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# Determinants of FDI in producer services:

# Evidence from Chinese aggregate and provincial sub-sectoral data

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## Abstract

**Purpose –** The purpose of this paper is to examine the determinants of FDI in producer services in China using both country aggregate and provincial sub-sectoral data.

**Design/methodology/approach –** This paper applies ARDL cointegration and panel data regression approaches in examining the determinants of Producer Service FDI (PSFDI).

**Findings –** Our results show differences between the determinants of aggregate FDI and PSFDI. Contrary to the typical influencing factors of general FDI (that include GDP, openness, low wages and environmental quality), the two main determinants of PSFDI inflows to China are found to be high wages and research intensity. Data drawn from 26

Chinese provinces disaggregated at sub-sector level of producer services, corroborate the results.

**Originality/value –** We add to existing literature by identifying the key determinants of inward PSFDI in China also via a provincial level data analysis and disaggregation at sub-sectoral level of producer services.

**Keywords** FDI, Producer services sector, Location determinants

**Paper type** Research paper

## 1. Introduction

Unlike general services, intended to fulfil final *consumer* demand, producer services provide service inputs to intermediate demand by *producers.* As originally defined by Greenfield (1966, p. 1), producer services are "*those services which business firms, non-profit institutions, and government provide and usually sell to the producer rather than to the consumer*". They typically involve the generation and exchange of information and knowledge, rely on skills and intellectual capital as the main inputs (Coffey, 2000) and are generally customized to some extent, meaning they are not generally good substitutes for the services of other firms (Markusen *et al.*, 2005). Specific service categories of producer services include financial, insurance, scientific and technical, brokerage and other knowledge-intensive activities that provide professional services to business clients (Browning and Singlemann, 1975).

The distinction between consumer and producer services is important since the latter are paramount to ensure economic growth, promote technological progress and foster industrial development thus improving production efficiency. In short, producer services constitute a driving force for a country's structural optimisation, playing a pivotal role in the upgrading and competitiveness of a country's primary, secondary and tertiary sectors. Indeed, a growing body of evidence and economic theory suggests that the close availability of a diverse set of business services is important for growth. The key idea in the literature, as summarized by Markusen *et al.* (2005), is that a diverse or higher quality set of business services allows downstream users to purchase a quality-adjusted unit of business services at lower cost. As early as the 1960s, the urban and regional economics literature (e.g., Greenfield, 1966) recognized the importance of non-tradable intermediate goods - mainly producer services produced under conditions of increasing returns to scale - as a critical source of agglomeration externalities. Given such benefits, foreign direct investment (FDI) has often been considered as a powerful vehicle to enhance the development of producer services. The limited empirical evidence supports the view that the largest benefits of FDI in business services could be expected from positive spillover effects to the local economy, "*related to the transfer of knowledge and skills, to indirect productivity of business services and to the improvement of their quality and range*" (Stare, 2001, p. 19). Producer services, therefore, have rightfully earned consideration as a crucial economic sector that carries special significance for inward FDI.

Although many empirical studies have examined the determinants of FDI in manufacturing, services or both, much less attention has been devoted to the factors influencing specifically FDI in producer services, particularly in the context of China, leaving a glaring gap to be filled by our study.

Since China's accession to the World Trade Organization (WTO), FDI into China has gradually increased. In 2003, the total amount of FDI into China exceeded that of the United States, becoming the world's largest FDI recipient. Against this backdrop, the scale of FDI in China's service industry has also expanded. Since the 1990s, an essential feature of FDI has been the increasing proportion of services. In parallel to the steady growth of FDI in the service industry, the growth rate of producer service FDI (PSFDI) has also been accelerating in China (see Figure I and II). As Noyelle (1997) states, the basis for high efficiency of foreign providers of producer services is the specialised knowledge and skills that are proprietary assets, leading to innovations that are diffused throughout the economy. However, this does not refer to technology transfer in its narrow sense, but to ‘soft technology’, meaning the transfer of professional knowledge, skills and experience to employees in the host country. Although the use of foreign capital in China's service industry has exceeded the scale of manufacturing FDI, a critical problem facing the opening-up of China's service industry is that the structure of the sector is unbalanced, and technological content is not high. The distribution of FDI within China’s service sector is shown in Figure I. Overall, FDI in the ‘Real estate’ sector has always dominated. But there is a significant shortcoming, with FDI concentrated too much on non-traditional service industries with higher profits such as real estate, indicating that the structure of FDI in China's service industry needs to be optimised and upgraded.

The above propositions and observations should suffice in emphasizing how devoting attention to inward PSFDI, also at sub-sectoral level, is not only important at a theoretical level, but also to gauge how better to leverage the attraction of high-value inward FDI in the contemporary investment landscape, particularly in countries like China, whose economic growth contributes one quarter of global growth in output and international trade.

[Figures I and II here]

We contribute to this literature, first, by investigating the still unsettled question of whether the determinants of Chinese inward PSFDI differ from those of aggregate inward FDI, and then, by delving into the question of the key determinants of PSFDI at sub-sector level. The determinants of FDI have been studied comprehensively in previous theoretical and empirical research (see, e.g., the reviews by Agarwal, 1980; De Vita and Lawler, 2004; Abbott *et al*., 2012), also with respect to China (see, e.g., Sun *et al*., 2002; Barros *et al.*, 2013; Belkhodja *et al*., 2017) where variables such as GDP, human capital, the level of infrastructure development, openness and agglomeration economies, have been found to have a significant impact. However, studies on PSFDI, especially in China, can be counted on one hand, and next to nothing is known about the specific FDI determinants at the sub-sector level of Chinese producer services.

Our time series Autoregressive Distributed Lag (ARDL) cointegration regression results on aggregate FDI and PSFDI unveil some important differences in terms of significant determinants but the reliability of these results may be hindered by the aggregate nature of the statistics collected from China's Ministry of Commerce. We, therefore, re-estimate new panel data models based on data drawn directly from the Chinese Provincial Statistical Yearbooks of 26 of China's provinces, with a sample period from 1997 to 2017. The results show that while for aggregate FDI, consistent with much previous literature, the main determinants are GDP, openness, low wages and environmental quality, for PSFDI the two main determinants are high wages and research intensity. Provincial level data further disaggregated at sub-sector level of producer services, corroborate these results.

The rest of the paper is organized as follows. Section 2 provides a brief literature review and outlines our theoretical hypotheses. Section 3 describes the empirical specification, data and methodology used. Section 4 presents and discusses the results. Section 5 concludes.

## 2. A brief synthesis of literature and theoretical hypotheses

There has been limited published research focusing on PSFDI location choice and studies relating to China are even fewer. Furthermore, the few studies mostly concentrate on specific service sector industries such as insurance and financial institutions. Wu and Strange (2000) employed a conditional logit model regression to investigate the determinants of location choice of foreign insurance companies (a small segment of the producer service sector) in China using a sample of 138 foreign representative offices from 1992 to 1996. They found that the openness for the award of operating licenses, current and future market demand, and previous FDI, have a significant impact on the choice of location while wage costs and infrastructure are of little significance. Using panel data on US FDI to 25 host countries over the period 1976-1995, Raff and Von der Ruhr (2001) found that, in addition to governmental and cultural barriers, PSFDI firms may face international barriers to entry into foreign markets and concluded that such barriers may partly explain why PSFDI tends to follow FDI by downstream industries. Yin *et al.* (2014) tested the location determinants of FDI in services utilizing panel data for 17 Chinese provinces and cities from 2000 to 2010. They found that growth potential, purchasing power, the development of the service industry, wage costs and agglomeration effects have a significant impact on FDI flows to the service industry. They also found that 'market-seeking' and 'client-following' are the two most important motives for Chinese FDI inflows in services. However, a limitation of their study is that it is based on a relatively small sample and they do not account for the heterogeneous nature of business activities across service industries (i.e., they do not use data disaggregated at sub-sector level). He and Yeung (2011) used a logit model to investigate the locational distribution of foreign banks in China in 2006 across 32 cities. Their results suggest that while smaller foreign banks tend to pursue a 'follow-the-customer' strategy to lower investment risks and maintain business–client networks in their choice of Chinese cities, large foreign banks have ownership advantages and tend to use the 'follow-the-competitor' strategy to select cities with large potential banking opportunities. Chen *et al.* (2014) used data from China's 2004 economic census and found that a city's urban economy, involvement in the global market and telecommunication infrastructure, have a significant impact on foreign financial business location choice.

