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JAMES COOK
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Foreign Entry and Firm Advertising Intensity: Evidence from China[1]

Sizhong SUN
College of Law Business and Governance
James Cook University
Townsville, QLD, 4811
Australia

E-mail: sizhong.sun@jcu.edu.au
Telephone: 61-7 4781 4710
Fax: 61-7 4781 4019
Mailing Address:
Sizhong Sun
College of Law Business and Governance
James Cook University
Townsville, QLD, 4811
Australia

[**Abstract**]

This paper investigates the determinants of advertising intensity at the firm level by focusing on the role of foreign entry. In a monopolistically competitive market with heterogeneous firms, we show that foreign entry affects the expected advertising intensity of domestic firms through its impact on the cost of resources, brand image, and productivity spillovers and its impact on firms' exit behaviour. Then, using comprehensive firm-level data from China's manufacturing sector between 2005 and 2007, we test this hypothesis and find that foreign entry significantly affects advertising intensity.

1. Introduction

Researchers have investigated firm advertising behaviour from various perspectives. For example, Bertrand et al. (2010) explore how advertising affects demand. One strand of this research focuses on determinants of advertising behaviour. Understanding why firms advertise and what determines a firm's advertising behaviour is crucial in that it has implications for both policy makers and business managers. Contributing to this strand, this paper will explore the determinants of firm advertising intensity in China.

This paper differs from previous studies in three aspects. First, we identify determinants of firm advertising behaviour using a comprehensive firm-level dataset, whereas many previous studies have employed industry-level data. Firms covered in the dataset used for this study account for over 85 per cent of the industrial outputs in the Chinese manufacturing sector. Using such a comprehensive, disaggregated dataset allows a detailed examination of what factors affect firm advertising behaviour and avoids information loss caused by aggregation.

Second, we investigate the impact of foreign entry[2] on firm advertising behaviour. Foreign entry has been shown to affect the domestic economy in a number of ways. For example, Richardson (1998) shows that foreign entry affects domestic welfare. Fang and Richardson (2010) demonstrate that foreign entry tends to increase both private and public incentives for domestic mergers. Since Caves (1974), a significant body of research has been devoted to measuring the impact of FDI on the productivity

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[2] Hereafter, foreign entry is synonymous with foreign direct investment (FDI) and the presence of foreign firms.

of domestic firms (see, for example, Blomstrom and Kokko, 1998; Saggi, 2002; Gorg and Greenaway, 2004; Smeets, 2008 for surveys). The presence of foreign firms is also found to affect domestic firms' exporting. Sun (2009; 2010; 2012) finds significant export spillover from foreign firms in China, which is the focus of this study.

Conceptually, researchers have identified three channels through which the presence of foreign firms (foreign entry) can affect domestic firms: backward and forward linkages, labour mobility, and demonstration and competition effects (Blomstrom and Kokko, 1998). Domestic firms can benefit from a linkage to foreign firms by being local suppliers and/or customers of foreign firms. Well-trained employees in foreign firms can move to domestic firms or establish their own business, taking with them the skills that they obtained in foreign firms. Domestic firms can learn from and imitate foreign firms, and, indeed, they may be forced to do so as a result of the increased competition due to foreign entry. Through these three channels, domestic firms are affected by foreign entry, and as a result, they may change their advertising behaviour.

The rest of this paper is organised into six sections. In Section 2, we survey previous studies on advertising determinants; in Section 3, we model firm advertising behaviour in a monopolistically competitive market and develop our hypothesis; in Section 4, we deploy the econometric model; in Section 5, we present the data; in Section 6, we discuss the empirical findings; and Section 7 concludes the paper.

2. Literature Review

The role of market structure in advertising behaviour has been part of an ongoing debate, as argued by Leahy (1997). Researchers test the impact of market structure on advertising by regressing the advertising intensity (i.e. the advertising-sales ratio) against such measures of market structure as the Herfindahl index (see, for example, Greer, 1971; Sutton, 1974; Strickland and Weiss, 1976; Martin, 1979; and Buxton et al., 1984).

Willis and Rogers (1998), using data on 58 US food and tobacco markets, find a J-shaped relationship between industry advertising intensity and market structure, as measured by the four-firm concentration ratio. Lee (2002) also finds a nonlinear relationship between industry advertising intensity and market structure, as measured by the Herfindahl index and the three-firm concentration ratio, in 426 five-digit Korean manufacturing industries.

Some studies emphasise the strategic interaction among firms' advertising expenditures (see for example Slade, 1995; and Zhao, 2000; Banerjee and Bandyopadhyay, 2003; Depken and Snow, 2008). Strategic interaction implies that one firm's advertising affects another firm's advertising behaviour. However, to some extent, such strategic interaction is captured by the market structure. In a more competitive market, it is difficult to imagine the existence of strategic interaction in advertising behaviour.

Dorfman and Steiner (1954) show that to maximise profit, a monopolist will choose an advertising intensity such that it is equal to the ratio of the advertising elasticity to

price elasticity. The Dorfman-Steiner model implies that profitability is another factor that affects advertising behaviour; this has been tested by a number of empirical studies. A positive relationship between profitability, measured as the price-cost margin, and advertising is found by Comanor and Wilson (1967), Willis and Rogers (1998), Oustapassidis et al. (2000), and Lee (2002).

Several studies focus on the impact of the firm's financial position on advertising. Chemmanur and Yan (2009) find that new equity issue positively affects firm advertising expenditure, whereas Fee et al. (2009) find a significant positive relationship between firm advertising expenditures and contemporaneous foreign cash flow in the US. Grullon et al. (2006) show that a firm's financial leverage has a 'dampening' effect on its advertising intensity.

