Working Paper Series

#2010-052

Innovation strategy, firm survival and relocation: The case of Hong Kong-owned manufacturing in Guangdon province, China

Naubahar Sharif and Can Huang

United Nations University – Maastricht Economic and social Research and training centre on Innovation and Technology
Keizer Karelplein 19, 6211 TC Maastricht, The Netherlands
Tel: (31) (43) 388 4400, Fax: (31) (43) 388 4499, email: info@merit.unu.edu, URL: http://www.merit.unu.edu

INNOVATION STRATEGY, FIRM SURVIVAL AND RELOCATION: THE CASE OF HONG KONG-OWNED MANUFACTURING IN GUANGDONG PROVINCE, CHINA

by

Naubahar Sharif[1,*] and Can Huang[2]

[1] *Division of Social Science, The Hong Kong University of Science and Technology, Clear Water Bay, Kowloon, Hong Kong SAR*

[2] *United Nations University-MERIT and Maastricht University, Keizer Karelplein 19, 6211 TC Maastricht, The Netherlands*

Based on a survey adapted from the Fourth European Community Innovation Survey (CIS-4), this study finds that, in the changing manufacturing environment of Guangdong province in China, Hong Kong-owned businesses that generate a higher share in new product sales as a percentage of total sales or engage in R&D or collaborative innovation activities in China are more likely to survive and remain in Guangdong. The study fills a gap in the literature by investigating the effects of innovation on the survival and relocation of Hong Kong-owned manufacturing firms in Guangdong. The results support policy initiatives that strengthen collaborative ties among key innovation system actors.

Keywords: Innovation, Survival, Relocation, Community Innovation Survey, Asia, China

JEL Classification: D21, L25, L52, O31, R11

Email addresses: sosn@ust.hk (N Sharif); can.huang@maastrichtuniversity.nl (C Huang)

UNU-MERIT Working Papers
ISSN 1871-9872

Maastricht Economic and social Research and training centre on Innovation and Technology, UNU-MERIT

UNU-MERIT Working Papers intend to disseminate preliminary results of research carried out at the Centre to stimulate discussion on the issues raised.

INNOVATION STRATEGY, FIRM SURVIVAL AND RELOCATION: THE CASE OF HONG KONG-OWNED MANUFACTURING IN GUANGDONG PROVINCE, CHINA

1. Introduction

Among developing countries, The People's Republic of China (hereinafter "Mainland China") indisputably has attracted the most Foreign Direct Investment (FDI) over the past two decades. Of Mainland China's total FDI over the 1985–2003 period, 30 percent went into Guangdong Province (hereafter "Guangdong") in southern China, in large part because of its geographical and cultural proximity to Hong Kong. An overwhelming 90 percent of FDI in Guangdong was invested by entrepreneurs from Hong Kong in the mid 1980s and, although the ratio decreased steadily after the mid-1990s, even as recently as 2008 as much as 55 percent of FDI in Guangdong originated in Hong Kong. From Hong Kong's perspective, then, Guangdong is the most important investment destination in Mainland China. Since the mid-1990s, Hong Kong-based entrepreneurs have channeled up to half of their Mainland China investments into Guangdong.

In the 1980s and 1990s, many firms in Hong Kong have transformed themselves into service providers, transitioning from manufacturing to trading. Many entrepreneurs in Hong Kong do both: They operate as traders in Hong Kong and as proprietors of or partners in plant facilities in Mainland China. The import/export firms in Hong Kong operated by these entrepreneurs import goods from their factories in Mainland China, especially Guangdong, and subsequently re-export those goods to the rest of the world from Hong Kong. Following this business model, Hong Kong entrepreneurs have successfully reduced their manufacturing costs by leveraging their access to the abundant, and relatively cheaper, labor and land resources in Guangdong. According to Hong Kong Census and Statistics Department figures (2007), there were

12,535 manufacturing firms registered in Hong Kong in 2007, but 15,798 import/export firms in Hong Kong engaged in manufacturing-related activities using subcontractors in Mainland China. In a study by the Federation of Hong Kong Industries (2003), the number of companies in Mainland China owned and controlled by Hong Kong businesses was estimated to have ranged between 50,000 and 60,000 in 2002, and these manufacturing firms were estimated to have employed approximately 447,000 and 11 million workers in Hong Kong and Mainland China, respectively. According to Tsang (2008), the National Bureau of Statistics of China reported that in 2007, in Guangdong, there were a total of 70,000 export-processing plants, of which 57,500—employing 9.6 million workers—were Hong Kong owned.

The Guangdong manufacturing environment has, however, been changing dramatically of late. Since mid-2007, Hong Kong manufacturers (as well as other manufacturers operating in Guangdong) have found themselves increasingly forced either to shut down or to move their manufacturing operations out of Guangdong. This shakeup in industrial activity has been caused by the combined effects of unfavorable central government policies that have penalized low-end and low-cost manufacturing. These include the regulation introduced by the Ministry of Commerce that requires exporters to pay a deposit equivalent to half the amount spent on importing almost two thousand raw materials;[1] cancellation and reduction of tax refunds for low-end processed exports (tax rebate cuts) on goods such as metals, plastics, textiles, and furniture (all of which are deemed by the central Mainland China government to be inefficient/energy-consuming, overly resources-oriented and highly polluting);[2] a stronger Yuan; escalating prices for energy, resources (such as coal, copper, and steel), and raw materials; stringent pollution control requirements in Guangdong; the introduction of welfare benefits for employees (such as annual leave

and medical coverage); and the introduction of a labor law—a binding, compulsory, labor contract to be signed by employers and employees (with more than two years service) stipulating the benefits and responsibilities of both parties (for instance, limiting work days to six per week and overtime to one-and-a-half hours per day, and guaranteeing one month's pay to fired employees for each year worked), providing insurance, and stipulating overtime pay.[3]

These challenging market and business conditions have squeezed thousands of firms operating in typically labor-intensive, highly polluting industries—such as leather tanning, shoemaking, and textile and garment production—most of which have been and continue to be run by Hong Kong-based entrepreneurs. Unless these entrepreneurs, who control a sizeable portion of low-end manufacturing in Guangdong, can develop new strategies—to somehow move up the value chain—they will find it difficult to survive in Guangdong, dramatically undermining Hong Kong's manufacturing-related service-based economy there. From the point of view of policy makers in Guangdong, highly polluting industries are far less desirable than clean, high value-added industrial activities. However, any dramatic shake-up in Hong Kong-owned manufacturing activity in Guangdong, which accounts for a significant share of local government tax revenue, employment, and value-added business, would have serious repercussions that might be hard to manage. The upshot is that the success or failure of Hong Kong-owned manufacturing firms in Guangdong matters tremendously to both regions, not only because their economies are increasingly integrated, but also because each region's prosperity rests on the health of these firms.

In such a changing environment, innovation is often the key to success for the firms in question. In this paper, then, we study the relationship between innovation

strategies and the decision to stay in, relocate out of, or cease operating altogether in Guangdong on the part of Hong Kong-owned manufacturing firms.

In light of the reasons identified in previous studies on cross-border investment between Hong Kong and Guangdong for Guangdong's "most-favored-destination" status in the eyes of Hong Kong's manufacturers (see Section 2, below), relocation out of Guangdong is clearly a sub-optimal choice. Rather, the prevailing sentiment, as expressed by leaders of Hong Kong's manufacturing associations, is that the substantial costs associated with relocation as well as increased operating costs in the new region effectively mean that relocation out of Guangdong and closing down are not markedly different choices—in light of the challenging market and business conditions, the two choices in fact more or less converge on the same outcome. Our survey data confirm the view that rising cost is the primary reason for a firm's decision to close down or move out of Guangdong, while attractive conditions in other locations or business expansion are the least important reasons (Figure 1).

[Insert Figure 1 here]

We tested this relationship (between, on the one hand, innovation strategies and, on the other hand, the decision to stay /relocate /cease operations altogether) by conducting an innovation survey, administered from March to September 2008, to 492 Hong Kong firms with manufacturing operations in Guangdong. The survey instrument was adapted from the Fourth European Community Innovation Survey (CIS-4), which itself conforms to the Organization for Economic Co-operation and Development's (OECD) Oslo Manual and provides the analytical framework for our study.

The remainder of the paper is structured as follows. In sections 2 and 3 we review past studies on cross-border investment between Hong Kong and Guangdong and the impact of innovative activities on firm survival and relocation. Section 4 introduces the survey and the data. Section 5 presents our econometric analysis and results. Section 6 concludes the paper, suggesting some policy implications.

2. Cross-border Investment Between Hong Kong and Guangdong

The roots of Hong Kong manufacturing can be traced to the opportunistic exploitation of a geographic area by Mainland Chinese immigrants, particularly textile barons from Shanghai (fleeing the Communist regime), who transferred start-up capital and managerial expertise to the territory (Wong, 1988; Hollows, 1999; Lau & Green 2001). Over time, however, as Hong Kong manufacturers felt the pressure of rising costs in the 1970s, they found an escape route for their manufacturing industries in the opening-up of Mainland China, particularly Guangdong, that began in 1979 (leading to cheaper land and labor resource costs; Yu 1998: 906; Baark & Sharif 2006).