It is important to note at this point that most of the studies cited above developed hypotheses that draw from theories of FDI in manufacturing since no full-blown theory of FDI in producer services exists. Some literature suggests that FDI theory, despite being mostly developed with specific reference to manufacturing FDI, could be used to explain FDI in services as well, and that most of the determinants tend to be similar (Dunning and McQueen, 1982). In the present study we challenge this view, aiming to investigate whether such an assumption holds by specifically testing whether the determinants of China's PSFDI inflows are different from the general determinants of China's FDI inflows. Indeed, there may be significant differences of determinants between general or manufacturing FDI and PSFDI. For example, low labor costs have long been considered an important determinant of FDI, leading to higher inward investment, especially of the efficiency-seeking type, with a higher cost of labor expected to have the opposite effect, i.e. discourage FDI (see, e.g., Dunning, 1988). However, if higher labor costs are related to higher labor quality in terms of a more educated and/or skilled labor force, which in turn leads to higher productivity, then labor costs can be reasonably expected to be positively associated with FDI. This is especially true of PSFDI which, as noted earlier, heavily rely on professional knowledge, higher-level skills and intellectual capital as the main inputs (Coffey, 2000).

Based on the above rationalisations and observations, the first hypothesis we subject to empirical scrutiny, is the following:

*H1:* The determinants of China's PSFDI inflows are different from the general determinants of FDI inflows.

While H1 aims to examine the difference between the determinants of PSFDI and total FDI at the aggregate level, the second hypothesis (H2) focuses on establishing whether there are any differences in PSFDI determinants across sub-sectors of producer services.

Yin *et al.* (2014) indicate that China's FDI inflows in the primary sector are the most labor intensive, and that FDI inflows in the secondary sector are more labor intensive than those in the tertiary sector. They also suggest that the service industries - especially the banking, insurance, security, consultancy, and IT services sub-sectors - generally have higher requirements of human capital and an educated labor force with a higher level of skills and experience. Hence, also in the light of previous findings that highlight sectoral differences in the determinants of FDI, it is worth investigating the determinants of inward PSFDI across sub-sectors of producer services. Major sub-sectors of producer services are shown in Figure I. Such sub-sectors clearly show the heterogeneous nature of producer service activities, consistent with the conceptualization of the service sector provided by Charles (1993). Accordingly, addressing Yin *et al.*'s (2014) explicit call for further research at sub-sector level, our second hypothesis is:

*H2:* The determinants of PSFDI may differ across sub-sectors of producer services.

## 3. Model specification, data and methodology

*3.1 Model specification*

To test H1, we generate two equations, Eq. (1) and Eq. (2):

$$FDI_t = a_0 + a_1 GDP_t + a_2 LABOUR_t + a_3 WAGE_t + a_4 TRADE_t + a_5 EXCHANGE\ RATE_t + a_6 CPI_t + a_7 MANU_t + a_8 INFRA_t + a_9 INTERNET_t + \varepsilon_t \quad \ldots\ldots (1)$$

$$PSFDI_t = \beta_0 + \beta_1 GDP_t + \beta_2 LABOUR_t + \beta_3 WAGE_t + \beta_4 TRADE_t + \beta_5 EXCHANGE\ RATE_t + \beta_6 CPI_t + \beta_7 MANU_t + \beta_8 INFRA_t + \beta_9 INTERNET_t + u_t \quad \ldots\ldots (2)$$

In equations (1) and (2), the explanatory variables are the same but the dependent variables are different, $FDI$ and $PSFDI$, respectively, with aggregate $FDI$ and $PSFDI$ inflows (rather than stock) data obtained from the Ministry of Commerce of China. Consistent with the measures employed in several prior studies, $GDP_t$ denotes the growth rate of real Gross Domestic Product (GDP). Taken as a proxy for the market size (see, e.g., Chakrabarti, 2001) and growth potential of the host country's economy (see, e.g., Asiamah *et al.*, 2019), the growth rate of GDP is expected to exert a positive impact on inward FDI. $LABOR_t$ represents urban labor demand measured by the number of skilled workers (as used by Driffield *et al.*, 2008), which may reasonably be expected to be positively associated with PSFDI. $WAGE_t$ is measured by the employee income (see, e.g., Zheng, 2009) and, as discussed above, its impact on inward investment is theoretically ambiguous. Trade openness can be expected to have a positive influence on inward FDI because MNEs are attracted to open economies by virtue of their intrinsic export potential and generally more stable economic climate (Wheeler and Mody, 1992). Hence, following the measure employed by De Vita and Abbott (2008), we control for trade openness ($TRADE_t$) using imports plus exports as a percentage of GDP. Various theoretical models have postulated a negative link between the exchange rate and

FDI (see, e.g., Froot and Stein, 1991, and Blonigen, 1997). Albeit through different channels, such models posit that a depreciation of the currency of the host country leads to higher FDI inflows (see also De Vita and Abbott, 2008). Accordingly, we also account for $EXCHANGE\ RATE_t$, measured as the level of the exchange rate of the CNY against the US dollar. Macroeconomic stability, typically measured by the consumer price index (CPI) or GDP deflator, is another classic explanatory variable included in FDI regressions that is expected to exert a positive effect on inward FDI as it reduces volatility in potential investor's returns. Here we use the consumer price index, $CPI_t$. We also include the Business Climate Index for the manufacturing industry ($MANU_t$) as a proxy for the business and economic climate of the manufacturing industry and industry trends. $INFRA_t$ is highway cargo traffic to proxy transport infrastructure, the availability of which is generally found to be a significant factor in determining the attractiveness of FDI (Khadaroo and Seetanah, 2009). Finally, we include the number of internet users, $INTERNET_t$, based on dial-up internet access as a measure of telecommunications infrastructure (see, e.g., Gani and Sharma, 2003), which is generally expected to have a positive impact on inward FDI, particularly in communication-dependent sectors.

Next, to assess the sensitivity of the results obtained from (1) and (2) based on data from the Ministry of Commerce of China (estimated using the ARDL bounds test cointegration model, as discussed below), we use provincial level PSFDI data obtained from China's provincial statistical yearbooks of the National Bureau of Statistics on a panel data model. Due to greater data availability for additional variables, we also employ an extended and revised model specification for this purpose, as shown in Eq. (3) and (4):

$$FDI_{i,t} = a_0 + a_1 GDP_{i,t} + a_2 AVERAGE\ WAGE_{i,t} + a_3 TRADE\ BALANCE_{i,t} + a_4 CPI_{i,t} + a_5 RECYCLING\ RATE_{i,t} + a_6 RESEARCH\ WORKER_{i,t} + a_7 HOUSE\ PRICE_{i,t} + a_8 PASSENGER\ TRAFFIC_{i,t} + \varepsilon_t \quad \ldots\ldots\ldots (3)$$

$$PSFDI_{i,t} = \beta_0 + \beta_1 GDP_{i,t} + \beta_2 AVERAGE\ WAGE_{i,t} + \beta_3 TRADE\ BALANCE_{i,t} + \beta_4 CPI_{i,t} + \beta_5 RECYCLING\ RATE_{i,t} + \beta_6 RESEARCH\ WORKER_{i,t} + \beta_7 HOUSE\ PRICE_{i,t} + \beta_8 PASSENGER\ TRAFFIC_{i,t} + u_t \quad \ldots\ldots\ldots.. (4)$$

Where $FDI_{i,t}$ and $PSFDI_{i,t}$ are FDI and PSFDI flows to province $i$ at time $t$. $GDP_{i,t}$ denotes real GDP for province $i$ at time $t$. Hence, instead of using the growth rate of GDP, in this specification we use China's real GDP to proxy market size (as done in Cushman and De Vita, 2017; and De Vita and Kyaw, 2008) which better reflects the size of the whole economy. As a proxy for labor costs, unlike Eq. (1) and (2), here we use $AVERAGE\ WAGE_{i,t}$, which represents the average wage for province $i$ at time $t$. $CPI_{i,t}$, as measured in Eq. (1) and (2), refers to the consumer price index for province *i* at time *t*. Following Torrisi (1985), in this specification we use $TRADE\ BALANCE_{i,t}$ rather than trade openness to reflect the dynamism, overall health and export potential of the economy. As underscored by Chakrabarti (2001), a trade surplus is likely to encourage FDI. There is a debate in the literature that developing countries tend to lower the environmental standards to attract more FDI (see, e.g., Neelakanta *et al.*, 2013), an idea based on the 'pollution haven hypothesis' according to which FDI in dirty industries flows to countries with lax environmental regulation (Walter and Ugelow, 1979). So, to proxy environmental standards, we also include in our specification the $RECYCLING\ RATE_{i,t}$, measured by the harmless treatment rate of domestic garbage for province *i* at time *t*. $RESEARCH\ WORKER_{i,t}$ stands for the number of workers who are involved in research for province $i$ at time $t$. As in

Friedman *et al.* (1996), this variable is meant to serve as a proxy for research intensity or scientific research capacity, and expected to be positively associated with FDI inflows, particularly in producer services. The price of commercial property ($HOUSE\ PRICE_{i,t}$) reflects the price of real estate for province $_i$ at time $_t$, and its effect could be positive or negative as the price of real estate can also capture the growth of the economy (which is why in this specification we use real GDP rather than the growth rate of GDP). Finally, we control for $PASSENGER\ TRAFFIC_{i,t}$, measured as the total movement of passengers using inland transport on a given network for province $_i$ at time $_t$. As used in much of relevant applied literature (see, e.g., Wekesa *et al.*, 2017), this measure is used as a proxy for infrastructure development, which is expected to increase FDI inflows as better infrastructural development lowers the cost of doing business in the host country.