Market size and market growth are often used as control variables in empirical studies (Willis and Rogers, 1998; Mavrommati and Papadopoulos, 2005). Willis and Rogers (1998) find that these two factors do not significantly affect advertising intensity in the US processed food and tobacco markets in 1987, whereas significant positive impacts are found by Mavrommati and Papadopoulos (2005) in the Greek food industry from 1990 to 1997. Mavrommati and Papadopoulos (2005) also emphasise the role of intangible capital in advertising behaviour. Using five-digit food industry data from 1990 to 1997, they find that intangible capital positively affects advertising intensity.

Demand-side factors also play a role. Meisel (1979) finds that demand-side factors such as the importance of auxiliary services, reliance on professional advisers, and

consumer experience with a product class significantly affected advertising intensity among convenience goods in the US in 1974. Srinivasan et al. (2011) examine whether firms spend more on advertising in times of recession by using data of publicly listed firms from 1969 to 2008 in the US. They find that the impact on profits and stock returns of advertising spending during a recession depends on the market share, financial leverage, and product-market profile.

A few studies explore the advertising behaviour of multinational corporations. Immordino (2009), in modelling firm decisions on levels of production, advertising expenditures and cost-reducing investments, proposes the existence of a positive relationship between firm advertising intensity and the probability of being a multinational corporation, whereas Samiee et al. (2003) and Griffith et al. (2003) investigate the determinants of advertising standardisation in multinational corporations.

In summary, a number of previous studies have explored the determinants of firm advertising behaviour. These studies use either industry-level data or firm-level data with small sample sizes from countries other than China. This paper instead investigates firm advertising behaviour using a large dataset in China: a rapidly growing economy. Nevertheless, we draw explanatory variables from these existing studies in our subsequent empirical exercises. Although several studies explore the advertising behaviour of multinational corporations (FDI), none of the studies, to the best of our knowledge, address the impact of foreign entry (FDI) on domestic firms' advertising intensity. This paper intends to fill this gap.

3. The Model

In this section, we show that foreign entry can affect domestic firms' advertising behaviour in a monopolistically competitive model, and develop the hypothesis for the subsequent empirical exercise. On the demand side, consumers have a constant elasticity of the substitution utility function, as follows:

$$U = \left[\int_{\omega \in \Omega} B(\omega) q(\omega)^{\rho} d\omega \right]^{1/\rho},$$

where Ω denotes the set of all available goods; q denotes the quantity of goods; and B is the brand image. A higher brand image increases the consumer's utility. All goods are substitutes for each other ($0 < \rho < 1$), with a constant elasticity of substitution of $1/(1-\rho)$ among them.

Consumer utility maximisation yields the demand function:

$$q(\omega) = A \left[\frac{p(\omega)}{B(\omega)} \right]^{1/\rho - 1}, \tag{1}$$

where p denotes price; $A \equiv \dfrac{R}{\displaystyle\int_{\omega \in \Omega} \frac{p(\omega)^{1/\rho - 1}}{B(\omega)^{1/\rho - 1}} d\omega}$ is a measure of aggregate demand level, which is exogenous to individual producers as they are small in size relative to the whole industry, such that their individual impact is negligible; and R is the consumer income. The demand function indicates that brand image positively affects demand. As firms can boost their brand image by increasing their advertising expenditures (see, for example,Clark et al., 2009), it also implies that advertising positively affects demand. A number of empirical studies have found this positive impact (see, for example, Rojas and Peterson, 2008; Zheng and Kaiser, 2008).

On the production side, there is a continuum of firms in the industry, each producing one variety of differentiated goods. Among these firms, there are γ $(0 < \gamma < 1)$ proportion of foreign-invested firms. Firms discover their productivity upon entry to the industry, and then choose the advertising expenditure and price of their products to maximise profits. Firms' advertising expenditure creates their brand image in the following way:

$$B = b(\gamma)a^{\beta}, \ 0 < \beta < 1 \text{ and } \beta + \rho < 1 \quad, \tag{2}$$

where firms invest a units of its outputs in advertising and $\partial b / \partial \gamma < 0$. The presence of foreign firms has a negative impact on brand image due to the competition effect from foreign firms ($\partial b / \partial \gamma < 0$). An increase in advertising expenditure will boost the brand image, subject to a decreasing marginal return. A number of previous empirical studies have found such a positive relationship between perceived brand image and advertising expenditure (see, for example, Kirmani, 1990; Kirmani, 1997; and Moorthy and Zhao, 2000).

The production process involves both a fixed cost (F) and a linear marginal cost ($c(\gamma) \times q/\theta$, where c measures the cost of resources and θ denotes firm productivity). The presence of foreign firms (γ) drives up the cost of resources, namely, $\partial c / \partial \gamma > 0$. θ is a Melitz (2003) style productivity, which firms discover from a prior distribution over the support $(0, +\infty)$ upon entry into the industry.

The associated density function is $g(\theta, \gamma)$, and $\partial g / \partial \gamma < 0$. The presence of foreign firms generates positive productivity spillovers, such that firms are more likely to discover a higher θ in an industry with a higher level of γ (i.e., the distribution of θ when γ is high first-order stochastic dominates the distribution when γ is low).