Feenstra and Hanson (2004) contended that Hong Kong import and export firms with manufacturing-related operations enjoyed an information advantage when pursuing trade between Mainland China and the rest of the world by specializing in finding Mainland Chinese producers who could meet foreign quality standards and in locating buyers for Mainland Chinese goods. Naughton (1999) suggested that Hong Kong firms enjoyed a similar advantage in "property rights arbitrage": They used their intimate familiarity with business conditions in Mainland China and the security of property rights in Hong Kong to broker deals with agents who sought access to Mainland China's market and were wary of the security of its property rights regime.

Lam and Lee (1992: 109) remarked that Hong Kong's firms succeeded by seeking out global opportunities (employing a kind of "guerilla force" strategy) and rapidly exploiting them through their extensive production networks in Guangdong.

Although Guangdong is adjacent to Hong Kong, geographical proximity per se is not the only advantage Hong Kong as a business partner with Guangdong. In addition, ethnic (i.e., cultural and linguistic) familiarity, reinforced through investment and encouraged by national, provincial, and local policies, has been the more important feature attracting Hong Kong firms to Guangdong (Womack & Zhao, 1994; Yu 2005). It is the combination of these factors that has made Guangdong the preferred destination for Hong Kong firms engaged in manufacturing on the Mainland. Hong Kong offers those in Guangdong a model of how to be both Chinese and modern, a model that many in Guangdong adopt with relish (Smart & Smart, 1998, 1999).

Despite an extensive body of literature on economic linkages and cross-border investment between Mainland China and Hong Kong, very few studies—including two undertaken by the Federation of Hong Kong Industries (2003, 2007) and another by Huang and Sharif (2009)—focus on the innovation activities of Hong Kong-owned manufacturing firms in Guangdong. Even fewer studies have linked the innovation patterns of these Guangdong-based, Hong Kong-owned manufacturing firms to their survival and relocation decisions. Because this activity has helped to forge strong economic ties between Mainland China and Hong Kong and transform the region into a manufacturing powerhouse in Southern China, this is a noteworthy gap in the literature. This study attempts to fill this gap by surveying Hong Kong-owned manufacturing firms in Guangdong to analyze their innovation and business strategies and to investigate the extent to which innovation affects survival and relocation.

3. Innovation, Firm Survival and Relocation

The view that innovation plays a key role in firm survival owes much to Schumpeter (1942: 84). This view has been endorsed more recently by Liemt (1992: 9), who argues that, in view of the growing technological intensiveness of production, innovation constitutes a clear competitive advantage, and Baumol (2002: 1), who observes that "innovative activity . . . becomes mandatory, a life-and-death matter for the firm . . . innovation has replaced price as the name of the game." Lazonick (2004: 273) argues that, at the national level, too, economic development rests on firm capacity to innovate by offering goods and services that elevate quality and lower costs. Defined as such, innovation makes it possible to improve the economic position of already established firms. Interest in innovation has spawned many studies of firm survival and industry dynamics related to innovative activity (cf. Audretsch, 1991, 1995; Agarwal & Gort 2002; Klepper & Simons 1997). Such studies suggest that innovation is the essence of firm survival—for new as well as established firms—since only firms that innovate successfully can establish and maintain a competitive advantage in the marketplace (Bruderl et al. 1992). Christensen et al. (1998) showed that the combination of technological and market strategies is an important predictor of firm survival, while Cefis and Marsili (2005) found an *innovation premium* in virtue of which the expected survival time of an innovative firm—be it new or established—is about 11 percent higher than that of a non-innovative firm.

Additional studies have found that innovation may increase the chances of firm survival by providing successful niche strategies. Technological change threatens established firms (Utterback & Abernathy 1975, Gort & Kelpper 1982), but innovation activity enables such firms to deal with emerging or "disruptive"

technologies while continuously improving existing capabilities (Banbury & Mitchell 1995; Christensen 1997).

Relocation provides an additional survival strategy and is therefore one of the ways in which firms weather challenging environmental and business conditions. Two streams in the economic geography literature—location theory (focusing on "pull" factors, or the attractiveness of a region) and relocation theory (which additionally considers "push" factors or factors that trigger relocation)—are most relevant here. The neo-classical approach to firm relocation focuses on cost-minimization or profit-maximization, employing the concept of "spatial margins to profitability" in order to differentiate between profitable and unprofitable locations, with an emphasis on pull factors. However, in reality, because relocation is usually associated with significant cost, and capital inertia discourages firms from moving out of established locations, firms are unlikely to relocate so long as they continue to profit. For this reason, a behavioral approach adds to the neo-classical view by accounting for the internal dynamics of firms in the context of imperfect information, uncertainty, and bounded rationality (Cox & Golledge 1981; Benoit 1995). This approach seeks to understand the actual behavior of entrepreneurs, and focuses on push factors: namely, the decision-making process that triggers the need to relocate.

Yet a third framework within which to conceptualize firm relocation is the institutional approach, which emphasizes the social and cultural context in which firm behavior is embedded (Martin 1999). On this approach, a firm's interaction with its environment in a regional innovation system (characterized by the presence/absence of linkages between actors in a system, as well as the strength of those linkages) or in an industrial district (Hayter 1997) determines the decision to relocate. Contrasting with the neo-classical approach, according to the institutional approach governments

understandably occupy a significantly more important role. Oukarfi and Basle (2009) found that companies involved in R&D are not likely to be enticed by public financial incentives for business relocation.

Hong Kong-owned manufacturing firms found that Guangdong not only offered them competitive advantages such as the benefits associated with Special Economic Zones (SEZs), general incentives for the development of export-driven firms, and so on, but also cultural and linguistic familiarity—through geographically bounded ethnic affinities—that is exceedingly difficult for other provinces in Mainland China to replicate. Each of the three approaches discussed above indicates how difficult relocation out of Guangdong might be in light of the weak pull factors characterizing other provincial economies in Mainland China.

In this paper we add a valuable perspective on economic integration in a region of rapid industrialization and growing innovation linkages to both these streams in the literature with our focus on Hong Kong-owned manufacturing firms in Guangdong. Using the CIS-4 survey questionnaire, we link the odds of surviving in and relocating out of a host region (here, Guangdong) to innovativeness and R&D and collaborative innovation activities on the part of foreign firms (here, Hong Kong-owned manufacturing firms in Mainland China). We believe that such activities indicate the competitiveness or integration of foreign-invested firms with respect to a local economy, as we demonstrate the extent to which such integration determines firm survival rates and relocation decisions.

4. Survey and Data

To study the effects of innovation strategies adopted by Hong Kong-owned manufacturing firms in Guangdong on survival or relocation, we conducted an innovation survey by using the questionnaire of the Fourth European Community Innovation Survey (CIS-4).[4] We encountered enormous difficulty in so doing because there is no available registry of Hong Kong-owned manufacturing firms in Guangdong. It is therefore impossible to conduct a random sampling of the population, let alone employ more sophisticated stratified sampling techniques. Moreover, it is difficult to convince Hong Kong companies to disclose sensitive information such as annual turnover, employment numbers, and R&D expenditures in a privately run survey. Nevertheless, with the assistance of the Chinese Manufacturers' Association (CMA) of Hong Kong, we surveyed the members of the Association (as well as other firms) between March and September 2008.

Established in 1934, the CMA is one of the oldest and most representative industrial associations in Hong Kong, with over 3,700 member-companies from various industry and trade sectors. Ordinary CMA members either are registered as factories in Hong Kong or operate factories outside of Hong Kong. The directory provided detailed information, including every company's contacts and major product lines as well as ownership/organization status, which greatly assisted our identification of target companies. We selected 2,300 companies from the list that operated both offices in Hong Kong and manufacturing facilities in Guangdong. To broaden the sampling frame, we also used personal networks to identify an additional 870 Hong Kong firms with manufacturing facilities in Guangdong. The sampling frame therefore ultimately comprised 3,170 Hong Kong firms with ownership of manufacturing facilities in Guangdong. Through phone-based and face-to-face

interviews, we collected 492 valid questionnaires from these firms. The response rate was 15 percent. All survey respondents were required to state the addresses of their offices in Hong Kong and their manufacturing facilities in Guangdong, to verify the authenticity of the responses.

With 98 percent of firms in Hong Kong classified as small or-medium-sized enterprises (SMEs), senior management not only centralizes decision-making when deploying design and productive resources for new product lines, but also manages all product development processes (Berger & Lester, 1997; Enright et al., 1997). For this reason, the targeted respondents most likely to be knowledgeable enough to be able to fill out the questionnaires in this study were presidents, general managers, or other senior managers. Indeed, 86 percent of the respondents were high-ranking managers whose titles were "manager," "director," "CEO," "member of the board," and so on.

Following the CIS-4 questionnaire pattern, the firms were asked questions about product and process innovation, innovation activities and expenditures, ongoing and abandoned innovation activities, sources of information and co-operation related to innovation activities, intellectual property rights, organizational and marketing innovations, and basic economic information. We added two additional questions, which were used to collect information about R&D or collaborative innovation activities in Mainland China and potential plans for moving manufacturing operations out of Guangdong. These two additional questions were devised and pilot-tested after discussions with senior industry managers.