Finally, to test H2, we generate five equations, see equation (5), where we disaggregate PSFDI into five producer services sub-sectors:

$$SUB-SECTOR_{i,t} = \epsilon_0 + \epsilon_1 GDP_{i,t} + \epsilon_2 AVERAGE\ WAGE_{i,t} + \epsilon_3 TRADE\ BALANCE_{i,t} + \epsilon_4 CPI_{i,t} + \epsilon_5 ENVIRONMENT_{i,t} + \epsilon_6 RESEARCH\ WORKER_{i,t} + \epsilon_7 HOUSE\ PRICE_{i,t} + \epsilon_8 PASSENGER\ TRAFFIC_{i,t} + \tau_t \ \ldots\ldots \quad (5)$$

The independent variables in Eq. (5) above, are identical to those in Eq. (3) to (4) but the dependent variable is different. Eq. (5) is re-estimated five times, one for each of the producer service FDI sub-sectors ($SUB-SECTOR_{i,t}$), namely, 'Transportation & storage', 'Finance & insurance', 'Real estate', 'Rental & leasing' and 'Professional, scientific & technical'.

*3.2 Data and methodology*

The quarterly time-series data ranging from 2003 to 2018 used to test H1 were obtained from different data sources. Table AI Panel A presents details of the description of each variable (measure) and relevant sources. The start and end dates of the sample period were chosen based on data availability. H1 uses the ARDL bounds testing approach to cointegration (Pesaran and Shin, 1998; Pesaran *et al*., 2001). As noted by Abbott and De Vita (2003, p. 71), the main advantage of the ARDL cointegration model is that "*it allows testing for the existence of cointegration when it is not known with certainty whether the regressors are purely I(0), purely I(1) or mutually cointegrated*". That said, the method requires that no variable is integrated of second-order or higher. Another advantage of the ARDL model is that thanks to its lag structure it attenuates potential endogeneity problems. Furthermore, even for small samples, the ARDL coefficient estimates are extremely accurate, with high statistical power (Pesaran and Shin, 1998).

The panel data analyses for robustness tests use FDI as well as PSFDI data derived from provincial level Chinese data (from the Provincial Statistical Yearbooks of 26 provinces in China) and then duly aggregated on the basis of the classification of service industries issued by China's National Bureau of Statistics, with a sample period from 1997 to 2017. The same source is utilized to obtain sub-sector level data for PSFDI in relation to H2. The sources are reported in Table AI Panel B, which also presents details of the definition of each variable (measure) used for the robustness tests and to test H2.

We collected the data from all the 26 provinces in China (there are 31 Chinese provinces in total) that record inward PSFDI data in their provincial statistical yearbooks. The remaining five provinces which do not report any PSFDI inflows and that are, therefore, excluded from the present analysis, are: Jinlin, Shanghai, Hunan, Sichuan and Tibet.

As shown in Eq. (5) to (9) above, the sub-sectoral disaggregation of PSFDI is based on five main sub-sectors. They are: 'Transportation & storage', 'Finance & insurance', 'Real estate', 'Rental & leasing' and 'Professional, scientific & technical'. These five sub-sectors of PSFDI are highly representative since they collectively account for 94.25% of China's total inward PSFDI over our sample period (authors' calculations based on data drawn from http://www.stats.gov.cn/tjsj/ndsj/). Reassuringly, the definition of the 'Industrial classification for national economic activities' issued by the National Bureau of Statistics of China (2017) defines and classifies producer services sub-sectors in a way consistent with the 'International Standard Industrial Classification of all economic activities' (ISIC) issued by the United Nations' Department for Economic and Social Affairs (United Nations, 2008). According to these classifications, 'Transportation & storage' refers to services related to the provision of passenger or freight transport, whether scheduled or not, by rail, pipeline, road, water or air and associated activities such as terminal and parking facilities, cargo handling, storage, etc. Included in this sub-sector is also the renting of transport equipment with driver or operator as well as postal and courier activities. 'Finance & insurance' refer to insurance, reinsurance and pension funding activities and activities to support financial services, the activities of holding assets such as activities of holding companies and the activities of trusts, funds and similar financial entities. 'Real estate' activities pertain to lessors, agents and/or brokers involved in selling or buying real estate, renting real estate, providing other real estate services such as appraisal or acting as real estate escrow agents. The 'Rental & leasing' sub-sector covers administrative and support services activities that include the renting and leasing of tangible and non-financial intangible assets, including a wide array of tangible goods, such as automobiles, computers, consumer goods and industrial machinery and equipment to customers in return for a periodic rental or lease payment. Finally, ‘Professional, scientific & technical’ includes specialized professional, scientific and technical activities.

An econometric issue likely to apply across the units of panel data in our analyses is cross-sectional dependence, which can arise due to spatial effects or unobserved common factors. Accordingly, we employ a fixed effects method with heteroscedasticity, autocorrelation and spatial correlation consistent, robust standard errors that are constructed by Driscoll and Kraay (1998). A “xtscc” command is available in the STATA program by Hoechle (2007), the one we use for estimation. The “xtscc” procedure first transforms all variables at an individual cluster level and then uses a pooled OLS regression to estimate the within-transformed panel data. The coefficients and their standard errors are robust to general forms of serial correlation and cross-sectional dependence. This technique has shown better performance than conventional linear panel regression models that do not account for cross-sectional dependence (Hoechle, 2007).

Table AII presents the pairwise correlation matrix for all the variables used in this study. The correlations between most of the variables are statistically significant at 1 or 5%. Although the table shows strong and significant correlations between some of the independent variables (e.g., RESEARCH WORKER and GDP, 0.9178), we further examine the variance inflation factors (VIFs) and the results show that there are no serious multicollinearity problems. The average VIF value is around 8 for time series data variables and 5 for panel data variables, values that lie below the critical threshold value of 10 suggested by Hair *et al*. (1998).

## 4. Results

### *4.1 Unit roots and ARDL cointegration tests (H1)*

The results of the Augmented Dicky-Fuller (ADF) unit root test in Table I, show that all the variables are integrated of order one in levels, and first-difference stationary. However, the ADF test does not account for possible structural breaks. It is safer, therefore, to conduct an additional unit root test capable of accounting for any potential breaks in the series. As shown from the results of the Narayan and Popp (2010) unit root test with two structural breaks reported in Table II, all the time series representations of the variables are confirmed to contain a unit root in levels and be first-difference stationary. We can, therefore, safely proceed to use the ARDL model to test for and estimate long-run level relationships in accordance to H1.

[Tables I, II and III here]

Table III shows that the F-bounds and t-bounds test statistics for both the FDI and PSFDI equations are statistically significant. The results show a cointegrating relationship in both the FDI and PSFDI regressions at the 1% significance level. To check the stability of the ARDL model, we employ the Cumulative Sum of Recursive Residuals (CUSUM) and Cumulative Sum of Square (CUSUMQ) (see, e.g., Bahmani-Oskooee and Ng, 2002; Pesaran *et al*., 2001). The test plots (CUSUM and CUSUMSQ) presented in Figures III and IV confirm parameter stability. The diagnostic tests presented in Table IV (the Breusch-Godfrey, and Durbin-Watson test results) also reassure as to the absence of heteroscedasticity and autocorrelation. Thus, the ARDL models pass all the diagnostic checks.

