor analysis, a Logit model, analysis of variance (ANOVA) and correlation analysis. Based on the initial model and hypotheses set up at the previous phase, there are three dimensions to analyse: motive factors of firm's direct investment, firm's internal condition, and stability of policy investment environment.

### **6.1. Motive Factors of Investment**

After factor rotation, based on the high level of relationship between the variables examined and each factor, these six factors, derived from a factor analysis of twenty two motive variables, can be redefined and renamed (see Table 1).

**Table 1: Motive Factors**

Factor	Motive Variable(Examined Variable)
Factor 1: R&D Input	RDETC: R&D expenses on total costs RDES: R&D expenses on sales RDEH: R&D employee in host firm RDNT: R&D on non-technology
Factor 2: Regional Investment and Production Environment	LI: local infrastructure CFS: convenience of financial system LLC: lower local labour cost QP: quality of product
Factor 3: UK-based Overseas Marketing	OM: distribution of overseas market BM: distribution of British market EM: European market DPM: distribution of product marketing
Factor 4: Differentiation of Brand Production	PB: product brand DP: differentiation of firm's production QP: quality of product PS: the level of product substitutability
Factor 5: Convergence of Location and Skill	IILS: industrial intensity of location toward sales CEC: convergence effect of customers PSK: possession of specific production skill
Factor 6: British EU Advantage on Marketing	EL: English – language advantage - one of the official EU languages BEU: Britain – one of EU member countries DPM: distribution of product marketing

After factor analysis, we got the six motive factors affecting the firm's investment behavior. These six factors were used as the independent variable in a Logit model. According to the analysis of research background, between 1992 and 2002, the inflow of Taiwanese FDI into the UK was 13.64 times greater than the accumulated investment in the previous forty years from 1952-1991. In order to explain why the majority of companies suddenly decide to invest in the UK after 1992, this study suggests it necessary to analysis how these motive factors affect the entry time of firm's

investment decision. Before we carry out the logit model to examine the relation between motive factors and entry time, the difference from the impact of motive factor on the entry time should be identified.

To confirm that these motive factors have different impact on the companies investing after 1992, the means of these factors between group one (invested before 1992) and group two (invested in 1992 and after) are tested using a t-test. It is therefore that the factors with significant differences between the two groups can be identified. In Table 2, the means of these six motive factors illustrate totally different directions; in addition, of them, Factor 3 and 6 demonstrate significantly different. It implies that, after 1992, the motive factors did make explicit contributions on Taiwanese firms' investment behavior and the impact weight from each factor has been different with the previous structure.

**Table 2: The T-test of Means between the Companies Investing before 1992 and the Companies Investing after 1992**

Factor	Mean (before 1992)	Mean (in 1992 and after)	T
1. R&D Input	.277	-.081	-1.54
2. Regional Investment and Production Environment	-.243	.071	1.25
3. UK-based Overseas Marketing	-.407	.119	1.63*
4. Differentiation of Brand Production	-.048	.013	.186
5. Convergence of Location and Skill	-.164	.047	.641
6. EU Advantages on Marketing	-.561	.164	2.29**

\*significant at 0.1; \*\* significant at 0.05

Then, after ensuring the different impact of motive factors on entry time exists, this study adopted a Logit Model to examine the relation between motives factors and entry time. This model has been broadly used in many fields, particularly in business and economics. Hence, Logit modelling could be said to be an econometric analysis method often used in economic issues.