Seventy-five percent of the firms in our sample fall into the manufacturing sector and 11 percent belong to the wholesale, retail-import/export trade, and restaurant-hotel sectors (Table 1). A further breakdown of the manufacturing firms shows that the top five manufacturing sectors, to which more than half of the firms in

the sample belong, comprise wearing apparel, textiles, plastic products, fabricated metal products, and electronic parts and components (Table 2). About half of the surveyed firms in our sample employed more than 250 staff members in Hong Kong and Guangdong combined (Table 3). These are labor-intensive operations, reflecting the motivation on the part of Hong Kong-owned manufacturing firms to move and expand their manufacturing operations to Guangdong to take advantage of the low cost of labor and land there.

[Insert Table 1 here]
[Insert Table 2 here]
[Insert Table 3 here]

In order to confirm that our sample was representative of the target population, we identified two bodies of evidence by reference to which we evaluated the quality of our survey exercise. According to both sets of evidence and based on sectoral distributions, we concluded that our survey exercise is representative. The first set of evidence, which is similar to ours, consists of two survey studies sponsored by the Federation of Hong Kong Industries that were conducted in the periods of 2002–2003 and 2005–2006, which resulted in two reports published under the titles "Made in PRD—The Changing Face of HK Manufacturers" and "Made in PRD—Challenges and Opportunities for HK Industry," respectively (Federation of Hong Kong, 2003 and 2007). In the 2005–2006 study, the survey was conducted by the Guangdong Bureau of Statistics. In that survey, 5,030 Hong Kong-owned manufacturing firms and Guangdong domestic companies whose shares were partially held by Hong Kong-owned manufacturing firms were contacted. The response rate was 75 percent. The shares of the top 10 sectors measured by the number of firms in the survey sample are very similar to the corresponding shares in our sample (Table 2).

The second reference point is the *Report on the 2007 Annual Survey of Industrial Production* published by the Census and Statistics Department of the Hong Kong government (Census and Statistics Department, 2007). According to the Census and Statistics Department, manufacturing establishments in Hong Kong can be classified into two categories: manufacturing firms and import/export firms that use subcontractors in Mainland China, including their manufacturing-related technical support services. The former accounted for 44 percent of all establishments engaged in manufacturing, while the latter accounted for 56 percent (Census and Statistics Department, 2007, Table 2). This information explains why, in our sample of Hong Kong-owned firms with manufacturing activities in Guangdong, 11 percent fall into the import/export sector.

To further confirm the appropriateness of the samples, we also conducted t-tests to verify that there was no statistically significant difference between the samples obtained from the CMA directory and those obtained from our personal network in terms of company profile, modes of innovation, innovation activities, and turnover. We also conducted a test to determine whether statistically significant differences existed between early and late respondents in terms of variables relevant to the research hypotheses (Armstron & Overton, 1977). The average values of items from the first 10 percent of the respondents were compared with those from the last 10 percent, using t-tests. The results indicated that the means for the items across the two groups are not statistically significantly different.

5. Model and Econometric Analyses

5.1 Baseline model

The central research question in this study is whether innovation activities undertaken by Hong Kong-owned manufacturing firms would help them survive and remain in Guangdong's the challenging market environment. We therefore carried out our analysis based on analyzing the following baseline Probit model:

(1) $y^* = x\beta + \varepsilon$, $y = 1$ if $y^* > 0$, 0 otherwise,

where y^* is a latent variable, which is not observed. Instead, we observe only y .

In equation (1), the dependent variable is closing down or moving out of Guangdong, which is a binary variable. It indicates whether a firm is expected to cut back its manufacturing operations in Guangdong, considered as a proportion of its total manufacturing operations in Mainland China, in the two years following the survey (i.e., 2009–2010). As discussed in Section 1 (Figure 1), it is noteworthy that firms move their operations out of Guangdong primarily to ensure their survival as viable business entities, not because of the intrinsic attractiveness of other locations. The key explanatory variables include new product share and R&D or innovation collaboration in Mainland China, which are proxies for innovation activities on the part of Hong Kong-owned manufacturing firms. New product share is a censored variable whose value ranges from 0 to 100. It is defined as the percentage of a firm's total turnover in 2007 in new-to-market and new-to-firm products. R&D or innovation collaboration in Mainland China is a binary variable that is constructed on the basis of "yes" or "no" answers given by firms when asked whether or not they had undertaken R&D or innovation collaboration in Mainland China during 2006–2007. Because these two key explanatory variables are highly correlated, they enter regressions separately.

If a Hong Kong-owned manufacturing firm received public financial support for its innovation activities from the governments of Hong Kong, Guangdong, or

Mainland China, it would probably choose not to relocate its business elsewhere. We tested this hypothesis by adding two corresponding dummy (control) variables into the equation. We also added seven sector dummies to control for the presence of firms in the apparel, textiles, plastic products, fabricated metal products, electronic parts and components, import/export, and business service sectors. Firms belonging to these seven sectors account for over 5 percent of the total sample share. The definitions of all variables are presented in Table 4.

[Insert Table 4 here]

The estimation of the baseline model shows that innovation activities are indeed associated with decisions not to relocate on the part of Hong Kong-owned manufacturing firms in Guangdong (columns 1 and 4 in Table 5). The marginal effects of the two innovation proxies are statistically significant and negative. An increase of one percent in new-to-market and new-to-firm product sales as a percentage of total sales will decrease the probability of closing down or moving out of Guangdong by 0.0018 (0.18 percent). Engaging in R&D or innovation collaboration in Mainland China will decrease the probability by 0.13 (13 percent). However, the probability of closing down or moving out of Guangdong for a firm in the textiles sector, in comparison with its counterparts in the reference industry sectors (all sectors not covered by the seven sector dummies), is 0.24 (24 percent) higher. Because textiles is a labor-intensive industry, it would be most heavily affected by the challenging market and environmental pressures in Guangdong, such as rising costs, a stronger Yuan, escalating raw materials prices, and so on. In contrast, for a firm in the business service sector, the probability is 0.27–0.28 lower.

Financial support for innovation from the governments of Hong Kong, Guangdong or Mainland China has no material impact on relocation decisions.

[Insert Table 5 here]

5.2 Endogeneity bias in the baseline model

A careful examination of the two innovation proxies reveals possible endogeneity in the baseline model. A firm might decide not to engage in innovation or R&D or collaborative innovation activities in Mainland China while facing market and environmental pressures because innovative activities are costly and risky. In other words, the closing-down-or-moving-out decision and the decision about innovation might be jointly determined, which would lead to endogeneity bias. We are able, however, to rule out—to some extent—reverse causality running from the closing-down-or-moving-out decision to the innovation decision because the former (dependent variable) depends on a firm's plans for the 2009–2010 period, while the latter (innovation proxies) cover the observation period of 2006–2007, and the business environment in Guangdong began souring in mid-2007. We nevertheless suspect the presence of endogeneity provided that our data is cross-sectional.

To correct for such potential endogeneity bias, we estimate an instrumental variable Probit model below:

(2) $y_1^* = y_2\beta + x_1\gamma + u$, $y_1 = 1$ if $y_1^* > 0$, 0 otherwise,

(3) $y_2 = x_1\lambda + x_2\varphi + v$,

(4) corr $(u,v) = \rho$,

where (u,v) has a zero mean, bivariate normal distribution and is independent of x_1 and x_2, y_1^* is a latent variable, y_2 is endogenous in Equation (2), x_1 are the

exogenous independent variables, and x_2 are instrumental variables. The model is estimated by conditional maximum likelihood (Stata, 2007: 21-24). Whether y_2 is exogenous can be tested with the null hypothesis $\rho=0$ (Wooldridge, 2002: 472-477). If $\rho=0$, u, and v are independent and there is no endogeneity problem.

The qualified instrumental variables need to be highly correlated with endogenous variables y_2, but not correlated with the residual of the structural function (Equation 2) u. We choose the importance to a firm of scientific journals and trade/technical publications as a source of information for innovation as our instrumental variable. The value of the variable equals 3 if scientific journals and trade/technical publications are ranked "high" in importance by a firm. The value equals 2 if journals and publications are ranked medium in importance, 1 if they are ranked low in importance, and 0 if they are not relevant. Firms with greater new product share or that engage in R&D or innovation collaboration in Mainland China should source more of the information they rely on from scientific journals and trade/technical publications than their counterparts do. This is confirmed by the results of a first-stage regression of the instrumental variable Probit model (columns 2 and 3 in Table 6). However, the importance of scientific journals and trade/technical publications does not contribute to a firm's closing-down-or-relocation decision, nor does such a decision affect its perception of the importance of journals and publications as sources of information for innovation. As a result, the instrumental variable is not correlated with the residual u.[5]

[Insert Table 6 here]

It is difficult to implement the instrumental variable Probit model (equations 2–4) vis-à-vis our data because new product share is a censored variable and R&D or

innovation collaboration in Mainland China is a binary variable. This violates the assumption that y_2 given x_1 and x_2 is normal, because *v* is normally distributed. Below we undertake a separate analysis for each potential endogenous variable.