[Table IV and Figures III and IV here]

Table IV shows the results for testing whether the factors that affect FDI and PSFDI may be different (H1). The manufacturing industry BCI (MANU, reflecting business climate and profitability) has a positive effect on both aggregate FDI and PSFDI in the long run, with estimated coefficients of 0.1879 and 0.1745, respectively, both significant at 5%. Hence, a favourable host business environment reflected in the development of the manufacturing industry, encourages both inward FDI and PSFDI. On the other hand, in both models, the coefficients of the exchange rate (EXCHANGE RATE), the demand for skilled workers (LABOR) and the volume of highway cargos (INFRASTRUCTURE) are not statistically significant at any reasonable significance level, suggesting these three variables have no significant effect on China's attraction of both FDI and PSFDI. Although these results are contrary to *a priori* expectations, several previous econometric studies have obtained similar results in the context of China with respect to aggregate FDI (see, e.g., Chen, 1996). In terms of the impact of GDP, our results show a statistically insignificant effect on aggregate FDI, while there is a long-run positive and significant (at 5%) association between GDP and PSFDI. The former result is at odds with theory but it is not unusual in previous empirical studies (see, e.g., Hansen and Rand, 2006, and for China, Zhang, 2001). Yet, for PSFDI, we unveil a significantly positive effect. Trade openness (TRADE) has a negative impact on PSFDI, with a coefficient of -0.3528, significant at 1%, while it is statistically insignificant for FDI. Brainard (1997) argues that the impact of trade openness on FDI varies depending on investors' motivation (e.g., export-oriented FDI, tariff-jumping FDI, etc.). We attribute the disparity of this result between FDI and PSFDI to such motivational differences, which we cannot control for, or data issues (see following analysis using provincial level data). CPI too is found from our data to have a significantly negative impact on PSFDI, with an estimated coefficient of -0.3186 (p-value = 0.0080). According to Fischer and Modigliani (1978), a low inflation rate offers a favourable business climate for foreign investors, conducive to improving shareholder value. We find this to be the case for PSFDI but not FDI in these estimations.

Another very interesting result, is a long-run positive relationship between WAGE and PSFDI, with a coefficient of 1.9117, significant at 5%. Although this result differs from that obtained for aggregate FDI, where WAGE is insignificant, and it is not *prima facie* intuitive (given the widely held belief that foreign companies are drawn to China chiefly because of its lower labor costs), its interpretation has logical grounding, and constitutes a key novel finding of the present study. Theoretically, Dunning (1993) argued that multinational firms, even if driven by efficiency-seeking motivations, often require experienced labor, which usually has higher wages. Some segments of producer services, such as finance and insurance, research, and even real estate, are highly knowledge-intensive, and practitioners are accordingly paid a relatively higher wage in these sub-sectors. Dunning's argument, therefore, assumes even greater appeal in the case of PSFDI, where foreign firms seek to invest in knowledge intensive areas that require more skilled and educated workers. Our finding validates empirically that a low wage and a low employee skill and technical level provide no appeal to foreign enterprises entering high value-added industries such as producer services.

Although in this study our interest centers on long-run effects, Table IV also reports the corresponding Error Correction Model (ECM) estimations of the short-run effects for FDI and PSFDI. The error correction terms (ECT) of the FDI and PSFDI regressions are -0.9092 and -0.9914, respectively, both significant at 1%. They imply a fast speed of adjustment, particularly for PSFDI, where it only takes one quarter of a year for almost full adjustment from short-run disequilibrium to long-run equilibrium.

*4.2 Panel data robustness using provincial level data*

The FDI and PSFDI data used for the estimations to test H1 were obtained from China's Ministry of Commerce. In an article examining the challenges to the Chinese data gathering and reporting process, Owyang and Shell (2017) recently observed that although China's data quality and collection practices have improved, "*due to the country's complex economy and challenges posed by the transition from a command economy to a market economy, China's economic statistics remain unreliable.*" (ibid, p. 8). Accordingly, prior to moving to testing H2 using sub-sector PSFDI data, we wish to subject the results obtained to some robustness checks. First, we use alternative panel aggregate data drawn from 26 Chinese provinces, including PSFDI data obtained from the Chinese Provincial Statistical Yearbooks, with a sample period from 1997 to 2017. Second, given the use of provincial level panel data, we employ fixed and/or random effects panel regressions, which allow us to establish how method dependent the results reported above are to the ARDL cointegration technique used. Finally, this permutation allows us to extend our model specification by including additional variables thanks to the enhanced provincial level data availability.

The results are reported in Table V. The Hausman test indicates that for the FDI regression (column 1) the fixed-effects model is appropriate while for the PSFDI regression (column 2) random-effects should be used. We can see that, consistent with our *a priori* expectations, the significant determinants of aggregate FDI and PSFDI are different, and these results, which we take as more credible given the provincial level data they are drawn from, also differ slightly from those reported above.

[Tables V and VI here]

The results show that GDP, openness (proxied by trade balance), CPI, the recycling rate (as a proxy for environmental quality) and house prices, are all positive and significant on aggregate FDI at the 5 or 1% level. Significantly though, average wage is negatively signed and significant at the 5% level (with an estimated coefficient of -0.3976), indicating that for general FDI, the lower the wage costs the greater the inward investment. On the other hand, for PSFDI, the average wage coefficient (0.7973) is positive and significant at 1%. This result, therefore, is robust to panel method re-estimation using provincial level data and confirms that producer service foreign investors are more interested in seeking access to high levels of human capital rather than cheap labor which could end up compromising the quality of their services. This result also aligns with the positive and significant (at 1%) 'RESEARCH WORKER' coefficient (0.2725) on PSFDI, which being measured by the number of research workers, serves as a good proxy for research intensity. Hence, highly skilled and educated workers, even if on a higher wage, are a key determinant for PSFDI but not for general FDI, where low labor costs are found to increase foreign investment. Indeed, it has long been recognized that a higher level of research intensity is expected to boost the confidence of foreign investors. The underlying logic for this result is consistent with that proposed by Ito and Wakasugi (2007), who argue that - from a technology seeking perspective - human capital can be considered as a core location determinant when foreign companies aim to access a foreign market's technologies. No other variable is found to have a significant effect on PSFDI at any reasonable significance level (1 or 5%).

*4.3 Panel data analysis using provincial level sub-sectoral PSFDI data (H2)*

The results of the regressions testing the determinants of PSFDI across its five main subsectors (H2) are reported in Table VI. By and large, they corroborate the aggregate PSFDI results reported in Table V, with ‘AVERAGE WAGE’ and ‘RESEARCH WORKER’ being positively and significantly associated with PSFDI in three and four sectors, respectively, out of five. There are, of course, a few other coefficients that are significant for individual sectors. For example, ‘TRADE BALANCE’ records a negative coefficient of 0.0020 under ‘RENTAL & LEASING’, significant at 1%. This negative effect may be due to the greater competition characterizing the ‘RENTAL & LEASING’ sector as the sector becomes more open to trading activity and more commercially active (see, e.g., Fazekas, 2016). Likewise, ‘HOUSE PRICE’ is positive and significant (at 1%, with a coefficient magnitude of 0.0129) under the ‘TRANSPORTATION & STORAGE’ sector, which may be simply due to an indirect effect of greater development in urban and more populated areas. But these significant coefficients are sporadic and in the main pertain to isolated instances thus failing to indicate any consistent pattern.

## 5. Conclusion

This study investigated whether the location determinants of Producer Service FDI (PSFDI) differ from those of aggregate FDI in China, also using provincial level FDI data at the sub-sector level of producer services.

By employing the ARDL cointegration technique with a sample period from 2003 to 2018, we found some differences in the determinants of aggregate FDI and PSFDI in China but these results, being based on aggregate statistics from China’s Ministry of Commerce, may not be fully reliable. We, therefore, re-estimated our models using panel data techniques with data drawn directly from 26 Chinese provinces. These additional estimations show that contrary to the typical factors attracting general FDI - including GDP, openness, low wages and environmental quality - the two key determinants of PSFDI inflows to China are high wages and research intensity. These findings are corroborated by a further analysis with data disaggregated across the main five sub-sectors of producer services, namely, ‘Transportation & storage’, ‘Finance & insurance’, ‘Real estate’, ‘Rental & leasing’ and ‘Professional, scientific & technical’.