This research plans to use the factors from factor analysis to structure the evaluation model and to use the Logit model to measure the difference between investors setting up at different periods. In other words, to achieve the goal of empirical examination of investment motive factors, the approach is to combine factor analysis with the use of the Logit Model. Therefore, in order to understand the relation between motive factors and entry time, this study adopted the variable of entry time as the dependent variable and used the motive factors concluded from the factor analysis as the independent variables of our model. The notational form of the model to be estimated is:

$$y=f(X_1, X_2, X_3, X_4, X_5, X_6) \quad \text{Eq (1)}$$

Y: entry time

$X_i$ : the  $i$ th motive factor,  $i= 1 \dots 6$

In order to satisfy the requirement of binary Logit estimation that the dependent variable should be dichotomous and; to address the issue that there is no absolute line to divide all observations of my sample into two distinct categories; to analyze how these motive factors we concluded at the previous stage make Taiwanese investment motivation become incredible strong after 1992, we use the logit regression to concentrate on the impact of motive factors on the companies investing in the UK after 1992. Briefly, to concentrate on the importance of entry time and to distinguish the motivation difference between firms setting up before and after 1992, the dependent variable is defined as follows;

Y=1, the company invested after 1992

Y=0, otherwise

$$\text{Prob}(Y=1, \text{invested after 1992})=\Lambda(\alpha_1+\alpha_2+ \dots +\alpha_6X_6)+\varepsilon \quad \text{Eq (2)}$$

where  $\Lambda(\cdot)$  indicates the logistic cumulative distribution function. Through variable definition, selecting a regression method, model formulation, evaluation and selection of models, examination of the strength of association for models, and model interpretation in a Logit model, the four regressions which cover five determinants were produced and rewritten in terms of the formulae below:

<i>Model 1:</i>						
FDI = f (Factor 1, Factor 2, Factor 3, Factor 4, Factor 5)						
	(+)	(+)	(-)	(+)	(+)	
=	1.640	+ 1.047Factor1	+ .580Factor2	- .544Factor3	+ .489Factor4 + .226Factor5	Eq.(3)

<i>Model 2:</i>						
FDI = f (Factor 1, Factor 2, Factor 3, Factor 4)						
	(+)	(+)	(-)	(+)		
=	1.651	+ 1.060Factor1	+ .591Factor2	- .549Factor3	+ .516Factor4	Eq.(4)

<i>Model 3:</i>						
FDI = f (Factor 1, Factor 2, Factor 3)						
		(+)	(+)	(-)		
=	1.602	+ 1.067Factor1	+ .535Factor2	- .561Factor3		Eq.(5)

<i>Model 4:</i>						
FDI = f (Factor 1, Factor 2)						
			(+)	(+)		
=	1.495	+ 1.014Factor1	+ .537Factor2			Eq.(6)

- Factor 1: EU Advantage on Marketing  
 Factor 2: UK-Based Overseas Marketing  
 Factor 3: R&D Input  
 Factor 4: Regional Investment and Production Environment  
 Factor 5: Convergence of Location and Skill

The models can present the influence of these five main factors on the entry time of FDI decision after factor analysis and Logit modelling. The two factors with highest impact are EU advantage on marketing (Factor 1) and UK-based overseas marketing (Factor 2). The lowest level of influence on FDI decision results from convergence of location and skill (Factor 5). However, the importance of regional investment and production environment (Factor 4) did not replace the significant role of Factor 1. It is, therefore, the factors of EU advantage on marketing and UK-based overseas that determine a firm's investment decision.

## 6.2. Firm's Internal Condition and Investment Decision

In this section, the study adopted the method of ANOVA and correlation analysis to evaluate respectively the firm's internal condition related to FDI decision as well as the structure of firm's internal condition.<sup>38</sup> First, Table 3 illustrates the empirical results of internal firm's status and FDI decision. Each variable of a firm's internal condition shows its difference on different entry time of investing in Britain. Among these variables, that of senior staffs' experience shows significant difference on the entry time of Taiwanese firms' investment. In other words, the average length of senior staffs' experience of firms established in the early time (before 1992) is significantly different from that of firms set up at later times (in 1992 and later). The negative correlation between the variables of senior staffs' experience and FDI entry time shows that the staffs' experience of firms investing recently is lower than that in firms set up in the earlier period. Therefore, as far Taiwanese firm entering the UK in the last ten years, senior staffs' experience in investing abroad is no longer gives advantage to its competitiveness. Briefly, the firms established recently become younger than before.