5.2.1 New product share

It is extremely difficult to estimate an instrumental variable Probit model with a censored endogenous variable. We are not able to estimate such a model directly, but we are able to replace the original censored endogenous variable with a new continuous variable that can also measure the ratio of new product sales to total sales. We consider regressing new product share on firm size, firm growth, and the seven sector dummies with the following Tobit model,

(5) $y = 0$, if $y^* \le 0$

(6) $y = y^*$, if $0 < y^* < 100$

(7) $y = 100$, if $y^* \ge 100$

(8) $y^* = x\beta + \varepsilon$

where y^* is an unobserved latent variable and *y* is an observed variable. In contrast to new product share, which is censored at values of 0 and 100, the Tobit model's linear prediction (latent variable) y^* is normal. In addition, *y* and y^* both indicate share of new product sales in total sales. We can replace the original new product share with its linear prediction in equations (2) and (3) and implement the instrumental variable Probit model.

Compared with small firms, large firms are better able to generate funds internally or to raise capital from external sources with which to invest in innovation projects, and larger firms benefit from economies of scale when undertaking

innovation activity. Empirical research has consistently found that the probability that a firm pursues innovation increases with firm size (Veugelers & Cassiman, 1999; Bartoloni & Baussola, 2001; Mohnen & Dagenais, 2002; Rammer et al., 2009). We thus include firm size and firm growth as explanatory variables in the Tobit model (Equations 5–8). Firm size is defined as a logarithm of number of employees in 2007. Firm growth represents increasing or decreasing number of employees from 2006 to 2007 divided by number of employees in 2006. The coefficients of both variables are statistically significant and positive in the model (column 1, Table 6).

The marginal effects of the predicted new product share are statistically significant and negative in the baseline Probit model (column 2 in Table 5). Exogeneity in the instrumental variable Probit Model (column 3 in Table 5) cannot be rejected by our sample because the null hypothesis, $\rho=0$, is not rejected. Although we did not perform this test on the original new product share, given the underlying economic meaning of the linear prediction of new product share from the Tobit model, it suffices for the purpose of testing endogeneity of the innovation proxy in the structural function that models firm survival and the relocation decision. The result to a great extent relieves our worry that the estimation of new product share might be biased by endogeneity.

5.2.2 R&D or innovation collaboration in Mainland China

Because R&D or innovation collaboration in Mainland China is a binary variable, we are able to test its exogeneity using the following bivariate Probit model (Wooldridge, 2002: 477-478):

(9) $y_1^* = y_2\beta + x_1\gamma + u$, $y_1 = 1$ if $y_1^* > 0$, 0 otherwise,

(10) $y_2^* = x_1\lambda + x_2\varphi + v$, $y_2 = 1$ if $y_2^* > 0$, 0 otherwise,

(11) corr $(u,v) = \rho$,

where (u,v) has a zero mean, bivariate normal distribution, is independent of x_1 and x_2, and each has unit variance. This bivariate Probit model can be understood by comparison to a Seemingly Unrelated Regressions model, which is used to test the survival-or-relocation decision and innovation decision jointly. If the null hypothesis of $\rho=0$ is not rejected, which means that the two decisions are not correlated, the two Probit equations (equations 9 and 10) can be estimated separately, and the log likelihood of the bivariate Probit model equals the sum of the log likelihoods of the two univariate Probit models. In this case, y_2 is exogenous. In estimating the bivariate Probit model using our data, we performed a likelihood-ratio test and the results show that the null hypothesis of $\rho=0$ cannot be rejected (column 5 in Table 5). Therefore, there is insufficient information in the sample to reject the hypothesis that R&D or innovation collaboration in Mainland China is exogenous in the model.

In summary, the econometric analyses of the surveyed data reveal that Hong Kong-owned manufacturing firms in Guangdong whose business strategy included either greater new product share or R&D or innovation collaboration in Mainland China were more likely to weather the challenging market and environmental pressures. R&D and, more broadly, innovation are costly and risky activities. In order to undertake R&D or innovation, firms must obtain internal sources of finance or raise capital from external sources to purchase laboratory equipment and advanced instruments and to hire qualified personnel. Firms that depend on a greater share of new product sales as a percentage of total sales or undertake R&D or innovation collaboration activities in Mainland China are presumably more competitive and have sufficient resources to absorb the costs of R&D or innovation collaboration over time. In addition, such firms identify and collaborate with partners in Mainland China,

which means that they have built up networks locally or are more deeply integrated into Mainland China's innovation system. For such firms, the odds of survival in Guangdong, and of not feeling pressure to relocate elsewhere, would thus be more favorable.

Financial support for innovation from the governments of Hong Kong, Guangdong, or Mainland China has no material impact on survival-or-relocation decisions and, surprisingly, almost no influence on either new product share or the decision to engage in R&D or innovation cooperation in Mainland China (with one exception in the regression of column 3, Table 6). Perhaps most of the innovation policies in the region, particularly those enacted by the Guangdong or Mainland central governments, benefited primarily state-owned enterprises or large companies, or targeted R&D activities in high-technology sectors, but overlooked innovative activities in the low- and medium-technology industries. Because a significant proportion of Hong Kong-owned manufacturing firms in Guangdong operate in labor-intensive low- and medium-tech sectors, government sources provide little public financial support for innovation activities in these firms.

5.4 R&D and innovation collaboration on the part of Hong Kong-owned manufacturing firms in Guangdong

The econometric analysis of the surveyed data shows that if Hong Kong-owned manufacturing firms are more strongly committed to the Mainland market, or more deeply integrated into Mainland China's innovation system, as demonstrated by their R&D or collaborative innovation activities in Mainland China, they are unlikely to relocate their businesses. As shown by the data, "low cost" and being "close to the market and customers" are the two primary motivations driving Hong Kong-owned

manufacturing firms to undertake R&D or collaborative innovation activities in Mainland China (Figure 2). Over 60 percent of the respondents regard "low cost" and about 35 percent consider being "close to the market and customer" as highly important reasons for carrying out R&D or collaborative innovation activities in Mainland China.

This finding contradicts the results of a similar survey of 250 multinationals from the US and Western Europe that was intended to examine their motivations for offshoring R&D (Thursby & Thursby, 2006). Thursby and Thursby found that, among multinational companies that locate their R&D activities in emerging economies, the most important attraction was the growth potential in the market, followed by the quality of R&D personnel. Tied for the third-most important reason were costs (net of tax breaks), the expertise of available university faculty, and the ease of collaborating with universities. Our explanation for this discrepancy is that firms surveyed by Thursby and Thursby are large multinationals with large-scale R&D investments and strong technological capabilities. Cost reduction is not their primary interest. On the contrary, the competitiveness of Hong Kong-owned manufacturing firms in Guangdong is not based on advanced technology that they are capable of inventing or developing but on their competence in manufacturing with a thin profit margin in Mainland China. For Hong Kong-owned manufacturing firms in Guangdong, cost reduction and better knowledge of markets and customers are keys to survival and success. It is important to differentiate these two types of multinationals and their diverse motivations for offshoring R&D activities to emerging economies.

[Insert Figure 2 here]

An analysis of the types of partners that Hong Kong-owned manufacturing firms chose for collaborative innovation also supports the above finding pertaining to innovation and the relocation decision (Figure 3). Regarding collaborating with partners from their own enterprise groups, suppliers, clients, and competitors, Hong Kong-owned manufacturing firms do not discriminate among partners from distinct locations. Almost an equal percentage of the partners of the four types are from Guangdong, other provinces in Mainland China, or Hong Kong. However, when considering collaborating with consultants, universities, and public research institutions, a much higher percentage of Hong Kong-owned manufacturing firms choose partners located in Hong Kong. This finding indicates that universities, public research institutions and, to a greater extent, consultants in Mainland China are not regarded as reliable sources of knowledge for Hong Kong-owned manufacturing firms in Guangdong. Similarly, "close to the knowledge source" is the weakest motivation for Hong Kong-owned manufacturing firms to undertake R&D or collaborative innovation activities in Mainland China.

[Insert Figure 3 here]

6. Conclusions and Discussion

Based on a survey of 492 Hong Kong-owned manufacturing firms in Guangdong administered from March to September 2008, this paper investigates the innovation strategies and decisions of these firms with respect to relocating from Guangdong or ceasing operations altogether. Firms that choose the latter option judge that moving to neighboring provinces is, in actuality, not a viable option insofar as neighboring provinces do not offer the geographical and cultural affinities that make Guangdong attractive to Hong Kong firms in the first place. The study makes a

unique contribution to the literature in that there have been no previous scholarly studies on such decisions on the part of Hong Kong-owned manufacturing firms. Indeed, previous research on Hong Kong-owned manufacturing firms clearly identifies the reasons for these firms' success (lower factor input costs) but has not considered survival, relocation, or innovation strategies, much less strategies for facing challenging business conditions. Admittedly, the challenges faced by Hong Kong-owned manufacturing firms in Guangdong are themselves of relatively recent origin (since 2007), a factor that may explain the absence of such studies.

Additionally, as other coastal regions in Mainland China increasingly upgrade their regional economies, this research provides lessons for understanding the relocation of manufacturing within China, as manufacturing activity moves inland to Mainland China's hinterland provinces (such as Jiangxi, Hunan, Shanxi, Guizhou, Henan, Anhui, and Hubei), in which the central government is actively promoting manufacturing activity, not only from the Pearl River Delta region, but also from the Yangtze River Delta region. Such lessons apply both at the firm level and at the provincial governmental level, provided that such governments are indeed keen to exploit this trend in some way (which depends, understandably, on whether the policymakers come from the region out of which manufacturing is moving or from the region into which it is moving).