Given the critical importance of producer services for the efficiency enhancement of the economic system in China and the growing role of PSFDI in total FDI flows to China, developing appropriate policies specifically targeted at PSFDI attraction rather than just attraction of general FDI, becomes paramount for Chinese policymakers. On this account, two important policy implications flow directly from our results. First, our findings clearly show China’s FDI attraction is driven by different factors compared to China’s PSFDI attraction. This also means that encouraging PSFDI inflows requires different policy measures. Second, and most importantly, our findings allow Chinese policymakers to implement sub-sector specific policies to encourage PSFDI in those producer service sub-sectors most likely to attract PSFDI. For example, our findings suggest that paying higher salaries to producer services practitioners in the ‘Finance & insurance’, ‘Real estate’ and ‘Transportation & storage’ sub-sectors, would not only not discourage PSFDI investors to invest in high wage cost locations but, in fact, act as a strong pull factor. It appears that the prospect of high profits prompts investors to be willing to accept the extra cost for a skilled and educated workforce, a finding that has been confirmed by our data from both aggregate country and provincial level analyses. Similarly, investing in research and education and expanding the number of researchers is likely to attract much PSFDI in all producer services sub-sectors with the sole exception of ‘Finance & insurance’, a sub-sector that over our sample period has already enjoyed a high premium wage level, well above all other producer service sub-sectors.

As a final caveat, we should acknowledge as a limitation of our study the underlying assumption of the absence of potential nonlinearities in the relationship between PSFDI and its determinants. We leave this profitable avenue for further inquiry to future studies.

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**Table I.** Augmented Dickey-Fuller unit root tests

| Augmented Dickey-Fuller statistics (constant only) | | | |
|---|---|---|---|
| Variable | t-Statistic | P-value | Inference |
| FDI | -1.6499 (1) | 0.4512 | Non-stationary |
| PSFDI | -1.2286 (1) | 0.6566 | Non-stationary |
| GDP | -1.7326 (1) | 0.4101 | Non-stationary |
| LABOR | -2.6354 (1) | 0.0916 | Non-stationary |
| WAGE | -0.8842 (1) | 0.7866 | Non-stationary |
| TRADE | -0.6923 (1) | 0.8403 | Non-stationary |
| EXCHANGE RATE | -1.6429 (1) | 0.4550 | Non-stationary |
| CPI | -1.3670(1) | 0.5918 | Non-stationary |
| MANU | -2.8574 (1) | 0.0562 | Non-stationary |
| INFRA | -0.2696 (1) | 0.9226 | Non-stationary |
| INTERNET | -2.0221 (1) | 0.2769 | Non-stationary |
| ΔFDI | -4.5161***(0) | 0.0006 | Stationary |
| ΔPSFDI | -15.3294*** (0) | 0.0000 | Stationary |
| ΔGDP | -6.6850***(0) | 0.0000 | Stationary |
| ΔLABOR | -9.3524***(0) | 0.0000 | Stationary |
| ΔWAGE | -4.0284**(0) | 0.0025 | Stationary |
| ΔTRADE | 3.8141**(0) | 0.0047 | Stationary |
| ΔEXCHANGE RATE | -9.9179*** (0) | 0.0000 | Stationary |
| ΔCPI | -5.5382***(0) | 0.0000 | Stationary |
| ΔMANU | -7.2994***(0) | 0.0000 | Stationary |
| ΔINFRA | -4.8390***(0) | 0.0002 | Stationary |
| ΔINTERNET | -11.1016***(0) | 0.0000 | Stationary |

**Note(s)**: Δ is the first difference. The estimation and ADF unit root tests were conducted using EViews 10.0. ***, ** and * denote the rejection of the null of a unit root at the 1, 5 and 10% significance level, respectively.

**Table II.** Narayan and Popp (2010) unit root tests with two structural breaks

| Two breaks in level and slope | | | | |
|---|---|---|---|---|
| Variable | Test statistic | Break dates | $\varphi$ | $k$ |
| FDI | -3.0200 | 2009Q1; 2010Q4 | -1.2240 | 3 |
| PSFDI | -3.4630 | 2009Q3; 2015Q3 | -1.7480 | 3 |
| GDP | -4.4470 | 2007Q4; 2008Q3 | -0.4332 | 0 |
| LABOR | -2.7440 | 2008Q3; 2010Q3 | -0.6266 | 3 |
| WAGE | -3.7940 | 2011Q3; 2013Q3 | -0.8547 | 5 |
| EXCHANGE RATE | -4.5240 | 2008Q1; 2015Q3 | -0.5781 | 0 |
| TRADE | -1.5580 | 2008Q4; 2009Q4 | -0.2424 | 3 |
| MANU | -4.3230 | 2008Q3; 2009Q4 | -0.5842 | 4 |
| CPI | -5.8690 | 2007Q2; 2009Q1 | -0.5747 | 3 |
| INFRA | -1.2900 | 2011Q3; 2013Q4 | -0.4418 | 3 |
| INTERNET | -4.1830 | 2006Q1; 2014Q4 | -0.1761 | 4 |
| ΔFDI | -21.4900*** | 2008Q4; 2011Q3 | -3.7460 | 2 |
| ΔPSFDI | -14.9100*** | 2010Q3; 2015Q3 | -3.5560 | 2 |
| ΔGDP | -6.4800*** | 2006Q2; 2009Q1 | -1.9910 | 4 |
| ΔWAGE | -7.7680*** | 2011Q3; 2013Q3 | -2.2050 | 3 |
| ΔLABOR | -10.3700*** | 2008Q3; 2010Q3 | -2.7490 | 2 |
| ΔEXCHANGE RATE | -4.7780** | 2011Q2; 2015Q2 | -1.9300 | 4 |
| ΔTRADE | -19.2500*** | 2008Q4; 2009Q4 | -3.4750 | 2 |
| ΔMANU | -5.8510*** | 2008Q3; 2012Q4 | -1.3470 | 4 |
| ΔCPI | -8.0160*** | 2008Q2; 2011Q3 | -1.5580 | 3 |
| ΔINFRA | -21.6100*** | 2011Q3; 2013Q4 | -3.8780 | 2 |
| ΔINTERNET | -10.8300*** | 2013Q4; 2014Q4 | -1.6920 | 2 |

**Note(s)**: Δ is the first difference operator, $\varphi$ denotes the autoregressive coefficient and $k$ is the optimal lag order. The 1, 5 and 10% critical values are -5.138, 4.741 and -4.430, respectively. The critical values are from Narayan and Popp (2010). The estimation and tests were conducted using a program code written in GUSS that was produced by Narayan and Popp (2010). ***, ** and * denote the rejection of the null of a unit root at the 1, 5 and 10% significance level, respectively.

**Table III.** ARDL long run form and bounds tests (FDI and PSFDI)

| F-Bounds Test | | | | | F-Bounds Test | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Dependent Variable | F-statistic | Critical Value Bounds | I (0) | I (1) | Dependent Variable | F-statistic | Critical Value Bounds | I (0) | I (1) |
| FDI | 7.6382*** | 10% | 1.63 | 2.75 | PSFDI | 16.5858*** | 10% | 1.63 | 2.75 |
| | | 5% | 1.86 | 3.05 | | | 5% | 1.86 | 3.05 |
| | | 2.5% | 2.08 | 3.33 | | | 2.5% | 2.08 | 3.33 |
| | | 1% | 2.37 | 3.68 | | | 1% | 2.37 | 3.68 |
| t-Bounds Test | | | | | t-Bounds Test | | | | |
| Dependent Variable | T-statistic | Critical Value Bounds | I (0) | I (1) | Dependent Variable | F-statistic | Critical Value Bounds | I (0) | I (1) |
| FDI | -5.9508*** | 10% | -1.62 | -4.26 | PSFDI | -7.9989*** | 10% | -1.62 | -4.26 |
| | | 5% | -1.95 | -4.61 | | | 5% | -1.95 | -4.61 |
| | | 2.5 | -2.24 | -4.89 | | | 2.5 | -2.24 | -4.89 |
| | | 1% | -2.58 | -5.25 | | | 1% | -2.58 | -5.25 |