Production technology is cost-reducing, and a higher realisation of θ implies a lower marginal cost of production. Firm profit can then be written as follows:

$$\Pi(p,a) = pq - \frac{c}{\theta}q^2 - a - F$$

$$= Ap^{\rho/(\rho-1)}b^{1/(1-\rho)}a^{\beta/(1-\rho)} - \frac{c}{\theta}A^2 p^{2/(\rho-1)}b^{2/(1-\rho)}a^{2\beta/(1-\rho)} - a - F,$$

where we assume a linear cost of advertising and the second equality is obtained by plugging in the demand function (equation 1) and brand image creation function (equation 2).

A firm chooses advertising expenditure and price level to maximise its profit. The first-order conditions (FOCs) are as follows:

$$p = A^{(1-\rho)/(2-\rho)}\left(\frac{2c}{\rho\theta}\right)^{(1-\rho)/(2-\rho)}b^{1/(2-\rho)}a^{\beta/(2-\rho)}$$

$$\frac{\beta}{1-\rho}Ap^{\rho/(\rho-1)}b^{1/(1-\rho)}a^{(\beta+\rho-1)/(1-\rho)} - \frac{2\beta}{1-\rho}\frac{c}{\theta}A^2 p^{2/(\rho-1)}b^{2/(1-\rho)}a^{(2\beta+\rho-1)/(1-\rho)} = 1,$$

which suggest that advertising positively affects price. From the FOCs, we can solve for optimal price level and advertising expenditure, as follows:

$$p = \beta^{\beta/(2-2\beta-\rho)}A^{(1-\rho)/(2-2\beta-\rho)}b^{1/(2-2\beta-\rho)}\left(\frac{2c}{\rho\theta}\right)^{(1-\beta-\rho)/(2-2\beta-\rho)} \tag{3}$$

$$a = \beta^{(2-\rho)/(2-2\beta-\rho)}A^{(2-2\rho)/(2-2\beta-\rho)}b^{2/(2-2\beta-\rho)}\left(\frac{2c}{\rho\theta}\right)^{\rho/(2\beta+\rho-2)} . \tag{4}$$

A firm's optimal advertising intensity can therefore be defined as:

$$\lambda \equiv \frac{a}{q} = \beta^{\frac{2-\beta-\rho}{2-2\beta-\rho}}A^{(1-\rho)/(2-2\beta-\rho)}b^{1/(2-2\beta-\rho)}\left(\frac{2c}{\rho\theta}\right)^{(1-\beta-\rho)/(2-2\beta-\rho)} , \tag{5}$$

where λ denotes firm advertising intensity.

If we plug equations (3) and (4) into the profit function, we can obtain the optimal

profit as:

$$\Pi^* = (1-\beta)\beta^{2\beta/(2-2\beta-\rho)}A^{2(1-\rho)/(2-2\beta-\rho)}b^{2/(2-2\beta-\rho)}\left(\frac{2c}{\rho\theta}\right)^{-\rho/(2-2\beta-\rho)} -$$

$$\frac{\rho}{2}\beta^{4\beta/(2-2\beta-\rho)}A^{4(1-\rho)/(2-2\beta-\rho)}b^{4/(2-2\beta-\rho)}\left(\frac{2c}{\rho\theta}\right)^{(2-2\beta-3\rho)/(2-2\beta-\rho)} - F$$

,

where the superscript * denotes the optimal level of profit. A firm will exit the

industry if $\Pi^* < 0$, and thus will not have any advertising expenditure. Let $\boldsymbol{\Theta}$ denote

the set of θ such that firms will not exit the industry, namely $\boldsymbol{\Theta} \equiv \{\theta : \Pi^* \geq 0\}$. Note

that $\boldsymbol{\Theta}$ depends on the level of foreign presence (γ). Then we can write the expected

advertising intensity as:

$$E[\lambda|A,c,F,\gamma,\theta \in \Theta] =$$

$$\beta^{\frac{2-\beta-\rho}{2-2\beta-\rho}}A^{\frac{1-\rho}{2-2\beta-\rho}}b^{\frac{1}{2-2\beta-\rho}}\left(\frac{2c}{\rho}\right)^{\frac{1-\beta-\rho}{2-2\beta-\rho}}\int_{\Theta}\theta^{-\frac{1-\beta-\rho}{2-2\beta-\rho}}g(\theta,\gamma)d\theta \qquad (6)$$

Equation (6) suggests that foreign presence (γ) affects the domestic firm's expected

advertising intensity through its impact on the cost of resources (c) and brand image

creation (b), the productivity spillovers, and its impact on the $\boldsymbol{\Theta}$ (the set of θ such that

a firm will not exit). From equation (6), we then set up the following hypothesis:

> *The expected firm advertising intensity depends on firm and*
>
> *industry characteristics as in equation (6). In particular, the*
>
> *presence of foreign firms affects expected advertising intensity*
>
> *through its impact on the cost of resources, brand image creation,*
>
> *and productivity spillovers and its impact on firms' exit*
>
> *behaviour.*

4. Econometric Specification

To explore the determinants of firm advertising intensity and the role of foreign entry, we operationalise equation (6) by setting up the following model:

$$ADINT = \alpha_0 + \alpha_1 \ln(firmsize) + \alpha_2 diversification + \alpha_3 profitability + \\ \alpha_4 ownership + \alpha_5 herfindahl + \alpha_6 herfindahl^2 + \alpha_7 fe + \alpha_8 dindustry + \varepsilon \quad , \quad (7)$$

where ε denotes the error term, and the definitions of the other variables are set out in Table 1. In equation (7), we capture the fixed cost of production and cost of resources in equation (6) by a set of firm characteristics (namely firm size, diversification, profitability, and ownership structure). In addition, following previous studies, we also include the Herfindahl index to capture the impact of market structure, and a set of two-digit industry dummy variables to allow firms to have different advertising intensities in different industries.