By employing the CIS-4 survey questionnaire, this research shows that Hong Kong-owned manufacturing firms in Guangdong whose market strategies aim at a higher share in new product sales as a percentage of total sales or who engage in R&D or collaborative innovation activities with other actors—such as universities, public research institutions, etc.—in the innovation system that are located in Mainland China are more likely to weather the challenging market and environmental pressures

imposed upon them. Such firms are less likely to close down or to move their business operations out of Guangdong.

Furthermore, the survey data shows that "low cost" and "close to the market and customers" are the two primary motivations for Hong Kong-owned manufacturing firms in Guangdong to undertake R&D or collaborative innovation activities in Mainland China. Finally, universities, public research institutions, and consultants in Mainland China are not sources of knowledge for Hong Kong-owned manufacturing firms in Guangdong.

This research yields policy implications for both the Guangdong provincial government and the Hong Kong Special Administrative Region government. While Steinfeld (2004) points to—at the government level—the impediments created by legacies of macro-level Chinese reform style, bottlenecks in the institutional reform process, and inconsistencies in central government policies in China's industrialization, this research identifies by contrast areas that provincial authorities would do well to target for improvement.

In particular, the research points to the need, first, to strengthen links between universities and public research institutes and industry, especially given how much public funding is devoted to the development of both these actors in both areas. Not only would this allow Hong Kong-owned manufacturing companies to survive in Guangdong (ensuring the sustainability of Hong Kong's manufacturing-related service-based economy), but it would also increase the likelihood that these companies—operating mostly in labor-intensive low- and medium-tech sectors—would move up the value chain and engage in innovative activities in relation to the products they manufacture (a major goal for Guangdong's government in instigating the new policy measures). Strengthening links between actors in an innovation system

is a particularly important lesson for emerging economies around the world. Where much attention may be devoted to the development of strong actors—universities, public research institutes, industry associations, etc.—within an economy's innovation system, simply pouring in resources dedicated to the development of such strong actors alone is insufficient. Rather, it is just as or perhaps more important to ensure or find ways of ensuring that, regardless of the level of maturity of the actors within an innovation system, such actors forge strong links with one another. Within any given innovation system, isolated islands of strength are of little value unless their contributions permeate the broader innovation system in any given economy.

Second, considering the issues more broadly, this research suggests that it may indeed make sense for policymakers on both sides of the Guangdong/Hong Kong border (and, by extension, policymakers governing activity in other developing regions) to seriously consider the viability of devoting resources to the development of a genuinely regional innovation system, whereby the two regions' strengths and capacities are combined (if the goals of both Hong Kong and Guangdong are to be achieved). This type of integration is important in a region featuring rapid development and growing innovation linkages. Insofar as the results of our research have shown that government financial support from Hong Kong, Guangdong, or Mainland China has no impact on a firm's decision to engage in innovation, and only a weak impact on its decision to carry out R&D or innovation collaboration in Mainland China, it follows that it would be wiser for policymakers at any level of government to allocate resources not only exclusively to firms in high-tech sectors in support of their R&D activities, but also to make sure these allocations support broader innovation activities such as acquiring advanced machinery and equipment, implementing advanced training programs, and purchasing or licensing patents or

other knowledge-based resources, particularly in the low- and medium-tech sectors. Attention should be also paid to improving the broader institutional framework and organizational environment of the region as well as encouraging the strengthening of linkages among the various components. Not only would this would allow Hong Kong-owned manufacturing firms to survive and thrive in Guangdong, becoming more deeply integrated into Guangdong's innovation system by taking advantage of the strengths of Guangdong's innovation system, but it would also allow Guangdong's firms to take advantage of the strengths offered by Hong Kong's innovation system (especially the higher education institutes) in their attempts to move up the value-added chain.

Such development of innovative capacity, if executed intelligently, could lead to the emergence of an even stronger region in which manufacturing firms as well as service firms are both deeply integrated into and are able to exploit the strengths of the regional innovation system irrespective of location—whether in Guangdong or Hong Kong—in which those strengths may be found. With their strengths combined, such manufacturing and service firms would be more likely to develop intellectual assets, production skills, modes of serving customers, and products that can be understood as proprietary assets that are irreproducible by other firms in their immediate environment—an achievement that both Hong Kong and Guangdong's policymakers would warmly welcome.

References

Agarwal, R., & Gort, M. (2002) Products and firm life cycles and firm survival. *American Economic Review 92*(2), 184–90.

Armstron, J.S., & Overton, T.S. (1977) Estimating non-response bias in mail surveys. *Journal of Marketing Research 16*(3), 396–402.

Audretsch, D. B. (1991) New firm survival and the technology regime. *Review of Economics and Statistics 73*(3), 441–450.

Audretsch, D. B., & NetLibrary Inc. (1995) *Innovation and industry evolution*. Cambridge, Mass.: MIT Press.

Baark, E., & Sharif, N. (2006) From trade hub to innovation hub: The role of Hong Kong's innovation system in linking China to global markets. *Innovation: Management, Policy and Practice, 8*(1-2), 193–209.

Banbury, C. M., & Mitchell, W. (1995) The effect of introducing important incremental innovations on market share and business survival. *Strategic Management Journal, 16*(Special Issue), 161–182.

Bartoloni, E., & Baussola, M. (2001) The determinants of technology adoption in italian manufacturing industries. *Review of Industrial Organization 19*(3), 305–328.

Baum, C.F., Wiggins, V., Stillman, S. & Schaffer, M. E. (2000) Overid: Stata module to calculate tests of overidentifying restrictions after ivreg, ivreg2, ivprobit, ivtobit, reg3, http://ideas.repec.org/c/boc/bocode/s396802.html#statistics, as of July 20, 2010.

Baumol, W. (2002) *Free market innovation machines: Analyzing the growth miracle of capitalism*. Princeton: Princeton University Press.

Benoit, S. (1995) Local policies to attract mobile investment: a theoretical survey and an application to two sets of local organisations in France. In: P. C. Cheshire & I. R. Gordon (Eds.), *Territorial Competition in an integrating Europe*. Aldershot: Avebury.

Berger, S., & Lester, R. K. (1997) *Made by Hong Kong*. Hong Kong: Oxford University Press.

Brüderl, J., Preisendörfer P., and Ziegler, R. (1992) Survival chances of newly founded business organizations. *American Sociological Review 57*(2), 227–242.

Cefis, E., and O. Marsili. (2005) A matter of life and death: Innovation and firm survival. *Industrial and Corporate Change 14*(6), 1–26.

Census and Statistics Department. (2007) *Report on 2007 Annual survey of industrial production,* www.censtatd.gov.hk as of 10 July 2010.

Christensen, M. C. (1997) *The innovator's dilemma*. Cambridge: Harvard Business School Press.

Christensen, C.M., Suarez, F. F., & Utterback, J. M. (1998) Strategies for survival in fast-changing industries. *Management Science 44*(12), S207–S220.

Cox, K.R., and R.G. Golledge (1981) *Behavioural problems in geography revisited.* New York, N.Y.: Methuen.

Enright, M. J., Scott, E. E., & Dodwell, D. (1997) *The Hong Kong advantage*. Hong Kong; New York: Oxford University Press.

Federation of Hong Kong Industries (2003) *Made in PRD: The changing face of Hong Kong manufacturers*. Hong Kong: Author.

Federation of Hong Kong Industries. (2007) *Made in PRD—Challenges & opportunities for Hong Kong industry*. Hong Kong: Author.

Feenstra, R. C., & Hanson, G. H. (2004) Intermediaries in entrepôt trade: Hong Kong re-exports of Chinese goods. *Journal of Economics and Management Strategy 13*(1), 3–35.
Gort, M., and Klepper, S. (1982) Time paths in the diffusion of product innovations. *Economic Journal 92*(367), 650–53.
Guangdong Statistics Bureau (2009) *Guangdong statistical yearbook 2009*. Beijing: China Statistics Press.
Hayter, R. (1997) *The dynamics of industrial location. The factory, the firm and the production system.* New York: Wiley.
Hollows, J. (1999) Historical trajectories of innovation and competitiveness: Hong Kong firms and their China linkages. *Creativity and Innovation Management Journal 8*(1), 57–63.
Hong Kong Census and Statistics Department. (2007) *Report on 2007 Annual survey of industrial production*. Hong Kong: Author.
Huang, C., & Sharif, N. (2009) Manufacturing dynamics and spillovers: The case of Guangdong Province and Hong Kong, Macau, and Taiwan (HKMT). *Research Policy 38*(5), 813–28.
Klepper, S., and Simons, K. L. (1997) Technological extinctions of industrial firms: An inquiry into their nature and causes. *Industrial and Corporate Change 6*(2), 379–460.
Lam, D. K. K., & Lee, I. (1992) Guerrilla capitalism and the limits of statist theory: comparing the Chinese NICs. In C. Clark & S. Chan (Eds.), *The Evolving Pacific Basin in the global political economy : domestic and international linkages* (pp. 107–124). Boulder, Colo.: Lynne Rienner Publishers.
Lau, H.-F., & Green, S. (2001) The electronics industry: Can manufacturing continue in Hong Kong? *World Economy 24*(8), 1075–1090.
Lazonick, W. (2004) Indigenous innovation and economic development: Lessons from China's leap into the information age. *Industry and Innovation 11*(4), 273–297.
Lee, L. (1992) Amemiya's generalized least squares and tests of overidenfication in simultaneous equation models with qualitative or limited dependent variables. *Econometric Reviews*, *11*(3), 319–328.
Liemt, G. v. (1992) *Industry on the move: Causes and consequences of international relocation in the manufacturing industry*. Geneva: International Labour Office.
Martin, R. (1999) The new 'geographical turn' in economics: some critical reflections. *Cambridge Journal of Economics, 23*(1), 65–91.
Mohnen, P. & Dagenais, M. (2002) Toward an innovatino intensity index: The case of CIS 1 in Denmark and Ireland." In Kleinknecht A, & Mohnen, P. (Eds.), *Innovation and firm performance: Econometric explorations of survey data* (pp. 3–30). New York: Palgrave Macmillan.
Naughton, B. (1999) Between China and the world: Hong Kong's economy before and after 1997," in G. G. Hamilton, (Ed.), *Cosmopolitan Capitalists: Hong Kong and the Chinese Diaspora at the End of the 20th Century*, (pp. 80–99). Seattle, WA: University of Washington Press.
Newey W. K. (1987) efficient estimation of limited dependent variable models with endogenous explanatory variables. *Journal of Econometrics 36*(3), 231–250.
Oukarfi S, & Baslé, M. (2009) Public-sector financial incentives for business relocation and effectiveness measures based on company profile and geographic zone. *The Annals of Regional Science 43*(2), 509–526.