**Table 3: Internal Firm's Status and Investment Decision**

Variable	Description	Empirical Result
Scale of enterprise: the number of employee in the host firm (NEUB)	The scale of enterprise reflects the difference on the entry time of Taiwanese firms' investment.	Non-significant
Experience of senior staff: the average experience of senior employees in an enterprise of investing abroad (ALSEI)	The experience of senior staffs shows the difference on the entry time of Taiwanese firms' investment.	Significant (Negative Relationship)
Financial capacity in Taiwan: the duration of registration on Taiwan's Stock Exchange (DCRTS)	The financial capacity reflects the difference on the investment entry time.	Non-significant

<sup>38</sup> UNCTD. *UNCTAD Handbook of Statistics*, Retrieved 30<sup>th</sup> October, 2003, from World Wide Web [http://stats.unctad.org/fdi/eng/ReportFolders/Rfview/Explorerp.asp?CS\\_referer](http://stats.unctad.org/fdi/eng/ReportFolders/Rfview/Explorerp.asp?CS_referer), 2003.

### 6.3. Stability of Policy Investment Environment

In order to analyze the stability of the policy investment environment which was constructed by one-ball-one-box at the previous phase of problem structuring, the method applied in this part is ANOVA. Table 4 illustrates that the variables of investment environment show difference with the entry time of investing in the UK. It also contains the influence of the stability of these variables on Taiwanese investors. In Table 4, other than TPOIM, there is no significant evidence to challenge the importance of the stability of policy investment environment since no other variables show significant disparity on the entry time of investing in the UK.

**Table 4: Stability of Policy Investment Environment**

Variable		Description	Empirical Result	Stability
Trade Activity	Export (TPOEX)	The impact of the UK's trade policy on firm's export illustrates the difference on the investment entry time.	Non-Significant	Yes
	Import (TPOIM)	The impact of the UK's trade policy on firm's import reflects the difference on the investment entry time.	Significant	No
Industry Category	Labour-intensive (LINTENS)	The level of firm's labour intensity reflects the difference on the entry time of investment	Non-Significant	Yes
	Capital-intensive (CINTENS)	The level of firm's capital intensity demonstrates the difference on the entry time of investment	Non-Significant	Yes
Market Style	UK (DMS)	The distribution of firm's marketing strategy on the British market shows the difference on the entry time of investment	Non-Significant	Yes
	Overseas (OMS)	The distribution of firm's marketing strategy on the overseas market reflects the difference on the entry time of investment	Non-Significant	Yes
	Taiwan (TMS)	The distribution of firm's marketing strategy on the Taiwan's market expresses the difference on the entry time of investment	Non-Significant	Yes