Advertising is a risky and sunk investment. Larger firms are usually more capable of paying for advertising expenses due to the lumpiness of the costs of advertising. Therefore firm size is expected to affect positively a firm's advertising intensity. Advertising also serves a pure informational function. The more new types of products a firm produces (i.e. the more diversified a firm is), the more necessary it is to advertise. Hence, we expect firm diversification to affect positively advertising intensity.

Due to the sunk nature of advertising, a more profitable firm can afford to advertise more intensively, as it has greater cash flow to finance the advertising, which otherwise will be hard to finance through external sources (namely, the capacity effect). In addition, a firm's higher profitability may suggest that it is faced with less elastic demand, which in turn leads to more intensive advertising (namely, the

Dorfman-Steiner effect). Therefore conceptually we expect firm profitability to affect advertising behaviour positively.

In equation (7), we also include a dummy variable – whether a firm is privately owned or state and collectively owned – to allow these two types of firms to have different advertising behaviour. On the one hand, state and collectively owned firms are likely to have better access to financing from the state and collectively owned banks, which in turn promotes their capacity to advertise. On the other, compared with privately owned firms, being state and collectively owned can mean they have less incentive to advertise. Therefore ownership conceptually affects advertising behaviour, with the direction of such impact being less clear.

As for market structure, a number of previous studies have shown that it affects advertising behaviour. In a more concentrated industry, the dominant firms are more capable of paying advertising expenses and have less spillover effect in their advertising, and thus tend to advertise more intensively. On the other hand, an industry with higher levels of concentration may have less vigorous competition, including advertising competition. In a more competitive (less concentrated) industry, competition will encourage firms to advertise, and firms may use advertising to create entry barriers. Thus, the market structure, captured by the Herfindahl index, affects firm advertising behaviour conceptually, but the direction of such impact is not clear. In equation (7), we include the squared term of the Herfindahl index to capture the possible nonlinearity found by previous studies.

The presence of foreign firms is expected to generate an impact on advertising intensity through four channels: its impact on the costs of resources, brand image, and productivity spillovers and its impact on the firm exit behaviour, as shown in Section 3.

In estimating equation (7), it shall be noted that some explanatory variables can be endogenous. Firm size is likely to be endogenous. On the one hand bigger firms are more likely to advertise; on the other hand, firms that are more likely to advertise tend to be larger: Advertising promotes firm growth. It is also likely that foreign entry is more likely to occur in industries where firms advertise more intensively, and thus foreign entry can be endogenous. Similarly, the diversification, profitability and Herfindahl index may be endogenous as well.

Later in the next section, we find that compared with non-advertising firms, advertising firms on average have different sizes, diversification, and profitability and are located in industries with a higher Herfindahl index and greater foreign entry, suggesting that they may be endogenous. Some previous studies also find evidence of endogeneity. For example, Grullon et al. (2004) find that firms with greater advertising expenditure have a greater number of investors and better liquidity of their common stock.

In consideration of the endogeneity issue, we use instrumental variables (IV) in the later regressions. The excluded instruments we use include the number of times that a firm exports in the three-year period (2005–2007), export intensity, age, capital

intensity, the number of firms in a four-digit industry, the number of exporting firms in a four-digit industry, and the sales in a four-digit industry.

For the excluded instruments to be valid, they need to be correlated with the endogenous variables and not correlated with the error term in equation (7). Firms' exporting behaviour, not surprisingly, is correlated with the endogenous variables. For example, exporting promotes firm growth. Since exporting is carried out to service foreign markets, we do not expect it to affect advertising decisions in the domestic market, conditional on the right-hand side variables in equation (7) – that is, it is not correlated with the error term. Therefore instruments that utilise firm exporting behaviour (for example, the number of exporting firms in a four-digit industry) are valid.

In addition, it appears reasonable to expect that a firm's decision on advertising intensity does not depend on the year in which the business started (that is, its age) and capital intensity. Therefore they are not correlated with the error term in equation (7). Besides, firm age and capital intensity are likely to be correlated with the endogenous variables. For example, firm age is correlated with firm size as a firm grows across time. The capital intensity is likely to influence diversification in that a more capital intensive firm is generally more capable of producing new types of products.

Conditional on the market structure and industry effect (namely the industry dummy variables), we also do not expect the number of firms and sales in a four-digit industry to affect firm advertising intensity – that is, they will not be correlated with the error

term. In addition, they are likely to influence the endogenous variables. For example, FDI tends to flow into industries with bigger markets, which is captured by the number of firms and sales in the industries. Later in the two-stage IV regressions, by examining the first-stage regressions where the endogenous variables are regressed against the exogenous variables, we find that these excluded instruments are indeed correlated with the endogenous variables.

5. The Data

Equation (7) is estimated using a comprehensive firm-level dataset from 2005 to 2007, which was collected by the China National Bureau of Statistics (NBS) for the 'Industry' section of the *China Statistical Yearbook*. The dataset covers the whole manufacturing sector (480 four-digit industries[3] with an average number of firms in a four-digit industry being 550), and accounts for over 85 per cent of China's total industrial output.[4] A number of previous studies have utilised similar data to investigate different aspects of the Chinese industrial economy: for example, Hu et al. (2005) on R&D and technology transfer, Jefferson et al. (2008) on productivity growth, and Sun (2009; 2010) on export spillovers of FDI.