Rammer, C., Czarnitzki, D., & Spielkamp, A. (2009) Innovation success of non-R&D-performers: Substituting technology by management in SMEs. *Small Business Economics 33*(1), 35–58.
Schumpeter, J. A. (1975) *Capitalism, socialism and democracy* (New York: Harper) [orig. pub. 1942].
Smart, A., and Smart, J. (1998) Transnational social networks and negotiated identities in interactions between Hong Kong and China." In *Transnationalism from Below*, M. P. Smith & L. E. Guarnizo (Eds.), (pp. 103–29). New Brunswick and London: Transaction Publishers.
Smart, A., and Smart, J. (1999) Failures and strategies of Hong Kong firms in China: An ethnographic perspective." In *Globalization of Chinese Business Firms*, H. W.C. Yeung & K. Olds, (pp. 244–308). London: Macmillian Press Ltd.
StataCorp. (2007) Stata Statistical Software: Release 10. Reference A-H, College Station, TX: StataCorp LP.
Steinfeld, Edward, S. (2004) China's shallow integration: Networked production and the new challenges for late industrialization. *World Development 32*(11), 1971–1987.
Thursby, J., & Thursby, M. (2006) *Here or there? A survey of factors in multinational R&D location.* The National Academies Press, Washington, DC: The National Academies Press.
Tsang, D. (2008, January 30) Delta factories face more curbs on production. *South China Morning Post*, (pp. B2).
Utterback, J. M. and Abernathy, W. J. (1975) A dynamic model of product and process innovation. *Omega 3*(6), 639–656.
Veugelers R, Cassiman B. (1999) Make and buy in innovation strategies: Evidence from Belgian manufacturing firms. *Research Policy 28*(1), 63-80.
Womack, B., & Zhao, G. (1994) The many worlds of China's provinces: Foreign trade and diversification. In *China deconstructs: Politics, trade and regionalism*, D. S. Goodman & G. Segals. (Eds.), (pp. 131-176). London: Routledge.
Wong, S.-l. (1988) *Emigrant entrepreneurs: Shanghai industrialists in Hong Kong*. Hong Kong, New York: Oxford University Press.
Wooldridge J. M. (2002) *Econometric analysis of cross section and panel data*. MIT Press: Cambridge, Mass.
Yu, T. (1998) Adaptive entrepreneurship and the economic development of Hong Kong. *World Development, 26*(5), 897–911.
Yu, F. (2005) Technological strategies and trajectories of Hong Kong's manufacturing firms. *International Journal of Technology Management, 29*(1-2), 21–39.

Table 1: Distribution of Sample Firms by Sector

Sector	Number of firms	Percentage
Agriculture and Fishing	1	0.2
Manufacturing	361	74.6
Electricity, Gas and Water	8	1.7
Construction	12	2.5
Wholesale, Retail and Import/Export Trades, Restaurants and Hotels	53	11.0
Transport, Storage and Communication	14	2.9
Finance, Insurance, Real Estate and Business Services	32	6.6
Community, Social and Personal Services	3	0.6
Total	484	100

Note:
1. The industry sector codes are not available for 8 of the 492 surveyed firms. Therefore, the total number of firms in this table is 484.

Table 2: Distribution of Sample Firms by Manufacturing Sector

Manufacturing sectors	Number of firms	Sector share as percentage of total (data within parentheses are percentages of number of firms in the sample of the 2005/2006 survey sponsored by the Federation of Hong Kong Industries, 2007) Percentage
Food	6	1.7
Beverage	2	0.6
Wearing apparel	57	15.8 (13.6)
Leather and leather	9	2.5 (7.7)
Footwear	4	1.1
Textiles	36	10.0 (6.4)
Wood and cork products	4	1.1
Furniture and fixtures	10	2.8
Paper and paper products	10	2.8 (3.3)
Printing and publishing	20	5.5 (3.6)
Chemicals	13	3.6 (3.4)
Rubber products	6	1.7
Plastic products	30	8.3 (9)
Non-metallic mineral	6	1.7
Basic metal	9	2.5
Fabricated metal products	25	6.9 (10.5)
Office, accounting and computing machinery	1	0.3
Radio, television & communications equipment and apparatus	7	1.9
Electronic parts and components	40	11.1 (17.4)
Electrical appliances & houseware and electronic toys	16	4.4 (5.4)
Machinery, equipment, apparatus, parts and components	21	5.8
Professional & scientific, measuring & controlling equipment and photographic & optical goods	13	3.6
Manufacturing industries, not elsewhere classified	16	4.4
Total	361	

Table 3: Distribution of Sample Firms by Size

Firm Size (Eurostat's definition)	Number of firms	Percentage share of total sample firms
Small firms (1-49 employees)	79	17
Medium firms (50-249 employees)	148	32
Large firms (250 or more employees)	241	51
Total	468	100
Firm Size (National Statistics Bureau of China's definition)	**Number of firms**	**Percentage share of total sample firms**
Small firms (1-299 employees)	252	54
Medium firms (300-1999 employees)	145	31
Large firms (2000 or more employees)	71	15
Total	468	100

Note:
1. Employment data are available for only 468 among the 492 surveyed firms. Therefore, the total number of firms in this table is 468.

Table 4: List of Variables

Variables	Definition
Closing down or moving out of Guangdong	If a firm expects to close down its manufacturing operations in Guangdong or its manufacturing operations in Guangdong as a proportion of its total manufacturing operations in Mainland China decreases within the next two years after the survey was conducted (2009-2010), the value is 1. Otherwise, 0.
New product share	Percentage of total turnover in 2007 from new-to-market and new-to-firm products.
R&D or innovation collaboration in Mainland China	If a firm carried out R&D activities or collaboration for innovation in Mainland China, the value is 1. Otherwise, 0.
Financial support for innovation from Hong Kong or Guangdong governments	If a firm received public financial support for innovation activities from the Hong Kong or Guangdong authorities, the value is 1. Otherwise, 0.
Financial support for innovation from central government in Mainland China	If a firm received public financial support for innovation activities from the central government in Mainland China, the value is 1. Otherwise, 0.
Firm size	Ln (number of employees in 2007)
Firm growth	Number of employees in 2007-number of employees in 2006)/number of employees in 2006
Importance of scientific journals and trade/technical publications as source of innovation information (instrumental variable)	If scientific journals and trade/technical publications are ranked 'high' in importance, the value equals 3. The value equals 2 if such sources are ranked to be of medium-level importance, 1 if ranked to be of low-level importance, and 0 when they are not relevant to the firm.
Dummy variables for apparel, textiles, plastic products, fabricated metal products, electronic parts and components, import and export, and business service sector	Taking the dummy for the apparel sector as an example, if a firm falls into the sector (industry code 320-322), the value for the apparel sector dummy is 1. Otherwise, 0. The dummy variables for other sectors are defined in a similar fashion.

Note: The industry code is from the Hong Kong Standard Industrial Classification version 1.1, available at http://fec.mofcom.gov.cn/uploadfile/xiangg.pdf.