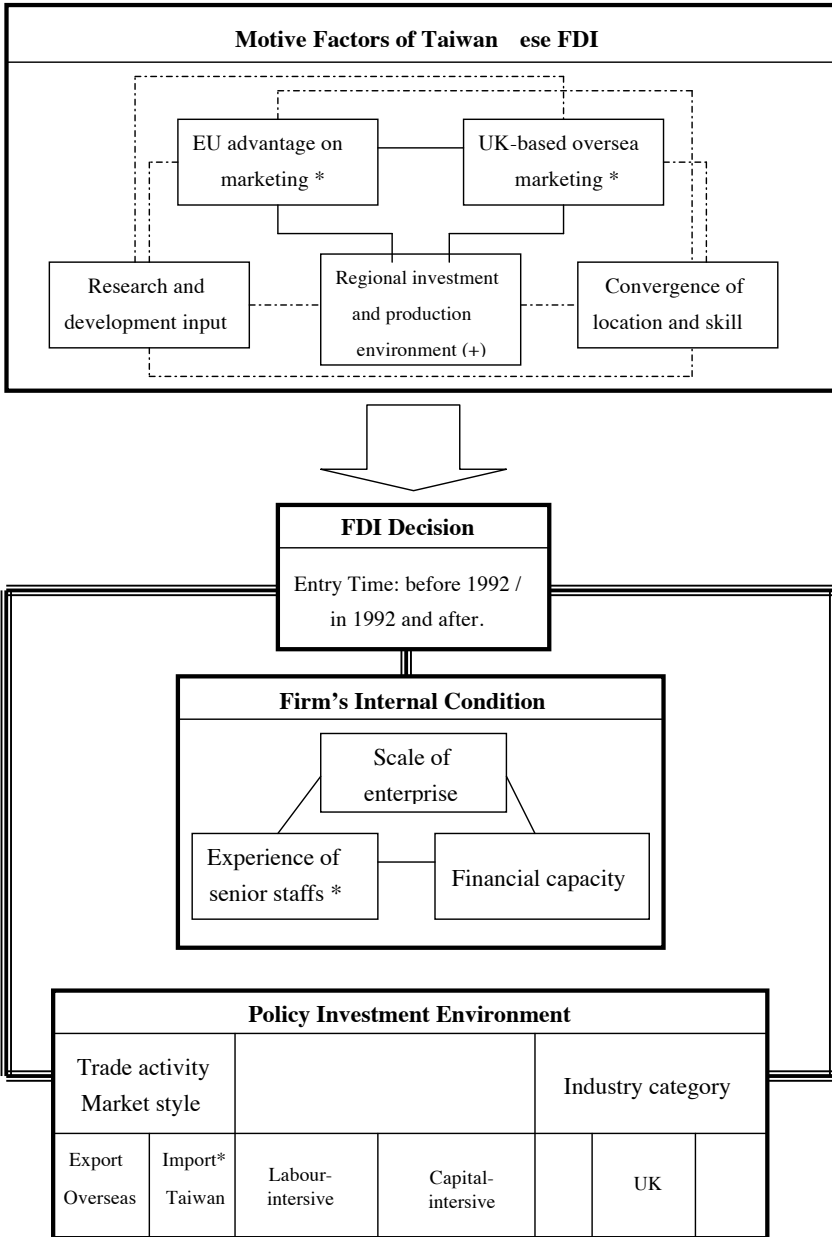
Table 5 presents a summary of the results from the empirical tests at this stage of problem structuring. Firstly, respecting motive factors for Taiwanese FDI, with the exception of the differentiation of brand production hypothesis all hypotheses associated with high-tech firms' direct investment decisions were proved to be accepted.

**Table 5: Results of Empirical Examination**

Hypothesis		Results
<i>Motive Factors for Taiwanese FDI:</i> (After Factor-Logit model analysis)		
Variation level of production	R&D input	Confirmed
Local advantage	Regional Investment and production environment	Confirmed
Market share	UK-based overseas marketing	Confirmed
The ratio of R&D	Differentiation of Brand Production	Not confirmed
EU influence	Convergence of location and skill	Confirmed
Economic effect of location	EU advantage on marketing	Confirmed
Substitutability of goods		Confirmed
<i>Firm's Internal Condition</i>		
Scale of Enterprise		Confirmed
Experience of senior staffs		Not confirmed
Financial capacity		Confirmed
<i>Policy Investment Environment</i>		
Trade activity- export		Confirmed
Trade activity- import		Not confirmed
Industry category- labour intensive		Confirmed
Industry category- capital intensive		Confirmed
Market style- UK		Confirmed
Market style- Overseas		Confirmed
Market style- Taiwan		Confirmed

Secondly, with respect to the firm's internal condition, the hypotheses of enterprise size and financial capacity were confirmed. Thirdly, for policy investment environment, except the hypothesis of trade activity - import, all hypotheses were found to be confirmed. Then, based on the results of empirical research, the initial model (see Figure 3) was modified and revised to construct the final formal representative model as the follows (see Figure 4).