**Table IV.** Error correction and cointegration models (FDI and PSFDI)

| Panel A: Long-run coefficients (levels regression) | | | | | |
|---|---|---|---|---|---|
| Variable | Coefficient | p-value | Variable | Coefficient | p-value |
| GDP | -0.0816 | 0.8679 | GDP | 0.9697** | 0.0304 |
| LABOR | 1.3721 | 0.1198 | LABOR | 1.5909* | 0.0759 |
| WAGE | -1.1088 | 0.1941 | WAGE | 1.9117** | 0.0254 |
| TRADE | -0.1199 | 0.3357 | TRADE | -0.3528*** | 0.0037 |
| EXCHANGE RATE | -0.3989 | 0.4925 | EXCHANGE RATE | -0.0629 | 0.8792 |
| CPI | -0.0520 | 0.6378 | CPI | -0.3186*** | 0.0080 |
| MANU | 0.1879** | 0.0336 | MANU | 0.1745** | 0.0179 |
| INFRA | 9.1422 | 0.3134 | INFRA | -11.2869 | 0.0971 |
| INTERNET | -8.7661*** | 0.0028 | INTERNET | -2.6231 | 0.2464 |
| Panel B: Short-run coefficients (ARDL error correction regression) | | | | | |
| Variable | Coefficient | p-value | Variable | Coefficient | p-value |
| D(FDI(-1)) | 0.1494 | 0.1344 | D(LABOR) | 0.2980 | 0.4735 |
| D(GDP) | 1.2575*** | 0.0033 | D(WAGE) | 0.5366 | 0.3379 |
| D(TRADE) | 0.2556** | 0.0316 | D(TRADE) | 0.0035 | 0.9797 |
| D(MANU) | -0.2439*** | 0.0004 | D(EXCHANGE RATE) | 2.4282*** | 0.0039 |
| D(MANU(-1)) | -0.2548*** | 0.0002 | D(MANU) | -0.2601*** | 0.0000 |
| D(INFRA) | -16.6753*** | 0.0019 | D(MANU(-1)) | -0.2924*** | 0.0000 |
| D(INFRA(-1)) | -16.4369*** | 0.0013 | D(INTERNET) | 6.3710* | 0.0778 |
| D(INTERNET) | 4.9839 | 0.1962 | @QUARTER=1 | -8.7359*** | 0.0000 |
| @QUARTER=2 | 10.0763*** | 0.0000 | @QUARTER=2 | -3.9052*** | 0.0001 |
| @QUARTER=3 | 4.0314*** | 0.0008 | @QUARTER=3 | -8.1755*** | 0.0000 |
| @QUARTER=4 | 17.7136*** | 0.0000 | ECT | -0.9914*** | 0.0000 |
| ECT | -0.9092*** | 0.0000 | | | |
| Diagnostics | | | | | |
| SC | 0.3617 [0.6988] | | SC | 1.0629 [0.3550] | |
| HETER | 1.2876 [0.2403] | | HETER | 1.3099 [0.2272] | |
| Normality Test | 1.2491 [0.5355] | | Normality Test | 1.3545 [0.5080] | |
| R-squared | 0.9433 | | R-squared | 0.9117 | |
| Durbin-Watson statistic | 2.0131 | | Durbin-Watson | 2.0251 | |

**Note(s)**: ***, ** and * denote the rejection of the null hypothesis of a unit root at the 1, 5 and 10% significance level, respectively. The optimal lag structure is selected by AIC, starting with max 5 lags. SC denotes the Breusch and Godfrey serial correlation test, HETER denotes the Breusch and Pagan heteroscedasticity test, and NORM denotes the Jarque–Bera test for normality. P-values are presented in square brackets. ECT stands for Error Correction Term.

**Table V.** The determinants of aggregate FDI and PSFDI in China, 1997-2017

| | (1)<br>FDI<br>Fixed effects | (2)<br>PSFDI<br>Random effects |
|---|---|---|
| GDP | 0.2732*** | -0.0900 |
| | (4.4093) | (-1.4812) |
| AVERAGE WAGE | -0.3976** | 0.7973*** |
| | (-2.4733) | (2.8580) |
| TRADE BALANCE | 0.1559*** | 0.0016 |
| | (5.1495) | (0.0424) |
| CPI | 0.0846** | 0.0962 |
| | (2.4974) | (1.0245) |
| RECYCLING RATE | 0.1873*** | -0.2385* |
| | (2.9620) | (-1.6845) |
| RESEARCH WORKER | 0.0325 | 0.2725*** |
| | (0.4265) | (3.0642) |
| HOUSE PRICE | 0.3116** | 0.2293* |
| | (2.6843) | (1.6513) |
| PASSENGER TRAFFIC | -0.1304 | -0.4231 |
| | (-0.5401) | (-1.2725) |
| Constant | -9.2051** | -10.5473 |
| | (-2.4872) | (-1.0861) |
| Observations | 392 | 374 |
| Number of groups | 26 | 26 |
| R-squared | 0.5632 | 0.2444 |
| Hausman test | 28.47 | 5.0100 |
| P-value for Hausman test | 0.0004 | 0.8336 |

**Note(s)**: ***, ** and * denote statistical significance at the 1, 5 and 10% level. Estimates use the 'xtscc' command in Stata 15.1 (Driscoll-Kraay standard errors in parentheses). Estimates use a maximum lag set to two years. The Hausman specification test is used to examine the null hypothesis that the random effects are consistent and efficient. The Hausman test for Eq. 5 confirms that the random-effects model is appropriate. However, we run both the fixed- and random-effects models and found that the empirical results are consistent between the two models.

**Table VI.** The determinants of sub-sectors of PSFDI in China, 1997-2017

| | (1) | (2) | (3) | (4) | (5) |
|---|---|---|---|---|---|
| | TRANSPORTATION & STORAGE | FINANCE & INSURANCE | REAL ESTATE | RENTAL & LEASING | PROFESSIONAL, SCIENTIFIC & TECHNICAL |
| | Random effects | Fixed effects | Random effects | Fixed effects | Random effects |
| GDP | -0.0058*** | 0.0130 | -0.0053* | -0.0015 | 0.0033 |
| | (-4.2253) | (1.5124) | (-1.7348) | (-1.5234) | (0.8033) |
| AVERAGE WAGE | 0.0378*** | 0.0841** | 0.0381*** | 0.0094 | 0.0176 |
| | (5.5012) | (2.6902) | (2.5740) | (1.0715) | (0.7693) |
| TRADE BALANCE | 0.0009 | -0.0069* | 0.0022 | -0.0020*** | 0.0024 |
| | (1.1661) | (-1.7569) | (1.2134) | (-4.1281) | (0.8690) |
| CPI | 0.0038* | -0.0113 | 0.0043 | 0.0034* | 0.0033 |
| | (1.7669) | (-1.0818) | (0.8982) | (1.7376) | (0.4148) |
| RECYCLING RATE | -0.0176*** | -0.0110 | -0.0005 | 0.0017 | -0.0038 |
| | (-4.9741) | (-0.2664) | (-0.0770) | (0.4434) | (-0.3005) |
| RESEARCH WORKER | 0.0052*** | -0.0031 | 0.0133*** | 0.0045*** | 0.0186*** |
| | (2.7397) | (-0.2978) | (3.0779) | (2.8677) | (3.2622) |
| HOUSE PRICE | 0.0129*** | -0.0288 | 0.0051 | 0.0012 | -0.0024 |
| | (3.5846) | (-1.4213) | (0.7009) | (0.2790) | (-0.1791) |
| PASSENGER TRAFFIC | -0.0056 | 0.0484 | -0.0184 | -0.0025 | -0.0432** |
| | (-0.7376) | (0.7977) | (-1.1403) | (-0.4897) | (-2.0511) |
| Constant | -0.3906* | 0.9486 | -0.4840 | -0.3617* | -0.3405 |
| | (-1.7756) | (0.8820) | (-0.9737) | (-1.7661) | (-0.4182) |
| Observations | 300 | 175 | 329 | 285 | 267 |
| Number of groups | 26 | 22 | 26 | 23 | 22 |
| R-squared | 0.3642 | 0.4221 | 0.2477 | 0.1414 | 0.2978 |
| Hausman test | 6.89 | 30.81 | 3.18 | 23.03 | 12.07 |
| P-value for Hausman test | 0.5480 | 0.0002 | 0.9569 | 0.0061 | 0.1593 |

**Note(s)**: ***, ** and * denote statistical significance at the 1, 5 and 10% level. Estimates use the ‘xtscc’ command in Stata 15.1 (Driscoll-Kraay standard errors in parentheses). Estimates use a maximum lag set to two years. The Hausman specification test is used to examine the null hypothesis that the random effects are consistent and efficient.