Table 5: Probit Model, Second Stage of Instrumental Variable Probit Model and Bivariate Probit Model

Independent variables	Dependent variable: Closing down or moving out of Guangdong (binary variable)				
	Probit model on new product share (marginal effects)	Probit model on predicted new product share (marginal effects)	Instrumental variable Probit model on predicted new product share (marginal effects)	Probit model (marginal effects)	Bivariate Probit model (coefficients)
	(1)	(2)	(3)	(4)	(5)
(Predicted) new product share	-.0018(.00085)**	-.0048(.0029)*	-.053(.054)	-	-
R&D or innovation collaboration in Mainland China	-	-	-	-.13(.049)***	-.24(.31)
Financial support for innovation from Hong Kong or Guangdong governments	.0096(.089)	-.0086(.087)	.033(.24)	.016(.089)	-.024(.035)
Financial support for innovation from central government in Mainland China	-.012(.14)	-.017(.14)	.11(.41)	.0039(.14)	-.13(.15)
Apparel sector	.054(.078)	-.00066(.084)	-.53(.74)	.057(.078)	.15(.20)
Textiles sector	.24(.089)***	.21(.092)**	.25(.48)	.24(.089)***	.60(.23)***
Plastic products sector	.091(.098)	.097(.099)	.30(.25)	.080(.098)	.20(.25)
Fabricated metal products sector	.0076(.10)	.057(.11)	.60(.66)	.013(.10)	.010(.28)
Electronic parts and components sector	.11(.089)	.22(.12)*	1.6(1.4)	.12(.089)	.31(.24)
Import and export sector	-.055(.10)	-.12(.10)	-1.1(1.0)	-.051(.10)	-.16(.28)
Business service sector	-.28(.078)***	-.29(.075)***	-1.1(.40)***	-.27(.084)***	-.89(.40)**
ρ	-	-	.34(0.45)	-	-.039(.20)
Number of observations	456	456	456	456	456
Chi-square statistic of Wald test of ρ=0	-	-	.49	-	-
Chi-square statistic of likelihood-ratio test of ρ=0	-	-	-	-	.84

Note: The data between the parentheses are standard deviations. *** denotes significance at the 1% level, ** denotes significance at the 5% level, * denotes significance at the 10% level.

Table 6: Tobit Model, First Stage of the Instrumental Variable Probit Model and Bivariate Probit Model

Independent variable	Dependent variable		
	New product share (censored variable)	Predicted new product share (continuous variable)	R&D or innovation collaboration in Mainland China (binary variable)
	Tobit model (coefficients)	First stage of IV Probit model (coefficients)	Bivariate Probit model (coefficients)
	(1)	(2)	(3)
Importance of scientific journals and trade/technical publications as sources of innovation information (instrumental variable)	-	1.0(.42)**	.57(.072)***
Financial support for innovation from Hong Kong and Guangdong governments	-	.77(1.4)	.39(.24)*
Financial support for innovation from central government in Mainland China	-	3.0(2.2)	.40(.37)
Firm size	2.8(1.7)*	-	-
Firm growth	16(7.4)**	-	-
Apparel sector	-13(11)	-13(1.3)***	-.11(.23)
Textiles sector	-5.1(12)	-6.1(1.5)***	-.085(.25)
Plastic products sector	3.1(13)	1.5(1.6)	-.31(.28)
Fabricated metal products sector	13(13)	11(1.7)***	.18(.29)
Electronic parts and components sector	24(11)**	25(1.4)***	.47(.24)*
Import and export sector	-15(15)	-18(1.7)***	-.14(.30)
Business service sector	-5.5(15)	-4.9(1.9)***	.50(.31)
Number of observations	456	456	456

Note: The data between the parentheses are standard deviations. *** denotes significance at the 1% level, ** denotes significance at the 5% level, * denotes significance at the 10% level.

Figure 1: Percentage of Respondents Assigning a High Degree of Importance to Various Reasons for the Closing-down-or-Moving-out-of-Guangdong Decision

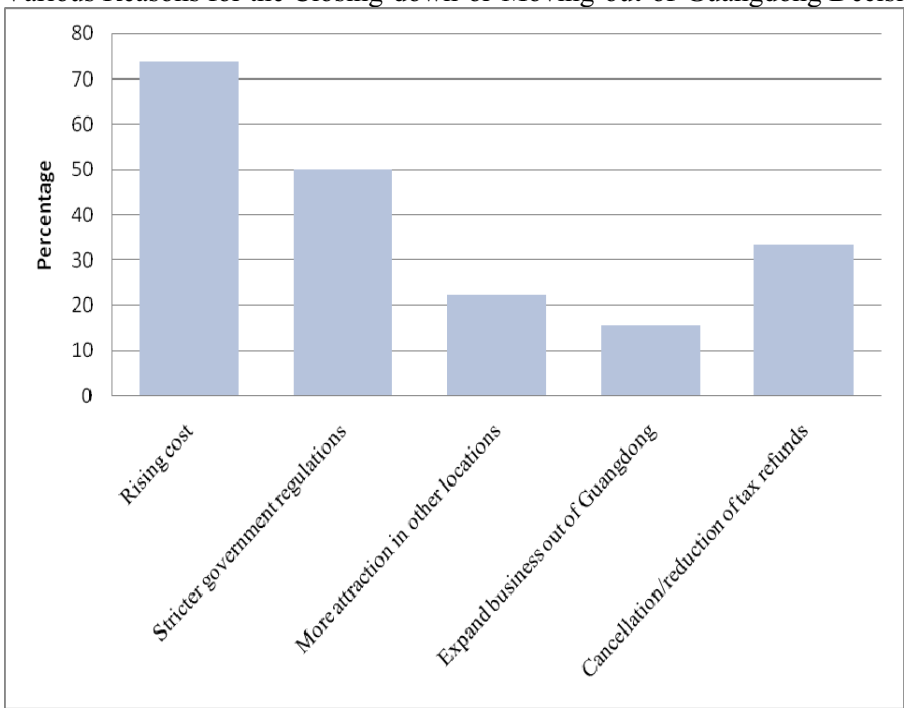


Figure 2: Percentage of Respondents Rating R&D and Cooperation for Innovation Activities in Mainland China with a High Degree of Importance

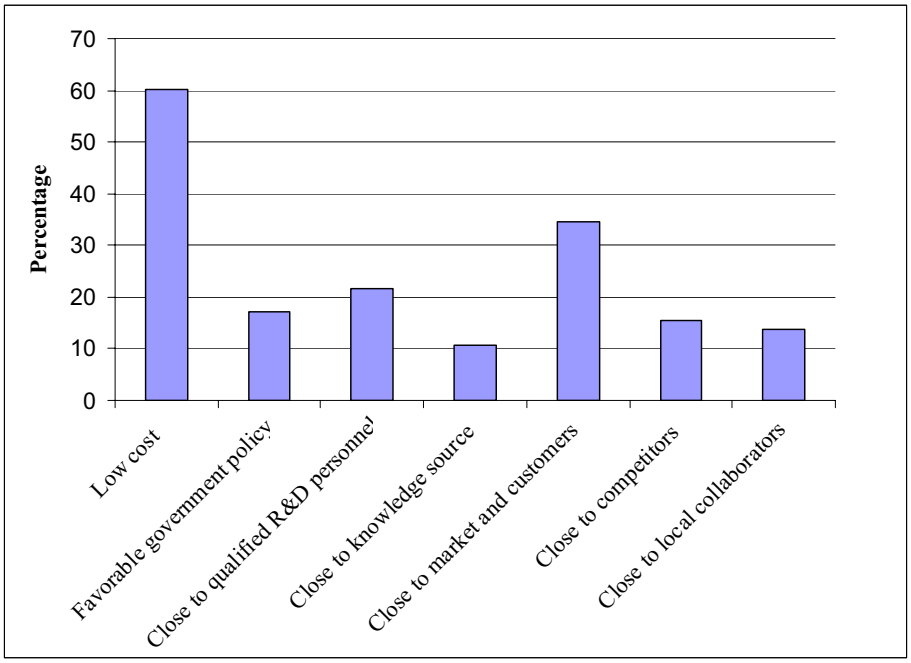
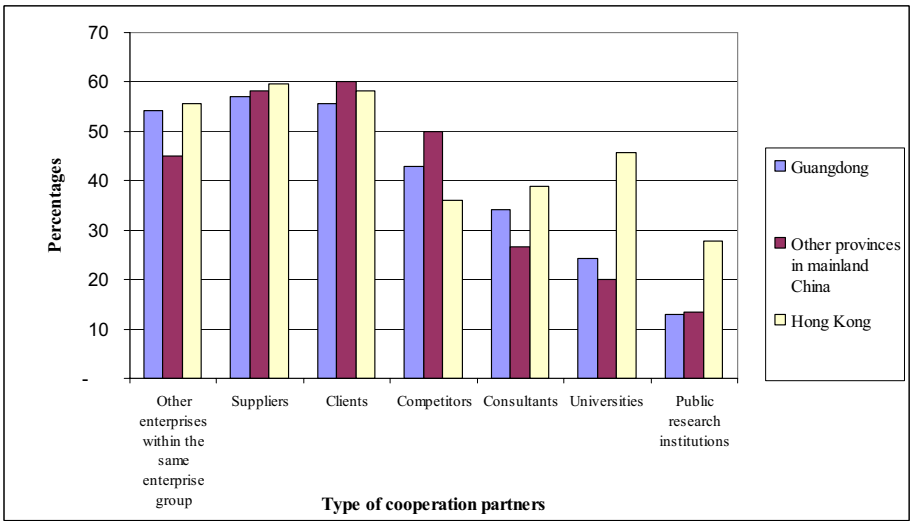


Figure 3: Percentage of Respondents Indicating Partnerships by Type of Partner in the Area



[1] "Public notice 22", 4 June 2007, Ministry of Commerce of the People's Republic of China. http://www.mofcom.gov.cn/aarticle/b/c/200804/20080405462357.html, accessed 10 April 2008.
[2] "Circular No.139", 19 June 2007, Ministry of Commerce of the People's Republic of China. http://www.mofcom.gov.cn/aarticle/b/e/200706/20070604800599.html&173433629=2827746338, accessed 10 April 2008.
[3] "China Legal Publicity," China Labor Contract Law. http://www.legalinfo.gov.cn/misc/2007-07/02/content_650514.htm, accessed 21 April 2008. See in particular Chapter 2, Clause 14 (on types of 'appropriate' contracts to be given to employees), Clauses 16 and 17 (on transparency of information between employers and employees), Clause 19 (on limits to probationary periods), Chapter 4, Clauses

46 and 47 (on employee severance pay), Chapter 6, Clauses 59 and 74 (6) (on commitment to social security benefit payments) and Clause 68 (on limits to working hours).