Following Jefferson et al. (2008), we exclude the following firms: (1) those firms that employed fewer than eight workers, as such firms may not have reliable accounting systems; (2) those that reported negative net values of fixed assets and advertising expenditures, as well as non-positive outputs, value added, and wages. To focus on

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[3] Firms are classified into the four-digit industries by their main business activities.

[4] Note that as the dataset does not cover all firms in the manufacturing sector there may be a selection effect, a common issue facing similar studies.

exploring the impact of foreign entry on domestic firms, we also exclude firms that have foreign ownership (i.e., firms with foreign capital).[5]

We then use the producer price index for manufactured goods obtained from the *China Statistical Yearbook 2008* to deflate monetary variables such as sales to the 2005 price. Some variables are reported directly in the dataset, such as firm size (number of employees), whereas the rest are calculated from the dataset. For example, the diversification variable is calculated as the proportion of the value of a firm's new products[6] in its total output, both of which are directly reported in the dataset.

Although we focus on domestic firms, the industry-level variables (the Herfindahl index and foreign entry) are constructed to include foreign firms. For example, the Herfindahl index is the sum of squared market share of both domestic and foreign firms in the four-digit industries. The industry-level variables are constructed at the four-digit level, into which firms are classified according to their principal business activities. As the Herfindahl index is measured on a national basis, it does not capture the impact of the fact that some industries have high per-unit transport costs and are more likely to be local. This impact is captured by the industry dummy variables included in subsequent regressions.

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[5] Although foreign firms are defined as firms with foreign capital, over 88 per cent of them have a share of foreign capital in their total capital that is greater than 30 per cent, and over 77 per cent of them have a share higher that is greater than 50 per cent.

[6] Note that as the value of new products is reported in monetary value in the dataset, it is comparable across industries and regions.

After constructing the variables for 2005, 2006, and 2007, we then take a three-year average of these variables, which are later used in the regression. In addition, to avoid the undesired impact of outliers, we exclude observations that lie outside four standard deviations from the sample mean for the variables of advertising intensity and profitability. It shall be noted that including these firms does not significantly change the regression results.

Table 2 reports the summary statistics.[7] The first observation is that the data cover a large number of firms: 238,126 firms. Second, on average firms only spend 0.05 per cent of their sales revenue in advertising, with a maximum advertising intensity of just 3 per cent. In addition, 78 per cent of firms do not advertise. This is in significant contrast with firms in western economies – for example, in Comanor and Wilson's (1967) sample of US consumer goods industries, firms on average spent 3.3 per cent of their sales revenue on advertising.[8] This difference can be attributed to different stages of economic development between China and more-developed western economies.

Third, there exist significant variations across all variables. For example, the standard deviation of advertising intensity is four times its mean. Fourth, the market structure (Herfindahl index) is very competitive on average, but it displays significant variance. The standard deviation of the Herfindahl index is higher than its mean, and the most concentrated industry has a Herfindahl index as high as 0.72, which is close to monopoly.

<insert Table 2 here>

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[7] The correlations among explanatory variables are also low.

[8] We thank the editor for pointing this out.

Fifth, for the foreign entry variable, we have three measurements: the share of the output of all foreign-invested firms in a four-digit industry; the share of foreign-invested firms from non-Hong Kong, Macau, and Taiwan (non-HMT) regions; and the share of foreign-invested firms from Hong Kong, Macau, and Taiwan (HMT). These three measurements allow us to investigate the impact of different sources of foreign entry. The HMT investment is different from non-HMT investment in that firms of Hong Kong, Macau, and Taiwan share a culture similar to that of domestic firms.

It is also likely that domestic firms first go to Hong Kong and invest back into the domestic market (so-called round-trip investment) to take advantage of the tax privilege. Additionally, investments from non-HMT are generally perceived to possess a higher level of technology. Previous empirical studies have found varying impacts of these two sources of foreign investment (see, for example, Li et al., 2001; and Buckley et al., 2007). Foreign entry, on average, is at a significant level, as approximately 31 per cent of the industry outputs are produced by foreign-invested firms.

Since firms generally spend a small proportion of their sales revenue on advertising and a large proportion of firms do not advertise, we further explore whether there exists a difference between advertising and non-advertising firms. Table 3 reports a comparison of advertising and non-advertising firms in both the consumer goods industries[9] and the industrial goods industries. Advertising firms appear to exhibit

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[9] Industries with two-digit industry codes less than 25.

different characteristics from non-advertising firms. On average advertising firms are bigger, more diversified, more profitable, and located in industries with higher levels of concentration and higher levels of foreign entry than is true for non-advertising firms.

<insert Table 3 here>

This pattern also hints that firm size, diversification, profitability, Herfindahl index and foreign entry may be endogenous, in that if they are exogenous (namely, there is no reverse causality from advertising to these variables), we will not observe the difference between advertising and non-advertising firms. It can also be observed that non-advertising firms are more likely to be privately owned – which, instead of suggesting advertising affects ownership structure, reflects the fact that privately owned firms are smaller than their state and collectively owned counterparts and thus have less capacity to advertise. On average, privately owned firms employ 125 workers, while state and collectively owned firms employ 285 workers.