**Appendix A**

**Table AI.** Variable definition and data sources

| Variable | Definition | Data Source |
|---|---|---|
| **Panel A: Time series data used for Hypothesis 1 (H1)** | | |
| FDI | Aggregate FDI | Ministry of Commerce of China |
| PSFDI | Producer Service FDI | Ministry of Commerce of China |
| GDP | The growth rate of real GDP | CEIC Database |
| LABOR | Urban labor demand: Skilled professional worker | Ministry of Human Resources and Social Security of China |
| WAGE | Employee income | National Bureau of Statistics of China |
| TRADE | Imports plus Exports as a percentage of GDP | Organisation for Economic Co-operation and Development |
| EXCHANGE RATE | Exchange rate (CNY against USD) | International Monetary Fund |
| CPI | Consumer Price Index, Quarter on Quarter (QoQ) | National Bureau of Statistics of China |
| MANU | Business Climate Index (BCI) for manufacturing industry | National Bureau of Statistics of China |
| INFRA | Highway cargo traffic | Ministry of Transport of China |
| INTERNET | Number of Internet users: dial-up internet access | Ministry of Industry and Information Technology |
| **Panel B: Panel data used for Hypothesis 2 (H2)** | | |
| FDI | Aggregate FDI | Chinese Ministry of Commerce |
| PSFDI | Producer Service FDI | Provincial Statistical Yearbooks |
| GDP | Real gross domestic product (GDP) | China Statistical Yearbooks |
| AVERAGE WAGE | Average wage | CEIC Database |
| TRADE BALANCE | Total value of all imports minus total value of all exports | China Statistical Yearbooks |
| CPI | Consumer price index | China Statistical Yearbooks |
| RECYCLING RATE | Harmless treatment rate of domestic garbage | Ministry of Housing and Urban-Rural Development of China |
| RESEARCH WORKER | The number of researchers | China Statistical Yearbooks |
| HOUSE PRICE | The price of commercial property | China Statistical Yearbooks |
| PASSENGER TRAFFIC | The total movement of passengers using inland transport on a given network | China Ministry of Transport |
| TRANSPORTATION & STRORAGE | FDI in transportation and storage activities | Provincial Statistical Yearbooks |
| FINANCE & INSURANCE | FDI in financial and insurance activities | Provincial Statistical Yearbooks |
| REAL ESTATE | FDI in real estate | Provincial Statistical Yearbooks |
| RENTAL & LEASING | FDI in rental and leasing activities | Provincial Statistical Yearbooks |
| PROFESSIONAL, SCIENTIFIC & TECHNICAL | FDI in professional, scientific and technical activities | Provincial Statistical Yearbooks |

**Table AII.** Correlation matrix (H1 and H2)

**Panel A: Correlation matrix (H1)**

| | FDI | PSFDI | GDP | LABOUR | WAGE | TRADE | EXCHANGE RATE | CPI | MANU | INFRA | INTERNET |
|---|---|---|---|---|---|---|---|---|---|---|---|
| FDI | 1.0000 | | | | | | | | | | |
| PSFDI | 0.9475*** | 1.0000 | | | | | | | | | |
| GDP | -0.5779*** | -0.5615*** | 1.0000 | | | | | | | | |
| LABOUR | 0.6939*** | 0.6262*** | -0.5956*** | 1.0000 | | | | | | | |
| WAGE | 0.8010*** | 0.8204*** | -0.7451*** | 0.7881*** | 1.0000 | | | | | | |
| TRADE | -0.7229*** | -0.7259*** | 0.8447*** | -0.6746*** | -0.8393*** | 1.0000 | | | | | |
| EXCHANGE RATE | 0.7278*** | 0.6732*** | -0.6283*** | 0.8837*** | 0.7767*** | -0.6791*** | 1.0000 | | | | |
| CPI | -0.1075 | -0.1875 | 0.4404*** | -0.1220 | -0.3291*** | 0.4333*** | -0.0942 | 1.0000 | | | |
| MANU | -0.3556*** | -0.3299*** | 0.6414*** | -0.2665** | -0.3540*** | 0.5373*** | -0.3942*** | 0.3179** | 1.0000 | | |
| INFRA | 0.7832*** | 0.7656*** | -0.7182*** | 0.8495*** | 0.9261*** | -0.8542*** | 0.7982*** | -0.3050** | -0.3347*** | 1.0000 | |
| INTERNET | -0.7746*** | -0.7074*** | 0.5155*** | -0.9049*** | -0.7599*** | 0.6555*** | -0.9277*** | 0.1013 | 0.3731*** | -0.8060*** | 1.0000 |

**Panel B: Correlation matrix (robustness and H2)**

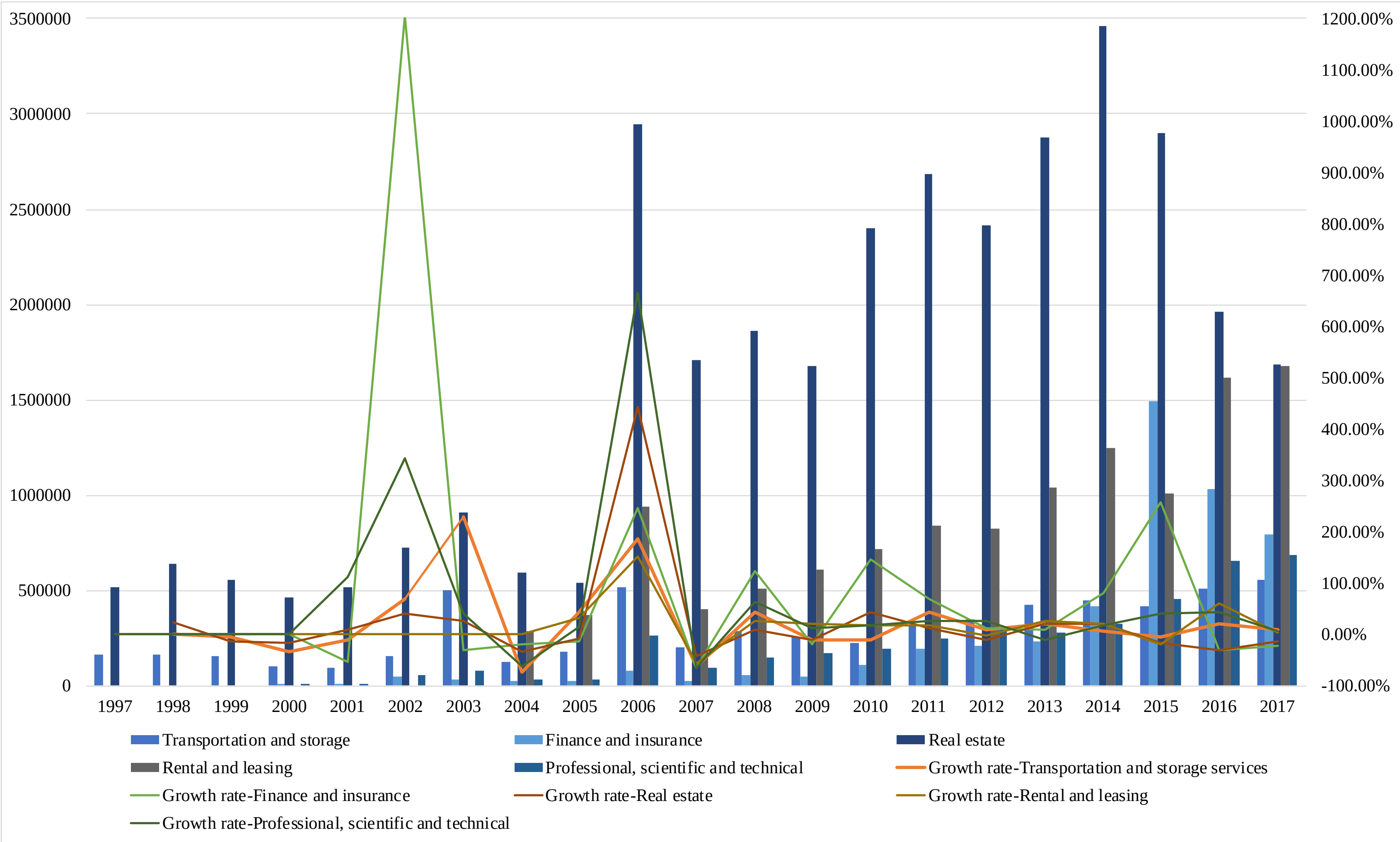
| | FDI | PSFDI | TRASPORTATION & STORAGE | FINANCE & INSURANCE | RENTAL & LEASING | REAL ESTATE | PROFESSIONAL, SCIENTIFIC & TECHNICAL | GDP |
|---|---|---|---|---|---|---|---|---|
| FDI | 1.0000 | | | | | | | |
| PSFDI | 0.5602*** | 1.0000 | | | | | | |
| TRASPORTATION & STORAGE | 0.3256*** | 0.9031*** | 1.0000 | | | | | |
| FINANCE & INSURANCE | 0.3847*** | 0.5971*** | 0.4198*** | 1.0000 | | | | |
| RENTAL & LEASING | 0.3165*** | 0.9389*** | 0.8911*** | 0.3983*** | 1.0000 | | | |
| REAL ESTATE | 0.5753*** | 0.9499*** | 0.8947*** | 0.3833*** | 0.8457*** | 1.0000 | | |
| PROFESSIONAL, SCIENTIFIC & TECHNICAL | 0.5814*** | 0.7686*** | 0.4792*** | 0.4369*** | 0.6114*** | 0.5509*** | 1.0000 | |
| GDP | 0.8315*** | 0.3894*** | 0.1306*** | 0.5346*** | 0.1930*** | 0.3585*** | 0.6008*** | 1.0000 |
| AVERAGE WAGE | 0.4890*** | 0.4524*** | 0.3751*** | 0.4368*** | 0.3919*** | 0.4307*** | 0.4095*** | 0.5915 *** |
| TRADE BALANCE | -0.3345*** | -0.1436*** | 0.0069 | -0.4687*** | -0.0984* | -0.1126** | 0.3335*** | - 0.5085 *** |
| CPI | 0.0850** | 0.0444 | 0.0378 | -0.1042 | -0.0525 | 0.0587 | 0.0070 | 0.1039 ** |
| RECYCLING RATE | 0.3908*** | 0.2911*** | 0.2171*** | 0.2815*** | 0.2391*** | 0.3151*** | 0.3301*** | 0.4331 *** |
| RESEARCH WORKER | 0.8304*** | 0.4149*** | 0.1463*** | 0.4823*** | 0.2436*** | 0.3686*** | 0.6100*** | 0.9178 *** |
| HOUSE PRICE | 0.4642*** | 0.4408*** | 0.4198*** | 0.3991*** | 0.3828*** | 0.3849*** | 0.4469*** | 0.4680 *** |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| PASSENGER TRAFFIC | 0.7146*** | 0.3544*** | 0.0881* | 0.4555*** | 0.2141*** | 0.2995*** | 0.4993*** | 0.7454 *** |