[4] The first Community Innovation Survey was conducted in European countries in 1993. It is the first survey on innovation implemented simultaneously in multiple countries on the basis of a harmonized questionnaire. The second and third surveys were conducted in 1997/1998 and 2000/2001, respectively. The CIS-4 was conducted in 2004. After the previous three exercises, the questionnaire was improved to enhance the clarity and usefulness of the questions. Moreover, the length of the questionnaire was shortened significantly.

[5] In order to confirm that the importance of scientific journals and trade/technical publications is not correlated with the residual *u*, we implement an overidentifying restriction test that is based on Newey (1987) and Lee (1992). The Stata command/ado file is programmed by Baum et al. (2000). To perform the test, we include another instrumental variable—the importance of information within the enterprise or enterprise group as an innovation information source, to yield one overidentifying restriction. The variable is defined in the same way as the variable of importance of scientific journals and trade/technical publications. The value of the variable equals 3 if information within the enterprise or enterprise group is ranked 'high' in importance by a firm. The value equals 2 if information within the enterprise or enterprise group is ranked to be of medium-level importance, 1 if ranked to be of low-level importance and 0 when they are not relevant to the firm. Similarly, the importance of information within the enterprise or enterprise group is highly correlated with the innovation proxies, but does not contribute to survival-or-relocation decision. The result is available upon request from the authors. The Chi-square statistic of the test is 0.251 with a P-value 0.62. The null hypothesis that instrumental variables x_2 are independent of *u* is thus not rejected, which confirms the validity of the instrumental variables.

The UNU-MERIT WORKING Paper Series

2010-01 *Endogenous Economic Growth through Connectivity* by Adriaan van Zon and Evans Mupela
2010-02 *Human resource management and learning for innovation: pharmaceuticals in Mexico* by Fernando Santiago
2010-03 *Understanding multilevel interactions in economic development* by Micheline Goedhuys and Martin Srholec
2010-04 *The Impact of the Credit Crisis on Poor Developing Countries and the Role of China in Pulling and Crowding Us Out* by Thomas H.W. Ziesemer
2010-05 *Is there complementarity or substitutability between internal and external R&D strategies?* by John Hagedoorn and Ning Wang
2010-06 *Measuring the Returns to R&D* by Bronwyn H. Hall, Jacques Mairesse and Pierre Mohnen
2010-07 *Importance of Technological Innovation for SME Growth: Evidence from India* by M. H. Bala Subrahmanya, M. Mathirajan and K. N. Krishnaswamy
2010-08 *Economic Adversity and Entrepreneurship-led Growth: Lessons from the Indian Software Sector* by Suma Athreye
2010-09 *Net-immigration of developing countries: The role of economic determinants, disasters, conflicts, and political instability* by Thomas H.W. Ziesemer
2010-10 *Business and financial method patents, innovation, and policy* by Bronwyn H. Hall
2010-11 *Financial patenting in Europe* by Bronwyn H. Hall, Grid Thoma and Salvatore Torrisi
2010-12 *The financing of R&D and innovation* by Bronwyn H. Hall and Josh Lerner
2010-13 *Occupation choice: Family, Social and Market influences* by Ezequiel Tacsir
2010-14 *Choosing a career in Science and Technology* by Ezequiel Tacsir
2010-15 *How novel is social capital: Three cases from the British history that reflect social capital* by Semih Akcomak and Paul Stoneman
2010-16 *Global Players from Brazil: drivers and challenges in the internationalization process of Brazilian firms* by Flavia Carvalho, Ionara Costa and Geert Duysters
2010-17 *Drivers of Brazilian foreign investments – technology seeking and technology exploiting as determinants of emerging FDI* by Flavia Carvalho, Geert Duysters and Ionara Costa
2010-18 *On the Delivery of Pro-Poor Innovations: Managerial Lessons from Sanitation Activists in India* by Shyama V. Ramani, Shuan SadreGhazi and Geert Duysters
2010-19 *Catching up in pharmaceuticals: a comparative study of India and Brazil* by Samira Guennif and Shyama V. Ramani
2010-20 *Below the Radar: What does Innovation in Emerging Economies have to offer other Low Income Economies?* by Raphael Kaplinsky, Joanna Chataway, Norman Clark, Rebecca Hanlin, Dinar Kale, Lois Muraguri, Theo Papaioannou, Peter Robbins and Watu Wamae
2010-21 *Much ado about nothing, or sirens of a brave new world? MNE activity from developing countries and its significance for development* by Rajneesh Narula
2010-22 *From trends in commodities and manufactures to country terms of trade* by Thomas H.W. Ziesemer
2010-23 *Using innovation surveys for econometric analysis* by Jacques Mairesse and Pierre Mohnen

2010-24 *Towards a New Measurement of Energy Poverty: A Cross-Community Analysis of Rural Pakistan* by Bilal Mirza and Adam Szirmai

2010-25 *Discovery of the flower industry in Ethiopia: experimentation and coordination* by Mulu Gebreeyesus and Michiko Iizuka

2010-26 *CSR and market changing product innovations: Indian case studies* by Shyama V. Ramani and Vivekananda Mukherjee

2010-27 *How firms innovate: R&D, non-R&D, and technology adoption* by Can Huang, Anthony Arundel and Hugo Hollanders

2010-28 *Sure Bet or Scientometric Mirage? An Assessment of Chinese Progress in Nanotechnology* by Can Huang and Yilin Wu

2010-29 *Convergence of European regions: a reappraisal* by Théophile T. Azomahou, Jalal El ouardighi, Phu Nguyen-Van and Thi Kim Cuong Pham

2010-30 *Entrepreneurship and the National System of Innovation: What is Missing in Turkey?* by Elif Bascavusoglu-Moreau

2010-31 *Keeping the eclectic paradigm simple: a brief commentary and implications for ownership advantages* by Rajneesh Narula

2010-32 *Brazilian Aerospace Manufacturing in Comparative Perspective: A Brazil/USA Comparison of Output and Productivity* by Daniel Vertesy and Adam Szirmai

2010-33 *Economic restructuring and total factor productivity growth: Tunisia over the period 1983-2001* by Sofiane Ghali and Pierre Mohnen

2010-34 *Impact of government support on R&D and innovation* by Abraham Garcia and Pierre Mohnen

2010-35 *Product, process and organizational innovation: drivers, complementarity and productivity effects* by Michael Polder, George van Leeuwen, Pierre Mohnen and Wladimir Raymond

2010-36 *Entrepreneurship Development and the Role of Economic Transition in Entrepreneurial Activities in China* by Ying Zhang and Geert Duysters

2010-37 *Pro-Poor, Entrepreneur-Based Innovation and it's Role in Rural Development* by Lina Sonne

2010-38 *Financing pro-poor entrepreneur-based innovation: A review of existing literature* by Lina Sonne

2010-39 *India's Rural Financial System: Does it Support Pro-Poor Innovation?* by Lina Sonne

2010-40 *How effective are level-based R&D tax credits? Evidence from the Netherlands* by Boris Lokshin and Pierre Mohnen

2010-41 *Analysing Multidimensional Poverty in Guinea: A Fuzzy Set Approach* by Fatoumata Lamarana Diallo

2010-42 *Bottom-up, Bottom-line: Development-Relevant Enterprises in East Africa and their Significance for Agricultural Innovation* by Andy Hall, Norman Clark and Andy Frost

2010-43 *Assessing Innovations in International Research and Development Practice* by Laxmi Prasad Pant

2010-44 *Research Into Use: Investigating the Relationship between Agricultural Research and Innovation* by Andy Hall, Jeroen Dijkman and Rasheed Sulaiman V.

2010-45 *The global institutional frameworks and the diffusion of renewable energy technologies in the BRICS countries* by Isabel Maria Freitas, Eva Dantas & Michiko Iizuka

2010-46 *The role of patent protection in (clean/green) technology transfer* by Bronwyn H. Hall and Christian Helmers

2010-47 *Localisation Strategies of Firms in Wind Energy Technology Development* by Radhika Perrot and Sergey Filippov

2010-48 *The R&D activity of multinational enterprises in peripheral economies: evidence from the EU new member states* by Rajneesh Narula and José Guimón

2010-49 *Bridging the Financing Gap for Pro-Poor Innovation: Towards a Framework* by Lina Sonne

2010-50 *Efficient Development Portfolio Design for Sub Saharan Africa* by Adriaan van Zon and Kirsten Wiebe

2010-51 *Global excellence at the expense of local relevance, or a bridge between two worlds? Research in science and technology in the developing world* by Helena Barnard, Robin Cowan, Moritz Müller

2010-52 *Innovation strategy, firm survival and relocation: The case of Hong Kong-owned manufacturing in Guangdon province, China* by Naubahar Sharif and Can Huang