6. Empirical Results

As the dependent variable (advertising intensity) in equation (7) is truncated between 0 and 1, we use the Tobit estimator to estimate equation (7). Tables 4 and 5 report the regression results. We first assume that the explanatory variables in equation (7) are exogenous (Tobit [1] in Table 4). Nevertheless, as discussed above, it is possible that some explanatory variables are endogenous. Therefore we use the two-step IV Tobit estimator to estimate equation (7), and conduct a Wald test of exogeneity of endogenous explanatory variables. The Wald test obtains a test statistic of 2324.62,

which rejects the null hypothesis of exogeneity at the 1 per cent level. Therefore, the two-step IV Tobit regressions are more appropriate.

The dataset covers both consumer goods industries and industrial goods industries. Conceptually, it can be expected that firms advertise more in consumer goods industries as compared to industrial goods industries, and the impact of foreign presence on advertising is stronger in consumer goods industries than in industrial goods industries.[10] In the consumer goods industries, the average advertising intensity is 0.051 per cent, while it is 0.0498 per cent for the industrial goods industries.

Therefore, we test whether it is appropriate to separate the sample into the consumer goods and industrial goods industries. To do so, we generate a dummy variable that takes a value of 1 if a firm belongs to the consumer goods industries and run a two-stage IV Tobit regression where the dummy is interacted with all explanatory variables. Then we test the joint significance of the dummy and its interaction terms, which, if jointly significant, suggests that firms in these two types of industries have significantly different advertising behaviour, and thus it is appropriate to separate the sample. The test statistic we obtain is 198.63, which is significant at the five per cent level. Thus the interpretations in the following will be based on the two-step IV Tobit regression results of the separated sample.

6.1 Determinants of firm advertising intensity

Table 4 reports the regression results where foreign entry is measured as the output share of foreign firms from all sources, while Table 5 presents the regression results

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[10] We thank the editor for pointing this out.

that separate foreign firms into two different sources, namely those from Hong Kong, Macau and Taiwan regions and those from the other regions. In both tables, we report the results for consumer goods and industrial goods industries separately. In addition, since the IV Tobit regressions are more appropriate than the Tobit regressions that assume exogeneity of explanatory variables, the interpretation in this section will be based on IV Tobit regressions.

Regarding the role of foreign entry in domestic firms' advertising behaviour, namely the point estimates of coefficient of foreign entry, two features can be observed from Tables 4 and 5: First, most regressions yield a significant point estimate, suggesting that foreign entry indeed significantly affects domestic firms' advertising intensity. In the consumer goods industries, the impact is positive, while in contrast it is negative in the industrial goods industries.

As in Section 2, foreign entry affects domestic firms through different channels. For example on the one hand it drives up the cost of resources, while on the other hand it generates productivity spillovers to domestic firms. Therefore the net impact on domestic firms' optimal advertising intensity can be either positive or negative, depending on the relative magnitude of its impacts in the different channels. Later in the robustness analysis, where we carry out regressions by industries, we also find positive impact in some industries and negative impact in the other industries.

Second, the point estimates in Table 5 exhibit some variations in the magnitude. These variations arise due to the difference in the nature of foreign investments of the HMT and non-HMT regions. HMT firms share a similar culture with domestic firms

and are more export-oriented, whereas foreign investment from the non-HMT regions is more domestic market-oriented (Wang et al., 2009). Furthermore, HMT firms are more labour-intensive, whereas the non-HMT firms have higher technological capabilities (Wei and Liu, 2006). Compared with the non-HMT firms, HMT firms are less responsive to local labour quality and technology capability (Wang et al., 2009). Given these differences, it is not surprising to find the two exert different impacts on domestic firms' advertising intensity.[11]

Firm size and new product diversification exert significant and positive impacts on domestic firms' advertising intensity in all regressions. The positive impact of firm size is consistent with our prior expectation, and not surprisingly, diversification (the share of new types of products in a firm's total output) positively affects advertising intensity, as firms require more advertising to sell their new products. Firms' ownership status also affects their advertising behaviour. In Tables 4 and 5, the estimated coefficient of ownership is significantly positive in the industrial goods industries and significantly negative in consumer goods industries, suggesting that privately owned domestic firms have different advertising behaviour than their state and collectively owned counterparts, *ceteris paribus*.

As for profitability, the estimated coefficients in both the aggregate and separate samples are significantly positive, and the positive estimates continue to hold when we use different measures of foreign entry (Table 5). As discussed above, the

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[11] More discussions on the difference between HMT and non-HMT firms can be found in Wei and Liu (2006) and Wang et al. (2009).

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significantly positive impact confirms that more profitable firms are more capable of paying for the sunk advertising expenses and may be faced with less elastic demand.

Regarding the role of market structure in firm advertising behaviour, in the aggregate sample, a nonlinear inverse U shape is found in the IV Tobit regression. When we separate the sample into consumer and industrial goods industries, the inverse U shape continues to hold in the consumer goods industries, while in contrast it is reduced to be insignificant in the industrial goods industries. In addition, when we use different sources of foreign entry in the regressions (Table 5), the consumer goods industries continue to exhibit an inverse U shape, while for the industrial goods industries, it is insignificant with non-HMT foreign entry and positive with HMT foreign entry. This different impact suggests that the role of market structure is not ubiquitous.

6.2 Robustness

In the previous section, we applied the IV Tobit estimation technique. As a robustness check, we also employ the IV regression, which is carried out over the sample of firms that have positive advertising intensity, and the IV Probit estimation, where the dependent variable is a dummy variable that takes a value of 1 if a firm advertises. Table 6 reports the regression results. Comparing the IV Tobit regressions (Table 4) with the IV Probit regressions (Table 6), we can find that generally the sign of estimated coefficients does not change. In contrast, there are more variations in the point estimate of coefficients between the IV regressions and IV Tobit regressions. The IV regressions are restricted to firms with positive advertising intensity, and thus are subject to sample selection bias.