| | AVERAGE WAGE | TRADE BALANCE | CPI | RECYCLING RATE | RESEARCH WORKER | HOUSE PRICE | PASSENGER TRAFFIC |
|---|---|---|---|---|---|---|---|
| AVERAGE WAGE | 1.0000 | | | | | | |
| TRADE BALANCE | -0.1296*** | 1.0000 | | | | | |
| CPI | 0.1974*** | -0.0155 | 1.0000 | | | | |
| RECYCLING RATE | 0.6879*** | -0.1017** | -0.1120** | 1.0000 | | | |
| RESEARCH WORKER | 0.5059*** | -0.4982*** | 0.0513 | 0.3596*** | 1.0000 | | |
| HOUSE PRICE | 0.8535*** | -0.0378 | 0.1521*** | 0.5788*** | 0.5402*** | 1.0000 | |
| PASSENGER TRAFFIC | 0.5065*** | -0.3802*** | 0.0845** | 0.2995*** | 0.8422*** | 0.6181*** | 1.0000 |

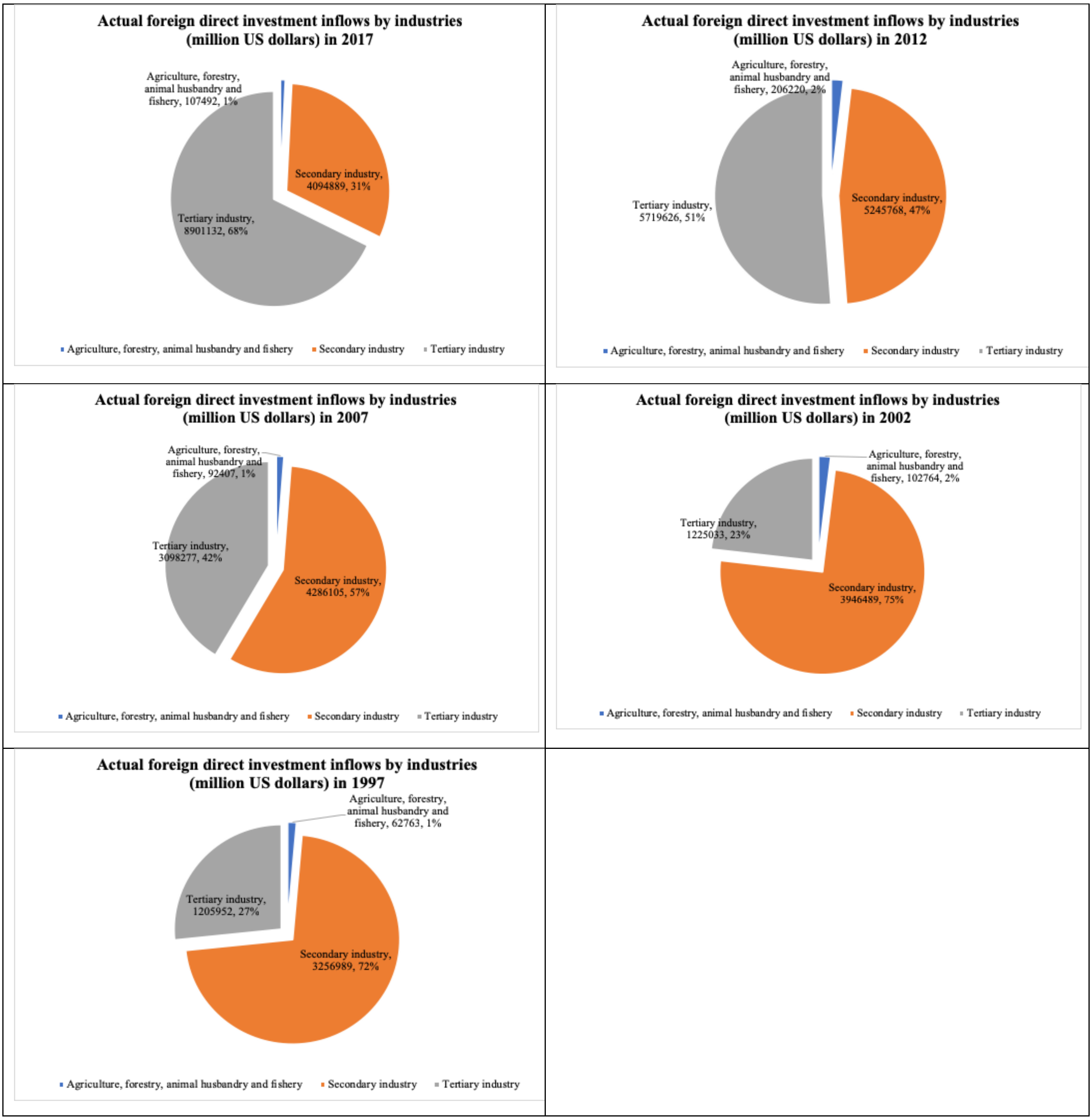
**Note(s)**: Variables are defined in Appendix AI. ***, ** and * denote statistical significance at the 1, 5 and 10% level.

**Figure I:** PSFDI (million USD) between 1997 and 2017 along with the annual growth rate (%)




Source: Author's own calculations based on data from China Statistical Yearbook

**Figure II:** Value of the actual use, annual growth rate of FDI in China by industries in 2017, 2012, 2007, 2002 and 1997




Source: Author's own calculations based on data from China Statistical Yearbook 1997, 2002, 2007, 2012 and 2017.

**Figure III. Cumulative sum (CUSUM) and Cumulative sum of squares (CUSUMQ) test for aggregate FDI**

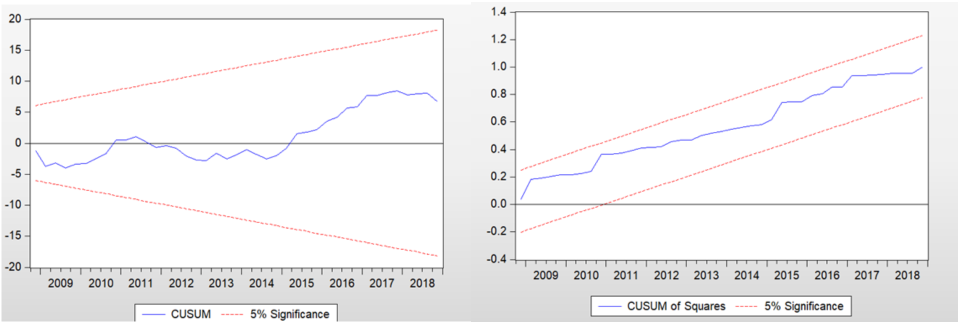



**Figure IV. Cumulative sum (CUSUM) and Cumulative sum of squares (CUSUMQ) test for PSFDI**