**Figure 4: Modified Model**



\* Significantly different with the other variables in the same dimension  
 — negative correlation, positive correlation

The most important determinants of firm's investment motivation include EU advantage in marketing, UK-based overseas marketing, research and development input, the regional investment and production environment, as well as convergence of location and skill. Of them all, the motive factor of EU advantage in marketing is the strongest influence on a firm's investment decision. Secondly, except R&D input, all motive factors are positively related with a firm's investment decision. The significance of the importance of the two factors, investment production environment and convergence of location and skill, is not higher than the others. This implies that these two motive factors were overestimated before the results of the empirical examination were obtained.

As far as the dimension of the firm's internal condition is concerned, among the variables scale of enterprise, experience of senior staffs, and financial capacity, the variable of senior staffs' experience demonstrated a significant difference with the entry time of FDI decision with a negative correlation. That means that it is not necessary that a firm has its own lengthy experience of investing abroad before implementing foreign investment projects in the UK. The structure of firm's internal condition is significantly close in terms of company's scale, senior staffs' experience, and financial capacity. These three variables are positively related to one another.

The dimension of the policy investment environment can be seen as a matter of stability because only the variable of the impact of British trade policy on firm's imports (TPOIM) in trade activity showed significant difference regarding the entry time of investment. From this viewpoint, all variables, except TPOIM, have a stable status for firms no matter whether companies invested before 1992 or in 1992 and after. In other words, this result can confirm the mechanism of policy investment stability of the theoretical assumption of one-ball-one-box.

## 7. Conclusion

Firstly, the findings of this study can provide some suggestions for both the Taiwanese government and Taiwanese high-tech companies. It is clear that Taiwan policy<sup>39</sup> on industrial migration is committed to liberalization by deregulating financial rules and laws. However, the advantage of production differentiation has not been an investment motive for firms.

<sup>39</sup> Taiwan Investment Commission, *Annual Report of Statistics*, Taipei: Taiwan Investment Commission, Ministry of Economic Affairs, 2002.

Hence, in order to avoid the effect of goods marginalization, the task for the Taiwanese government<sup>40</sup> and individual enterprises is to improve the capacity for brand innovation.

In addition, the empirical results confirm the importance of R&D input but shows that this motive factor is negatively related with Taiwanese firm's direct investment, differently from the other four motive factors that are positively related with FDI entry time. The firms investing in the last ten years have preferred the benefits from the advantage of EU marketing rather than securing the advantages of technology. Firms seem unwilling to devote to the potential benefit from updating technology through cooperation with local industries and foreign high-tech firms. Moreover, the motive factors of investment production environment as well as the convergence of location and skill are not considered to be higher than the others; this implies that in recent times the policy of the British national and local governments toward foreign high-technology firms has lost a key role in attracting foreign investors. Hence, the study suggests that these declining advantages for attracting firms' direct investments should be restructured and improved.

Second, this study found that lengthy experience of investing abroad is not necessary for firms to carry out an FDI project. For the host country – the UK - increasingly, since 1992, Taiwanese firms have lacked experience of implementing investment projects; therefore, this paper suggests that the British government not only should evaluate the potential benefit from these firms' investment but also needs to measure the risk of these firms' credit.

In contrast to the others in policy investment environment, the impact of the UK's trade policy on firm's import gave an uncertain signal. For the host country - the UK - it achieved some policy goals, particularly in protecting domestic markets; but that gives firms more trade barriers affecting the delivery cost of production material imported from other countries. As far as firms that are heavily dependent on imported materials or goods are concerned, the instability of British import policy will erode those firms' willingness to make FDI. Hence, the study suggests that the UK trade policy should be more flexible and open in respect to importing of high tech goods, though its FDI policy has been restructured to be active and open for attracting FDI inflow from high technology industries from abroad since the 1980s.

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<sup>40</sup> Taiwan Trade Centre in London, *Taiwanese Companies in the UK*, London: Taiwan Trade Centre, 2003.



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