Previously, foreign presence is measured as the share of the outputs of foreign firms in a four-digit industry, which significantly affects the advertising intensity of domestic firms. Some previous studies also use different measures of foreign presence, which capture different mechanisms of spillovers (see, for example, Wei and Liu, 2006). To determine whether our findings are robust to alternative measures of foreign presence, we re-run the regressions using the shares of employees, shares of assets, and number of foreign firms in a four-digit industry as measures of foreign presence, respectively. The estimated coefficients of foreign presence are all significantly positive in the consumer goods industries and significantly negative in the industrial goods industries, confirming the robustness to different measures of foreign presence.[12]

The regressions in Section 6.1 are estimated over the whole manufacturing sector. In addition, we also estimate equation (7) over each of the 29 two-digit industries separately. Not surprisingly, the estimated coefficients display variations across different industries, as advertising has a differing degree of importance for firms in different industries and foreign presence may vary significantly across industries due to governmental policies. For the coefficients of foreign presence, the point estimate ranges from -0.0408 to 0.3302, with an average of 0.0189 and a median of 0.0021. Among the 29 industries, 10 industries have significantly positive estimates, 15 industries obtain insignificant estimates, and the remaining four industries have significantly negative estimates.

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[12] The results, including those of regressions by industries, are not reported here to save space. They are, however, available upon request.

7. Concluding Remarks

This paper explores the determinants of adverting intensity at the firm level with a focus on the role of foreign entry. In a monopolistically competitive market with heterogeneous firms, we show that foreign entry affects the advertising intensity of domestic firms through four channels: its impact on the cost of resources, brand image, and productivity spillovers and its impact on firm exit behaviour.

We then test the theoretical model using a comprehensive firm-level dataset of manufacturing sector from China. Three major findings can be drawn from the empirical exercises. First, firms' advertising behaviour appears to be different in the consumer goods and industrial goods industries, in that the estimated coefficients are different in regressions of consumer goods industries and industrial goods industries. Second, firm diversification positively affects advertising intensity, which is robust across different regressions. Third, foreign entry is found to affect positively domestic firms' advertising intensity in the consumer goods industries and affect negatively advertising intensity in the industrial goods industries. The source of foreign entry also plays a role, as foreign entry from Hong Kong, Macau, and Taiwan exerts an impact on the advertising intensity of domestic firms that is different from that of foreign entry from other regions.

Our findings provide a better understanding of firm advertising behaviour and present significant implications for both business managers and policy makers. For policy makers, foreign entry (or FDI) significantly affects domestic advertising intensity, which appears to be pro-competitive; therefore, it is reasonable to promote foreign

entry. For managers of domestic firms, foreign entry is a challenge to which they can respond by reducing their production costs and adjusting their advertising.

Table 1 Definition of Variables

Variables	Definition
ADINT	Firm advertising intensity: the proportion of advertising expenditure in sales.
firmsize	Firm size: the number of employees.
diversification	New product diversification: the percentage of a firm's new types of products (in Chinese Yuan) in its total output (in Chinese Yuan).
profitability	Firm profitability: the ratio of profits divided by total sales.
ownership	Firm ownership structure: a dummy variable that takes a value of 1 if a firm is privately owned and 0 if a firm is state and collectively owned.
herfindahl	Herfindahl index: equal to the sum of the squared market share, in a four-digit industry.
fe	Foreign entry/FDI/foreign presence: the proportion of the outputs of foreign-invested firms in a four-digit industry.
dindustry	A set of two-digit industry dummy variables.

Table 2 Summary Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
advertising intensity	238126	0.0005	0.002	0	0.03
firm size	238126	172.48	643.37	8	126855
new product diversification	238126	0.04	0.14	0	1
profitability	238126	0.04	0.06	-0.27	0.35
ownership	238126	0.71			
Herfindahl index	238126	0.02	0.03	0.001	0.72
foreign entry [1]	238126	0.31	0.17	0	0.99
foreign entry [2]	238126	0.19	0.12	0	0.93
foreign entry [3]	238126	0.13	0.09	0	0.60

Note: [1] is measured as the proportion of the output of all foreign-invested firms in a four-digit industry; [2] is the output proportion of all foreign-invested firms from non-Hong Kong, Macau and Taiwan; [3] is the output proportion of all foreign-invested firms from Hong Kong, Macau and Taiwan. Foreign entry [2] and [3] are only used in regressions in Table 5. Ownership is a dummy variable, and thus we only report its means (i.e., the percentage of firms that take a value of 1). Firm size is measured as the number of employees.
Source: Enterprise Data, NBS, 2005-7.

Table 3 Comparison of Advertising Firms and Non-advertising Firms

	consumer goods industries						industrial goods industries					
	advertising firms			non-advertising firms			advertising firms			non-advertising firms		
Variable	Obs	Mean	Std. Dev.	Obs	Mean	Std. Dev.	Obs	Mean	Std. Dev.	Obs	Mean	Std. Dev.
firm size	16044	290.4900	766.9044	66861	139.1151	590.8460	35822	341.7695	1202.2760	119399	124.5168	322.4323
new product diversification	16044	0.0441	0.1475	66861	0.0205	0.1095	35822	0.0839	0.2045	119399	0.0296	0.1346
profitability	16044	0.0424	0.0552	66861	0.0385	0.0549	35822	0.0450	0.0600	119399	0.0408	0.0600
ownership	16044	0.6983		66861	0.7684		35822	0.6105		119399	0.7005	
Herfindahl	16044	0.0154	0.0285	66861	0.0115	0.0185	35822	0.0197	0.0312	119399	0.0166	0.0292
foreign entry	16044	0.3321	0.1682	66861	0.3135	0.1585	35822	0.3227	0.1796	119399	0.2958	0.1704

Note: Consumer goods industries are industries with two-digit industry code less than 25.
Source: Enterprise Data, NBS, 2005-7.

Table 4 Regression Results

	Tobit [1]		IV Tobit [2]		IV Tobit [3]		IV Tobit [4]	
	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.
firm size	0.0013***	0.00002	0.0023***	0.0001	0.0031***	0.0002	0.0015***	0.0001
new product diversification	0.0035***	0.0001	0.0141***	0.0021	0.0126***	0.0035	0.0222***	0.0022
profitability	0.0027***	0.0003	0.0632***	0.0042	0.0742***	0.0058	0.0343***	0.0051
ownership	-0.0002***	0.00003	0.00002	0.0001	-0.0003***	0.0001	0.0003***	0.0001
Herfindahl	0.0100***	0.0010	0.0834***	0.0115	0.1106***	0.0194	0.0050	0.0099
Herfindahl^2	-0.0189***	0.0032	-0.5519***	0.0931	-0.7822***	0.1837	-0.0516	0.0804
foreign entry	0.0023***	0.0001	-0.0019***	0.0005	0.0014**	0.0006	-0.0045***	0.0006
constant	-0.0018***	0.0001	-0.0018***	0.0003	-0.0015***	0.0004	-0.0024***	0.0003
Number of obs	238126		238113		82902		155211	
Wald χ^2/F	271.19		8831.62		3052.89		6754.74	

Note: [1] is the Tobit regression over aggregate sample; [2] is the IV Tobit regression over aggregate sample; [3] is the IV Tobit regression over consumer goods industries; [4] is the IV Tobit regression over industrial goods industries; the coefficient estimate of industry dummy variables is not reported to save space; ***, **, and * denote significance at the 1, 5, and 10 per cent levels, respectively.

Table 5 Regression Results with Different Sources of Foreign Entry

	[1]				[2]			
	consumer goods		industrial goods		consumer goods		industrial goods	
	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.
firm size	0.0031***	0.0002	0.0013***	0.0001	0.0031***	0.0002	0.0016***	0.0001
new product diversification	0.0128***	0.0036	0.0245***	0.0022	0.0126***	0.0035	0.0210***	0.0023
profitability	0.0748***	0.0059	0.0267***	0.0049	0.0739***	0.0057	0.0401***	0.0054
ownership	-0.0003***	0.0001	0.0004***	0.00005	-0.0003***	0.0001	0.0002***	0.0001
Herfindahl	0.1204***	0.0194	0.0223**	0.0112	0.1062***	0.0197	0.0006	0.0098
Herfindahl^2	-0.8821***	0.1828	-0.1369	0.0871	-0.7270***	0.1878	-0.0725	0.0836
foreign entry	0.0024	0.0015	-0.0102***	0.0013	0.0026**	0.0010	-0.0082***	0.0011
constant	-0.0014***	0.0004	-0.0025	0.0003	-0.0016***	0.0004	-0.0024***	0.0003
Number of obs	82902		155211		82902		155211	
Wald χ^2	2944.95		6620.55		3119.02		6622.28	

Note: [1] is the IV Tobit regression where foreign entry is measured as the output share of foreign-invested firms from non-Hong Kong, Macau, and Taiwan regions; [2] is the IV Tobit regression where foreign entry is measured as the output share of foreign-invested firms from Hong Kong, Macau, and Taiwan regions; the coefficient estimate of industry dummy variables is not reported to save space; ***, **, and * denote significance at the 1, 5, and 10 per cent levels, respectively.

Table 6 Alternative Regression Results

	consumer goods industries				industrial goods industries			
	[1]		[2]		[1]		[2]	
	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.
firm size	0.0004**	0.0002	0.6266***	0.0329	-0.0006***	0.0001	0.6058***	0.0347
new product diversification	-0.0182***	0.0030	5.1989***	0.7035	0.0041**	0.0017	4.1705***	0.5629
profitability	0.0321***	0.0085	14.9614***	1.1635	-0.0169***	0.0046	15.5698***	1.2816
ownership	-0.0005***	0.0001	-0.0204	0.02122	0.00003	0.0001	0.0546***	0.01314
Herfindahl	-0.0370**	0.0169	27.1984***	3.8220	0.0035	0.0090	3.9666	2.4930
Herfindahl^2	0.2359*	0.1245	-206.7818***	36.3576	0.1558**	0.0794	-57.9469***	20.2406
foreign entry	0.0044***	0.0006	-0.1609	0.1228	0.0026***	0.0005	-1.6761***	0.1430
constant	0.0015***	0.0005	-0.0043	0.0860	0.0001	0.0003	0.1936**	0.0844
Number of obs	16044		82902		35822		155211	
Wald χ^2	918.18		2142.4		1159.21		6783.78	

Note: [1] is the IV regression over firms with positive advertising intensity; [2] is IV Probit estimation where the dependent variable is a dummy that takes a value of 1 if a firm advertises; the coefficient estimate of industry dummy variables is not reported to save space; ***, **, and * denote significance at the 1, 5, and 10 per cent levels, respectively.

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